Mitigation deterrence effects of GGRs, Briefing note – AMDEG project

'Mitigation deterrence effects of GGR' – say whaaat??

Greenhouse Gas Removal (GGR) techniques promise to remove greenhouse gases from the atmosphere and so provide negative emissions. Negative emissions could be very useful in terms of compensating for emissions that are very hard to decarbonise, and for remedying any emissions exceeding (over-shooting) safe – say 1.5°C – limits to global warming. A potential negative side-effect is the risk that pursuing GGR could deter or delay emissions reductions – we call this *mitigation deterrence* (MD). Think of having that extra doughnut after your healthy run…

Mitigation deterrence matters. Recent research has identified debatable and poorly communicated assumptions made in climate modelling over the last decade about massive future use of GGR techniques, and has shown that these have already undermined the need and urgency felt by policy makers to accelerate mitigation efforts (and, ironically, to support GGR development). Our own research shows that many stakeholders in industry, policy making, environmental organisations and academia think the risk of MD is plausible and worth taking seriously. Our initial quantitative estimate of the risk suggests it could result in as much as an *extra* 1.4˚C warming (above a 1.5˚C target). To pursue GGR with as little MD risk as possible, we therefore recommend clear separate targets for GGR and emissions reduction (amongst other measures – see below).

Our research has involved several components: (1) We have developed improved ways to understand MD effects, which take into account new kinds of possible side-effects of pursuing GGR. (2) We interviewed experts on modelling and GGR techniques to make sure we understood technical aspects and implications. (3) We ran a set of workshops with a wide range of stakeholders, exploring together different scenarios of MD from GGR techniques. (4) We developed a new way to estimate the size of MD risk. All of this underpins the results reported here, and our policy recommendations.

Why has (the severity of) mitigation deterrence risk been under-recognised?

The idea of GGR has multiple origins, both in climate modelling, as an assumption that helps make the sums add up and keep projections within safe limits, and in science and engineering, as a set of proposals for what might be possible in the future. It is not simply the case that modellers have incorporated the knowledge of scientists and engineers. Rather, technology promises and modelling approaches have developed together, alongside climate targets and debates, typically in ways that have served to preserve the economic (and emissions) status quo. So, for instance, sometimes the models have preceded what is technologically possible, which in turn helped to legitimate both policy promises about achievable climate targets and specific new technologies.

To become successfully deployed technologies, GGR techniques need to be turned into working technological systems, through innovation processes. Such processes includes development and testing, but also the embedding of the techniques in society through policies, regulations, financing, skills sets, narratives etc. And these processes are difficult to predict, including for GGR techniques. The success of GGR innovation processes is both dependent on context and uncertain, in terms of availability and side-effects, in ways that are hard to capture in modelling. Most of the modelling used to underpin the Paris Agreement's ambitions to stay within 1.5˚C warming assumed (not very transparently) the future availability of GGR (in the form of afforestation, and Bioenergy with Carbon Capture and Storage, BECCS). Such ubiquity of (downplayed, and then unexamined) assumptions about availability served to downplay uncertainty about availability. Moreover, when building

models, only some interactions between GGRs and other variables are included, focusing mainly on price and resource competition. This downplays the many other ways in which GGR techniques can interact with, and potentially deter and delay, mitigation options. Since they are, therefore, largely left out, MD risks may be under-estimated in current modelling work (especially where models allow overshoot of carbon budgets and heavily discount future costs), which matters due to a neglectful over-reliance on the authority of those as objective descriptions of reality.

Note that this is not a GGR-specific dynamic. Similar deterrence effects can be identified looking back in history for other climate policy options; for example, CCS on fossil fuel-sourced CO_2. Although, GGR may be worse given its apparent future possibility of reversing overshoot of carbon budgets retrospectively. Current modelling practices actually contain strata of old technology promises that weren't delivered on. Also, the solution here is not simply a technical one of improved modelling. Rather, if we are not to continue overlooking risks of MD we must address the wider dynamic of modelling, technology promises and policy targets all evolving together.

How can we best understand how mitigation deterrence effects arise?

Firstly, previous research by one of our team suggested that MD-type effects are more likely when options are perceived to be readily *substitutable* (i.e. having the same effect), potentially ignoring significant differences. Such exaggerated perceptions of substitutability are more likely, in turn, when climate policy goals are narrowly perceived, notably if focussing only on emitted (or removed) tonnes of CO_2 and ignoring (environmental, social, economic, political etc.) side-effects. Our research has also noted that such narrowly constructed substitutability is at the heart of emissions trading. Trading negative emissions for emissions reductions requires them to be 'fungible' – an extreme form of substitutability which reduces emissions to the same, quality-free pure quantity. Fungibility, however, is much harder to establish if taking complex (and uncertain) side-effects into account. We could end up wishing we had done more mitigation (and of specific types), and that we had used a more 'holistic' approach to assessing the options and so spotted more possible side-effects in time.

