



Department for
Business, Energy
& Industrial Strategy



Science & Technology
Facilities Council



WORKSHOP REPORT ON SOCIO-ECONOMIC ASPECTS OF GGRT PROGRAMME

20/9/2018, Cranfield University

Workshop summary and next steps

The workshop was the first opportunity across GGRT programme to bring at least one social scientist from each project together. Overall the attendees welcomed the opportunity to meet and find out about other projects.

The mapping of socio-economic research produced by socio-economic working group, led by Nazmiye Ozkan and Nils Markusson, was found useful. Suggestions were made to gather other data, including 'expected results'. The mapping has revealed interesting things about the variation across the projects on types of GGRTs covered, methods adopted and types of social science disciplines covered (and not covered). The importance of communication with external stakeholders and addressing their unfamiliarity with GGRTs were highlighted.

The need for social science input into consequential life cycle analysis was reiterated as we have limited insights on technological and societal feasibility of different GGRTs and their feedback effects on the economy. Use of scenarios can help with addressing this limitation. However there is a wide range of methods that projects will use in developing their scenarios. It was agreed that i) all projects will put effort into translating their own scenarios into IPCC scenarios (e.g. how they differ) so that the results can be compared and assessed; ii) scenarios developed will be shared with LCA working group to inform their work on consequential life cycle analysis.

Next steps:

- 1) Updating of mapping document → Each team to provide the following details in the revised mapping document by November 16, 2018

Expected results: a free entry cell for the team to provide details of their expected results

- 2) Collation of shared definitions → Each team to provide the five to ten terms and definitions most important to their work by November 30, 2018
- 3) Collation of socio-economic scenarios: To support LCA group, each project team to provide information on three aspects on any scenarios used: 1) use of IPCC's SSP scenarios; 2) other external scenarios, 3) developing in-house scenarios. For cases 2 and 3, please explain how your scenarios are different from the SSPs → November 30, 2018.

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The workshop was attended by 19 people, including at least one social scientist from each project, NERC programme coordinator, a BEIS representative and life cycle analysis experts some of whom joined at the last session via Skype.

The aims of this workshop were three-fold:

- 1) Identify shared research challenges for understanding and analysing socio-economic aspects of implementation of GGRTs
- 2) Compare and contrast the diversity of socio-economic research, especially methods and assumptions, used across NERC's GGRT programme
- 3) Identify areas/steps to consider to ensure consistency and coherence (assuming we need some?) across the GGRT programme [given we have very little experience with these very different technologies]

The workshop kicked off with short introductory remarks by the each attendee. The discussions are summarised below for each session as outlined in the workshop agenda.

Mapping of different research methods and assumptions: Nils Markusson

The mapping of socio-economic research across the projects in the GGRT programme was made based on input from researchers across the projects. The mapping showed a focus on two technologies: BECCS technologies and land management. However, there is no major funded project on DAC or CCU, although 2 projects engage with DAC as case studies. Another observation is that though there is some work on agroforestry there is not much going on forestry. The audience of most projects are policy-makers and users (but also civil workers, NGOs). Across the projects, there is a lot of economics and a bit of social science (including sociology, political science) and some psychology. But looks like some disciplines are not present at all, such as law or philosophy.

Research topics can be broadly categorised in two themes: 1) drivers and barriers, especially economic/financial and public/social feasibility, and 2) the role of GGRTs in climate policy (and also some broader governance questions). A theme that is not covered much is international, geopolitical aspects of GGRTs.

Following these observations, there was an open discussion. Two major research challenges were identified: 1) the integration of socio-political aspects with modelling, and 2) high uncertainties on GGRTs due to lack of data, overall non-readiness of the majority of a diverse set of technologies. We have limited insights into the **feasibility, whether from a technological or societal level**, of GGRTs. We don't know whether they will work technically in real world. Are there any limiting factors? Also, is the 'weakest link' (i.e. most limiting factor) for the implementation of these different GGRTs the same? For DAC, economics might be most important constraint but how about public acceptability? How can CGE/ macro-economic models capture feedback effects in the economy, when there is no market for these technologies yet? We can use theoretical links at micro economic models but these are not based on actual data, and we don't have useful estimates.

