Global Sustainability

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# Rethinking climate policy with alternative framings of carbon dioxide

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**Intelligence Briefing**

**Cite this article:** Levänen J, Hukkinen JI (2019). Rethinking climate policy with alternative framings of carbon dioxide. *Global Sustainability* **2**, e25, 1–4. https://doi.org/10.1017/sus.2019.24

Received: 9 January 2018
Revised: 6 November 2019
Accepted: 7 November 2019

**Keywords:**
carbon dioxide; circular economy; climate policy; framing; recycling

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## Abstract

Since the earliest stages of international climate policy, carbon dioxide ($CO_2$) has been framed and widely accepted as a problem that needs to be solved by reducing its amount in the atmosphere. In principle this is a correct and relevant starting point for efforts to decarbonize societies. At the same time, however, the unquestioned and one-sided framing of $CO_2$ as a problem has significantly biased the strategies for tackling climate change. We introduce the origins, meanings and implications of one-sided framing of $CO_2$ in climate policy. We also discuss how alternative framings could impact policymaking and eventually our capacity to mitigate climate change. We introduce a paradox: framing $CO_2$ as a problem often translates into policies that hamper the implementation of technologies to decrease the amount of $CO_2$ emitted into the atmosphere. We suggest that plurality in framing $CO_2$ could lead to innovative ways and strategies to combat climate change.

## Social media summary

New article suggests alternative framing of carbon dioxide as a fruitful starting point for climate policy.

## 1. Introduction

Even though climate change increasingly threatens the wellbeing of humankind and this threat was recognized decades ago (IPCC, 1990), responses have remained weak (Rogelj *et al*., 2016). It seems more than obvious that current and past efforts to tackle climate change have been seriously insufficient. Given carbon dioxide's ($CO_2$) role as the main greenhouse gas and the urgency of actions needed to meet the goals of the Paris agreement – most importantly staying well below 2°C increase in global average temperature – we need to profoundly rethink our approach to $CO_2$ management. In this paper, we argue that taking different perspectives on $CO_2$ is a fruitful starting point for such an effort.

In the battle against climate change, the first thing to accept is that carbon neutrality is no longer an ambitious enough goal. Carbon negativity is needed, i.e. ensuring that $CO_2$ converted into solid or liquid form stays that way over centuries. It will be very difficult to meet global temperature goals without carbon removal from the atmosphere with negative emission technologies (IPCC, 2018). Although the development of these technologies contains great uncertainties (EASAC, 2018) and they should not form the basis of a mitigation agenda (Anderson & Peters, 2016), they still play an important role in global response to climate change. Therefore, functional incentives for the development and implementation of negative emission technologies are urgently needed.

We suggest that an alternative framing of $CO_2$ can increase political support for policies and technologies that otherwise remain unutilized despite their significant potential for addressing problems brought about by climate change. The main argument for an alternative framing of $CO_2$ is that it transforms the perceived solutions to tackle climate change. Framing $CO_2$ as a valuable resource or a source of innovation, for example, strengthens the idea that $CO_2$ reduction is not only a challenge, but also an opportunity. Plurality in $CO_2$ framings allows the development of a richer variety of climate strategies and provides support for industrial efforts to facilitate carbon removal from the atmosphere.

$CO_2$ reduction has been considered a costly business, making it difficult to find global consensus on actions needed to tackle climate change (Sunstein, 2007; Keohane & Victor, 2016). Alternative framings can encourage research and development activities that could reduce costs. As an example, a change in framing can enable the creation of practices for profitable utilization of $CO_2$ instead of its costly storage. The possibility to make a profit from clever utilization of $CO_2$ would probably reduce the reluctance of many actors to take part in the battle against climate change. In addition to opening new profit streams, alternative framings would provide political support for new innovative technologies and policies.

## 2. Current framing and its origins

One explaining factor behind the failed climate policy is that for too long scientists and politicians have framed $CO_2$ unequivocally as a problem. Over the decades the one-sided definition of $CO_2$ as a problem has become a doctrine that has been difficult to challenge even though it unnecessarily simplifies the complex operational environment of $CO_2$ management. The resulting policies have delayed action and narrowed the perceived solution space.

