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Green economy thinking and the control of nitrous oxide emissions[☆]

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ABSTRACT

As a potent greenhouse gas and contributor to stratospheric ozone depletion, nitrous oxide (N₂O) represents a global pollutant of growing concern. We use the N₂O example to consider the potential for Green Economy thinking to promote sustainability through emission reduction. A fundamental barrier to change arises from the distinction between 'Sector View' (green actions consistent with improved profit) and 'Societal View' (incorporating the value of all externalities). Bringing these views closer together requires a long-term perspective, while counting all co-benefits of taking action. N₂O control should be considered within the context of the wider nitrogen cycle, with an emphasis on improving full-chain nitrogen use efficiency (NUE_{fc}), exploiting a combination of technical measures in agriculture, industry, transport, waste water management and other combustion sources. Avoiding excessive meat and dairy consumption by citizens in developed countries can substantially

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reduce N₂O emissions. These measures offer many options for low-cost control of N₂O emissions, while reducing the health and ecosystem threats of other N pollution forms. In order to bring the 'nitrogen green economy' forward, a much stronger public profile is needed to motivate citizens' actions and to encourage investment in bringing new technologies to profitability. A recent estimate suggests that improving global NUE_{fc} by 20% would provide a N-saving worth ~23 billion USD to business, plus health and environmental benefits worth ~160 billion USD. The value of externalities highlights the green economy case for governments to develop a suite of instruments to go further in controlling N₂O emissions than the Sector View would typically allow.

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1. Foundations of a developing nitrogen green economy

There are many definitions of the green economy. For some, the reference to 'green' implies a link to agriculture. For others the idea of the green economy encompasses all the economic opportunities arising from actions that promote sustainability, improving "human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (UNEP, 2010). The phrase 'green growth' is also frequently used, focusing on the contribution of environmental technologies to a growing economy (OECD, 2011), for example as measured by gross domestic product. Allen and Clouth (2012) provide a summary of recent perspectives and definitions in the Green Economy, also noting its central position as a theme of the Rio+20 declaration (UN, 2012).

Diverse points of view are also illustrated by the example of agriculture. In this case, while some have emphasized the benefits of 'sustainable intensification' as a means to reduce environmental degradation, others have pointed to a rather different vision that seeks to avoid intensification (see discussion by Garnett and Godfrey (2012)). The latter group would instead encourage a move away from dependence on external fertilizer inputs in conventional farming practices (Kotschi, 2013), focusing on the role of "organic resource inputs and natural biological processes to restore and improve soil fertility" (Herren et al., p. 68 in UNEP, 2011).

Whatever the outcome of this hot debate, there are strong shared challenges, with many available actions to reduce nitrous oxide (N₂O) emissions while contributing to improved economic performance. This applies whether the focus is on industrial or agricultural emissions of N₂O, whether the local paradigm is one of intensive or extensive management, and whether the focus is on utilizing or avoiding external inputs. In all cases, there is a need to develop consensus around the common opportunity for improving production efficiency, business profits and citizens' welfare through environmentally targeted measures.

It is essential to recognize the link to the wider nitrogen cycle. This means that strategies to reduce N₂O emissions from a climate perspective can be developed that simultaneously lead to overall reductions in nitrogen losses (Oenema et al., 2011; Sutton et al., 2013a). The nitrogen saved contributes to improving food production, while reducing its contribution to air, land and water pollution. Such co-benefits can be critical in developing the 'green economy case' to motivate the changes needed.

2. Contrasting green economy perspectives

The green economy includes issues related to profitability of production sectors and related to societal welfare. This leads to two distinct perspectives regarding N₂O control, especially as this relates to the effect of greening on product prices and the decisions of producers and consumers.

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