Secondly, we also need to be careful not to ignore temporal differences between mitigation options and GGR techniques. Even trading emissions reduction for any *current* negative emissions has risks; not least that carbon stored in forests, soils or even underground reservoirs might subsequently leak. Exchanging mitigation ambitions now for merely imagined *future* negative emissions is even more reckless. GGR proposals may not come true, or only work less well, and more expensively, and with worse side-effects than imagined. GGR *failing* in practice – for narrowly technical reasons, or in terms of their embedding in society – is another key mechanism through which MD risks occur. Painting rosy pictures of the future of GGR proposals is easier than to deliver them, and it may of course be tempting to rely exclusively on marketing (greenwashing), especially since commercial ventures can remain profitable just by keeping financial investors happy while the actual GGR projects (and their 'bad news') may be far away and comparatively inaccessible in poorer, industrialising regions. In short, we could end up wishing we had gone that extra mile with mitigation, if it becomes clear that GGR didn't live up to its promise.

Finally, there is a range of indirect mechanisms (here called *rebounds*) through which GGR deployment could lead to additional emissions; for example, if CO_2 streams get diverted into enhanced oil recovery (whether temporarily or becoming more embedded over longer time periods), or if expanding biomass growing leads to clearing of forested land elsewhere for growing of crops. Economic pressures and the growth imperative may thus lead to co-option and subversion of otherwise good GGR ideas. We could end up wishing we had done more mitigation, if it turns out that GGR caused new unexpected additional emissions.

In all three respects, then, the current political economy, with its ever-present and intense growth imperative, strong focus on market instruments, and financialised economies, constitute pressures that increase MD risks. For such conditions drive the priority of fungibility, and the incentive for greenwashing and maximal exploitation of existing natural resources, respectively. This isn't to say, however, that a change in political economy would necessarily resolve the problem, only that the current context shapes how MD effects may arise here and now.

How bad could mitigation deterrence effects of GGR be?

We have developed the first estimate of how big the MD effects of GGR could be. And since it is the first attempt, the estimation method is also brand new. We draw primarily on figures produced from carbon budget analysis and integrated assessment modelling, complemented with other literature.

Distinguishing between three types of effects (and separating formal, centrally-planned substitution, for example in carbon trading schemes, from substitution undertaken without central coordination, estimated as affecting the remaining most expensive mitigation), we estimate a worst case to be that more than 500Gt-C are at risk from MD (see table below). This would add up to 1.4˚C additional warming above a 1.5˚C target level. Note that this is not a prediction. But the numbers warrant more research, and contribute to our concern that MD risks are worth taking seriously.

Type	**Estimate (Gt-C)**		
	Low	**Central**	**High**
1: formal substitution + failure	50	156	229
2: rebounds	25	71	134
3: imagined substitution	297	216	182
Total	371	444	545

Notes: 1) The numbers for type 3 are intentionally ordered from high to low, as they co-vary negatively with type 1, and otherwise the totals would be misleading. 2) The uncertainty of the estimates grows across types from 1 to 3 (and the range as such is not an indication of uncertainty).

What does mitigation deterrence feel like?

Participants in our workshops were generally concerned about climate change and aware of the magnitude of the problem, and there is a tension inherent in thinking about the risk that pursuing GGR – seen by many as a necessary part of the solution – could at the same time be part of the problem. Contemplating this tension can be emotionally difficult, and for some triggered quite strong emotional reactions. Due to the challenging nature of the topic, being able to talk about solutions, or at least responses (see below), was a relief for the participants, and contributed to their being able to acknowledge the MD risk in the first instance. And we were able to talk about the dilemma that MD from GGR poses for decision makers and the incentives they face (e.g. due to systemic pressures discussed above) - what we have ended up calling 'the attraction of delay'.

Not everyone we have engaged with agrees that the risk of MD from GGR is real, or big enough to matter. The workshops were constructed so as not to demand agreement or assent from participants, whether regarding our scenarios or the positions of others, and there and there were plenty of reactions against the scenarios. But many did agree, and saw MD as a plausible risk. Moreover, we had a large set of scenarios, with different GGR techniques, but also different kinds of political regimes (neoliberal, egalitarian, authoritarian etc.), and all of them had MD in some form. This meant that our workshop scenarios presented no easy political fixes to MD, irrespective of

whether they put their faith mainly in markets, or activism, or top-down leadership, etc. Concern about MD was shared by participants with different political orientations.