In retrospect, it is understandable that during the late 1980s and early 1990s climate change was conceptualized as an emission problem. At the time, awareness of environmental problems had emerged as a reaction to environmental hazards, such as ozone layer depletion and acid rain (Kowalok, 1993). The rationale in all reactions to these hazards followed the same logic: there needed to be a clear reason for the problem. It was logical that $CO_2$ as a fundamental cause of climate change was understood and widely accepted as a problem. Likewise, it is logical that policy and technological responses to climate change ever since have focused on $CO_2$ mitigation. Today the framing of $CO_2$ as a problem is perceived to be normal to an extent that thinking differently requires a mental effort. We all are used to talking about $CO_2$ *emissions* per capita and air *pollution* caused by greenhouse gases – all profoundly negative things.

## 3. Alternative framings

It is possible to frame $CO_2$ differently. An analytical take on framing helps to understand how social groups collectively value and give meanings to phenomena in particular contexts and situations (Goffman, 1974; Entman, 1993). Shared frames are powerful mental constructs: they highlight some things as normal and appropriate and at the same time direct attention away from other things (Tversky & Kahneman, 1986; Benford & Snow, 2000). On one hand, it is very difficult among people who share a frame to get support for an idea that contradicts the mental premises of the frame (Gamson, 1992). On the other hand, widely accepted frames may become institutionalized relatively easily (Schön & Rein, 1994; Lenschow & Zito, 1998).

Because different actor groups frame things differently, situations with multiple actors often turn into collective issue framing, which can mean anything from mediation to 'struggles over the naming and framing of a policy situation' (Schön & Rein, 1994: 29). Issue framing can be used to push a different agenda (Jacoby, 2000) and, in the context of $CO_2$ management, it significantly affects the ways in which different stakeholders think and talk about $CO_2$. When there is only one accepted frame, technological and socio-political path-dependencies begin to emerge which can lock in the entire operational environment.

## 4. Putting framing in practice

In the context of $CO_2$ management, alternative framings of $CO_2$ are particularly relevant for efforts to reduce $CO_2$ after it has been emitted into the atmosphere. In this context, utilization of $CO_2$ has much in common with the circular economy approach where different fractions of waste are seen as potential raw materials or by-products (Ellen MacArthur Foundation, 2017; Murray *et al.*, 2017). The predominant framing of $CO_2$ as a problem hampers the development of a circular economy with respect to carbon management because it limits the utilization opportunities of $CO_2$.

*First, the current framing hampers considering $CO_2$ as a raw material.* Mineralization technology enables converting $CO_2$ into industrial side streams for new products (Brent *et al.*, 2011) and mineralization-based solutions for carbon capture and utilization (CCU) are currently at lab-scale (Levänen & Eloneva, 2017). The key difference between mineralization-based CCU and conventional geological carbon capture and storage (CCS) is that in mineralization the captured $CO_2$ is an essential raw material for new products – not a substance that needs to be stored without utilization. For example, through mineralization $CO_2$ can be combined with steelmaking slag so that the end-product is pure precipitated calcium carbonate (PCC), which is needed in numerous industrial processes, such as filler or coating material in the paper industry (Eloneva *et al.*, 2012). The use of this combination product reduces the need to mine virgin limestone, the traditional raw material for PCC. It has been estimated that in the future $CO_2$ utilization could mitigate 700 Mt of $CO_2$ per year (Leung *et al.*, 2014).