The variety of assumptions and methods applied across different projects dealing with GGRTs was also highlighted, and there was discussion about the whether there was a need to harmonize the methods and assumptions used. There was also discussion about working inter-disciplinarily, together with natural/physical scientists.

There was discussion about how to use the mapping, including for the purposes of presenting ourselves to the wider world. It was mentioned that a website for the GGRT programme is under construction, in which links for each individual project websites can be added. A point was raised on how the information on the website will be used by different stakeholders.

- An action from these discussions was that the mapping will be updated and improved. It was also agreed that the outputs from this working group can be placed on the UPGreenLCA project website.

Identification of research challenges across the programme: Nazmiye Ozkan

This session started by revisiting a long list of issues that were highlighted at the first socio-economic working group meeting at the GGRT programme kick-off meeting in Oxford in 2017. Issues in particular about characterisation of different GGRTs (including costs, their efficiency) and how they might influence the economy via feedback effects followed on from the discussions in the first session. Beyond economic costs, timescales are also important in describing which technology can be implemented at what scale and when and how their penetration can be characterised dynamically in the projects.

The need to understand how results fit in with IPCC outputs was noted. This will require transparency and traceability of underpinnings of the models/ scenarios so that they can be compared. It was also noted that when different technologies were scaled up, there might be key constraints that need to be taken into account.

Communication with the public can also be challenging and it matters for the level of acceptability of the different GGRTs. Beyond public, regulations can influence the implementation of GGRTs as well as other social factors. The issue of the lack of understanding of GGRTs by the policy-makers was also raised. While BECCS is novel, afforestation is an old technology, raising asymmetry of information and knowledge on GGRTs (level of readiness of GGRTs, data use, availability and reliability).

Another challenge is the heterogeneity of terminology; is it important to use similar terms and definitions across all the projects in order to improve the understanding and the communication with other stakeholders. Or at least to understand how our language varies.

Similarly, is it better to harmonize the assumptions and scenarios related to GGRTs or understand the differences between them. While the audience agreed that scenarios to be developed across the projects might have a particular focus, a 'translation' work to see how they map onto IPCC scenarios was deemed necessary. Alternatively, the projects might start with IPCC based work and then make changes in the scenarios depending on the project outputs while ensuring consistency.

Two actions emerged from all these discussions:

- It was agreed to share the socio-political scenarios across the GGR programme, and that the scenarios should be accompanied with a comment about whether they were in line with IPCC's SSP scenarios, or how they differ from them.
- It was agreed that every project within the GGR programme should give definitions of the top 5 or 10 concepts in order to establish a shared terminology, or at least a shared understanding of divergent definitions.

Positioning the international research landscape on socio-economic aspects of GGRT: David Reiner

David started his talk with a comment on integrating different aspects together. UK Carbon Capture and Storage Research Centre (UKCCSRC) 2017-2022, which is an integrated research programme where academics, industry and policy makers collaborate to analyse problems and carry out research related to CCS. He then gave an overview of the international research activities on socio-economic aspects of GGRTs.

The first NETs conference was held in Gothenburg, Sweden and the next conference will take place in Canberra, Australia on 30 and 31 of October 2018 (GHGT-Melbourne). The first wave of research were carried out in European and North American countries and the second wave if from the rest of the world. The international landscape focuses on net zero emissions for the world, where GGRTs have the best potential and where we want to be.

A lot of research is going on in the United States, but this is not visible as they don't describe it as climate change related. Also, philanthropic organisations are more important funding sources there. There may be different cultures to the study of socio-economic aspects of GGRTs.

Policy has a responsibility to support this process though. The policy pathway bias where poor countries are not causing climate change but suffering the impacts and don't have the capacity to address them needs to be addressed. Building relationships across developed and developing countries are important.

Socio-economic research on GGRTs is not an established field, and so it's somewhat hard to analyse them separately from e.g. CCS or land-use research. The increased attention to socio-

economic issues in SR1.5 report has had an impact though, potentially leading to emergence of this field.

Marginal abatement cost curves (MACC): Vera Eroy

MACC is a decision-support tool based on detailed economic analysis and experience and designed a wide range of sectors. MACC charts show the cost effectiveness in £ per ton of CO₂eq and the quantity of CO₂eq abatement compared to a “business as usual” case, and it’s expressed in tons of CO₂eq. MACC curves help determining the optimal levels of pollution control, how much effort is economically efficient and which technologies to promote.