Most participants became more likely to acknowledge MD risks as the workshops progressed. This change happened for several reasons:
(1) We had developed scenarios of MD coming to pass in multiple time steps, and with a sequence that ran from GGR promises (in 2020), disappointing results (in 2030) and finally some clarity as to why the results were disappointing, i.e. why MD had occurred (in 2050). This allowed participants to experience MD through a sequence of events, and many came to acknowledge their plausibility.
(2) It was also important for many participants *first* to express support for and to defend GGR, *before* being able to acknowledge MD risks. There is a risk that talking about MD from GGR is seen as an attack on GGR, and for many it was important to first establish their openness to GGR as a responsible, and potentially crucial, form of climate action.
(3) For many, it is easier to think in terms of the kinds of interaction effects between options (price and resource competition) that models are already good at handling. In contrast, the kinds of effects involving cultural and/or political economy issues that we are also thinking about here are often less intuitive or familiar (at least as spoken about in public), and so may take longer to think through.

How to avoid mitigation deterrence – tips for policy makers

1. We remain convinced that GGR should be pursued, but the risk of MD should be taken seriously. Thorough ***risk assessments that include assessments of MD risks*** should be undertaken using a wide set of criteria, going well beyond tonnes of carbon, price and resources used. Nature-based GGR techniques should be assessed with the same rigour as high-tech forms, to avoid similar risks of hype and exaggeration.

2. A key principle for developing policy for the safe pursuit of GGR is ***separation*** of negative emissions from emissions reductions, to avoid MD processes involving (unplanned) substitution. To elaborate, this should involve:
   - separate targets,
   - redesign of offsetting and trading systems, so that the GGR techniques are protected from low carbon prices, at least until mature,
   - changed incentives and portfolio building (e.g. directed support for early stage development of a range of GGR techniques),
   - separate evaluation and assessment methods (e.g. the equivalent of 'Chinese walls' in finance sector between appraisals of negative emissions and emissions reduction options),
   - GGR techniques that can be justified on grounds of co-benefits should be supported on those grounds, and not treated as tradeable carbon.

3. Robust systems of ***accountability*** must also be developed, involving effective monitoring, reporting and verification to avoid double counting, cheating etc., and to ensure that carbon ends up stored for the long-term, rather than diverted into short-life products, or unreliable forms of storage.

4. To prepare for the risk of mitigation deterrence, we will need more of the kind of ***deliberation*** undertaken in this project, to raise awareness and to explore MD type risks further. To organise stakeholders' access to policy making to channel action against GGR-MD in support for low-MD GGR policy.

Project outputs

Journal Papers

- *Towards a cultural political economy of mitigation deterrence by negative emissions technologies (NETs)*. Markusson N., McLaren D. and D. Tyfield 2018 In: Global Sustainability 1 e10, 1–9. https://doi.org/10.1017/sus.2018.10
- *Beyond "Net-Zero": A Case for Separate Targets for Emissions Reduction and Negative Emissions*. McLaren, D., Tyfield, D., Willis, R., Szerszynski, B. and N. Markusson 2019 In: Frontiers in Climate 1:4. doi: 10.3389/fclim.2019.00004

Working papers

- *Towards a cultural political economy of mitigation deterrence by Greenhouse Gas Removal (GGR) techniques*, AMDEG Working Paper 1, Markusson N., McLaren D. and D. Tyfield
- *Quantifying the Potential Scale of Mitigation Deterrence from Greenhouse Gas Removal techniques*, AMDEG Working Paper 2, McLaren D. and A. Jarvis

Submitted papers

- *Quantifying the Potential Scale of Mitigation Deterrence from Greenhouse Gas Removal Techniques*, Climatic Change, McLaren D.
- *Technologies of prevarication: the co-production of technological promises, policies and targets for climate change*, Nature Climate Change, McLaren D. and N. Markusson

Blog posts, podcasts and media items

- *UK launches 'world first' research programme into negative emissions*, Carbon Brief
- *What on earth is mitigation deterrence? If you care about climate, you need to know*, Rebecca Willis
- *A false promise?*, LEC blog
- *After the pledge: Scientists scramble to make politicians' climate goal a reality*, Christian Monitor
- *How the pernicious promises of imaginary carbon removal harm essential climate action*, Duncan McLaren
- *Exaggerating how much CO2 can be absorbed by tree planting risks deterring crucial climate action*, Duncan McLaren, The Conversation
- *Trees: one way to tackle climate change?*, Duncan McLaren, Shell, The Energy Podcast
- *When essential research might be a bad thing. The carbon removal research dilemma*, Nils Markusson and Duncan McLaren, FCEA blog
- *The problem with net-zero emissions targets*, Duncan McLaren, Carbon Brief guest post
- *A Case for Separate Emissions Reduction and Negative Emissions*, Duncan McLaren, NORI podcast