*Second, the current framing hampers considering $CO_2$ as a source of innovation for new by-products.* $CO_2$ can also be used as a feedstock to produce renewable energy sources in bio-CCS systems (Rahman *et al.*, 2017). When combined innovatively with diverse catalysts, the captured $CO_2$ can be converted into numerous types of biofuels, such as methanol, dimethyl ether, ethanol and methane. This would allow the total amount of utilized biofuels to be increased without increased production of crops that are currently used as raw material for biofuels – an issue that has been connected to various socio-economic and environmental problems (Phalan, 2009). Technologies allowing biofuel production from $CO_2$ are currently at pilot-scale (Olah *et al.*, 2008, 2011; Jadhav *et al.*, 2014). Replacement of fossil fuels with biofuels significantly contributes to global energy transition toward renewable sources and improves long-term energy security as well. The economic potential of bio-CCS has been estimated to be in the range of 2–10 Gt $CO_2$ storage per year in 2050 (Creutzig *et al.*, 2015).

Examples of $CO_2$ as a potential raw material or a source of innovation demonstrate the power of framing. The idea that the problem of $CO_2$ can be solved by injecting it underground or beneath the sea is reflected for example in the European Union's (EU) CCS directive, which defines CCS as 'environmentally safe capture and geological storage […] of $CO_2$' (Directive 2009/31/EC of the European Parliament and of the Council, article 10a). In practice, this framing means that the EU's Emissions Trading System (EU ETS) automatically compensates $CO_2$ that is geologically stored but remains unclear on how emission reductions achieved through other promising methods, such as mineralization and bio-CCS, would be compensated (Levänen, 2015). The uncertainty is problematic for the developers, development funders and potential users of new applications, as it places different technologies in an unequal position (Kainiemi *et al.*, 2015).

## Conclusions

It is not problematic *per se* that $CO_2$ is framed as a problem. The problem is rather that '$CO_2$ as a problem' is such a strong and exclusive frame that it narrows the opportunities arising from alternative framings, such as considering $CO_2$ as a raw material or a source of innovation. Framing is always tightly connected to the prospects of policymaking. In the context of $CO_2$ management, alternative framings can be utilized in the development of novel policy instruments aimed at reducing the total amount of $CO_2$ in the atmosphere.

We have highlighted alternative framings that may help in the development of solutions that utilize $CO_2$ already emitted. Implementation of such solutions can be efficiently supported with economic policy instruments, such as carbon tax or trade. It is critically important that one-sided framing of $CO_2$ as a problem does not narrow the development of technologies and related policy instruments. Instead, in the management of end-of-life $CO_2$ all utilization opportunities should be considered equally from the perspective of overall sustainability. In addition, policies need to move upstream in the product cycle to beginning-of-life product planning. In this, alternative framings of $CO_2$ could turn out to be valuable as well. For example, extended producer responsibility for solid carbon could cover broadly the products of petrochemical, wood, and paper and pulp industries, which would incentivize these industries to lengthen the lifetime of their products.

We recognize that neither alternative framings of $CO_2$ nor increased deployment of new forms of CCU will provide a quick fix for climate change. However, as we move toward carbon negative societies, the fraction of emitted $CO_2$ that can be utilized in industries will need to increase continuously. The challenge is to increase the market demand for emitted $CO_2$ by removing institutionalized barriers to its innovative utilization. It is also important to remember that $CO_2$ is a raw material for numerous established industries, from beverage production to plastics and fuels. While we have introduced some ideas for alternative framings, other kinds of framings could result in different implications for $CO_2$ management. We therefore encourage more research on different framings of $CO_2$.

It matters how we think and talk about technologies, substances and materials. As our examples point out, framings underlying our expressions can translate into justifications for seemingly rational policies and legal definitions with significant unwanted impacts. In the long run, we need to learn to recycle all kinds of substances that the contemporary way of life generates, including $CO_2$. Seeing emissions as a resource is a logical next step in thinking about the future of post-industrial societies and the development of a circular economy.

**Acknowledgements.** The authors wish to thank the editor and anonymous reviewers for helpful comments.

**Financial support.** This research has received funding from the following projects: Decentralizing Finland's energy regime: The triggers and dynamics of transition (DEFEND), Academy of Finland project number 284972; Creative adaptation to wicked socio-environmental disruptions (WISE), Academy of Finland's Strategic Research Council project number 312623; University profiling (Profi), Academy of Finland project number AKA/4/02.04.10/2016.

**Conflicts of interest.** None.

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