Measures are screened from left to right, from low cost to high ones. There are two issues to note: i) as transaction costs of implementing measures aren’t included, costs are limited; ii) interpretation of negative figures are tricky as they highlight the need for behavioural studies rather than cost efficiency perspective.

Overall, MACC curves, even though they use simple graphs, can be quite complex in informing decision making as they can be misinterpreted easily. It is important that the figures are accompanied with discussion to explain the underlying complexity.

Linking socio-economic aspects to consequential Life Cycle Assessment approaches (LCA): Pietro Goglio

LCA is a tool to assessing the environmental impacts associated with a product or a service taking into account all the stages of a product's life from raw material extraction through manufacturing, distribution, use and disposal. There are two different approaches to LCA:

- Attributional LCA: uses average data to attribute the average environmental impacts for producing a unit of the product or a service. The system studied is generally limited to a single complete LCA.
- Consequential LCA: uses marginal data represented by the product, resource, supplier or technology, which is the most sensitive to changes in demand. Economic value criteria are used to identify the marginal products. CLCA is based on system enlargement to include the life cycles of products affected by a changes.

The discussion then focussed on how these methods can inform the usefulness of GGRTs and whether the focus should be national (e.g. UK) or international. It was noted if a land management technology is more effective for rice than oats, then the results would be relevant internationally (e.g. for China and India). However, the research should still aim to identify how the technology might influence the carbon content in UK soils.

As GGRTs are not yet implemented, our insights on the feedback effects in the economy are limited. This issue can be address by using scenarios. Global scenarios (e.g. IPCC) can be used to develop UK specific scenarios.

The main questions raised from this presentation where:

- Which socio-political aspects should be included in the CLCA and
- Which methodology should be followed to develop the different scenarios?

It was decided to share the scenarios across the working group on social-political aspects. These will then be further discussed within the LCA working group for GGRT.

List of Participants

	Attendees	Affiliation	GGRT Project
1	Phillip Williamson	University of East Anglia	GGRT Programme Coordinator
2	Beth O'Connell	Department for Business, Energy and Industrial Strategy	
3	Duncan McLaren	Lancaster University	Assessing the mitigation deterrence effects of GGRs
4	Nils Markusson	Lancaster University	Assessing the mitigation deterrence effects of GGRs
5	Michelle Felton	University of Reading	Co-delivery of food and climate regulation by temperate agroforestry (CALIBRE)
6	David Reiner	University of Cambridge	Comparative assessment and region-specific optimisation of GGR
7	Zeynep Clulow	University of Cambridge	Comparative assessment and region-specific optimisation of GGR
8	Laurie Waller	University of East Anglia	Feasibility of afforestation and biomass energy with carbon capture storage for greenhouse gas removal (FAB GGR)
9	Huw Pullin	Cardiff University	Greenhouse gas removal in the iron and steel industry
10	Nazmiye Ozkan	Cranfield University	Harmonising and upgrading greenhouse gas removal (GGR) consequential life cycle assessment (UP-green LCA)
11	Neil Harris	Cranfield University	Harmonising and upgrading greenhouse gas removal (GGR) consequential life cycle assessment (UP-green LCA)
12	Khaled Abdou	Cranfield University	Harmonising and upgrading greenhouse gas removal (GGR) consequential life cycle assessment (UP-green LCA)
13	Adrian Williams	Cranfield University	Harmonising and upgrading greenhouse gas removal (GGR) consequential life cycle assessment (UP-green LCA)
14	Vivian Scott	University of Edinburgh	Metrics for emissions removal limits for nature
15	Peter Healey	University of Oxford	Releasing divalent cations to sequester carbon on land and sea
16	Diana Marisa Silva Feliciano	University of Aberdeen	Soils research to deliver greenhouse gas removals and abatement technologies
17	Vera Eory	Scotland's Rural College	Soils research to deliver greenhouse gas removals and abatement technologies
18	Pietro Goglio	Cranfield University	Soils research to deliver greenhouse gas removals and abatement technologies
19	Michele Seghetta	Cranfield University	Soils research to deliver greenhouse gas removals and abatement technologies