Project Clover – Feasibility Report Summary

Decarbonising the Agri Food Supply Chain

November 2021

Prepared on behalf of

Wyeth Nutrition | Carbery | glanbia ireland | Danone | dairygold | Lakeland Dairies | Tipperary Co-op

KPMG Sustainable Futures

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Introduction to Project Clover

In response to the significance, scale and complexity of the sustainability and climate action challenges impacting the competitiveness and legal obligations of the Irish food industry, key industry representatives ("SteerCo Members"), led by Danone Ireland, formed a collaboration of industry participants in June 2020 under the banner "Project Clover" (or the "Project").

Having previously scrutinised all options for decarbonising their industrial heat processes, including biomass and electrification, the SteerCo Members concluded that switching to biomethane was the most economic and viable option available.

With biomethane available in many other jurisdictions, SteerCo Members are of the view that Ireland's lack of an indigenous biomethane industry will harm the Irish food industry's international competitiveness, impact FDI, and limit Ireland's decarbonisation ambitions under the national Climate Action Plan.

Project Clover represents a shared vision of a fully integrated, agriculture led, on-farm sustainability approach to the decarbonisation of the Irish food supply chain. Central to the vision is the use of indigenous AD biomethane to decarbonise thermal heat processes, commercialisation of its by-product digestate to produce organic fertiliser and monetisation of the currently unquantified soil carbon sequestration on Irish farms.

In September 2020, SteerCo Members commissioned Phase 1 Feasibility Study for Project Clover.

Project Clover was originally informed by the *"Integrated Business Case for a Biomethane Industry in Ireland",* KPMG / RGFI 2019, a full cost benefit analysis in compliance with the Public Spending Code, as well as earlier analyses including "*Decarbonising Domestic Heating in Ireland"*, KPMG / Ervia, 2018 and *"Business Case for Biomethane Production – Cluster Report",* KPMG/RGFI May 2020.

Project Clover Phase 1 Feasibility Study

Phase 1 Feasibility Study (Sept 2020-March 2021) considered the economic, regulatory and practical feasibility of delivering the three core workstreams:

- Developing a viable indigenous biomethane industry
- Monetising organic fertilisers
- Maximising soil carbon sequestration potential

The work was fully funded by industry participants – Danone, Glanbia Ireland, Dairygold, Carbery, Lakeland Dairies, Tipperary Co-op and Wyeth Nutrition.

These industry partners also contributed expertise, participated in workshops, and engaged with Government, while overseeing the Project through a Steering Committee.

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Feasibility Study Conclusions

- Each of the three components of Project Clover are technically and practically feasible within an Irish context.
- There remains an economic funding gap, however the feasibility study has demonstrated a number of pathways to long-term economic competitiveness.
- While the long-term ambition of 125 x 20GWh AD plants by 2030 remains credible and achievable (generating 2.5TWh of renewable gas per annum), the study recommends an initial pilot scheme based on eight farm / community based 20GWh AD plants,, to build full stakeholder buy-in, knowledge transfer and ecosystem support in a measured way.
- Clover is fully aligned with the Teagasc Signpost Farms Programme. Teagasc has indicated its support for any future Signpost Farm participation in Project Clover.
- The AD plants should be agri-based, utilising a mixture of crop and slurry inputs (incl. grass silage, rotation crops and multi-species swards).
- Ireland has sufficient feedstock potential to supply the proposed AD plants without impacting current volumes and usage.
- The use of multi-species swards should be encouraged, bringing numerous benefits including biodiversity and increased yields with lower fertiliser inputs and better drought resistance.
- The agri-based biomethane will be able to comply with EU RED II sustainability criteria and will be certified by the Green Gas Certification Scheme.
- The Feasibility Study recommends the development of a Project Clover Charter to ensure all AD plants under the scheme meet strict criteria to ensure environmental, economic and social sustainability, and create no unintended consequences.

The Potential of Project Clover

The Feasibility Study has established the business case for industry to proceed with this project. Project Clover recognises that its objectives can only be achieved through ongoing collaboration, aligned with the requirements of all stakeholders.

It has determined that Project Clover has the potential to:

- Align with the Paris Agreement, EU Green Deal, Farm to Fork Strategy, Ag-Climatise, Interim Climate Actions 2021 and national targets to reduce emissions.
- Achieve emission reductions, displacing over 680kt CO_2 per annum by 2030, in a way that is commercially viable.
- Assist in decarbonising the full supply chain, addressing scope 3 emissions.
- Generate additional revenue streams to support on-farm sustainability through the use of bio-fertilisers, multi-species pastures and carbon sequestration. While feasible, these areas need further work in the next phase of Project Clover.
- Support commercial sustainability and competitiveness of the Irish food industry.
- Support Irish industry in adapting to future legislative trends including carbon labelling and ESG reporting, and help industry to access sustainable, taxonomy-aligned finance.

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Environmental Sustainability

- Project Clover will be developed in an environmentally sustainable way.
- The Feasibility Study recommends the development of a Project Clover Charter to ensure all AD plants under the scheme meet strict criteria to ensure environmental, economic and social sustainability, and create no unintended consequences.
- AD feedstock will be produced sustainably, enhancing biodiversity by drawing on Devenish's multi-species swards research, as well as advice and experience from Teagasc.
- Project Clover will provide an outlet for excess slurry across the agriculture system, while producing organic fertilisers to displace artificial fertilisers, which will improve water and air quality and soil structure.
- Project Clover will provide a mechanism to decarbonise some of the most difficult to decarbonise sectors, where no alternative solution has been found.
- AD biomethane is a key enabler in contributing to reducing emissions in the Irish agriculture sector.
- The Teagasc AD, biomethane plant at Grange, based on grass and slurry feedstock, will be a demonstration plant for Project Clover. Clover will work with Teagasc to develop a Centre Excellence for AD Biomethane, knowledge transfer and information sharing on supporting sustainable practices and land management including carbon farming.
- Through its research and development, Teagasc is committed to supporting Project Clover and its associated carbon mitigation and carbon farming benefits.

Farmer Opportunities

- Project Clover provides an opportunity to shift the current position of agriculture within the climate debate, placing farmers at the centre of the solution.
- AD biomethane has the potential to provide a diverse additional income, greater than what can currently be achieved in the cattle, sheep and tillage sectors and from leasing the land.
- Project Clover reduces carbon emissions, complies with measurement, reporting and verification ("MRV") requirements for soil carbon sequestration, supports the principle of the EU Carbon Farming Initiative, and enhances biodiversity, water and air quality.
- Provides additional income options to farmers through diversification including lease income, operational salaries, long-term price-certain feedstock supply contracts, economic ownership, chemical fertiliser displacement and soil carbon value.
- Supports the potential for additional emissions savings by adapting carbon farming initiatives.
- Facilitates knowledge transfer to and among farmers via Teagasc Signpost Farms Programme and Teagasc AD biomethane demonstration plant.
- Project Clover supports the rural, circular bio-economy and community engagement in renewable energy production.

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Bridging the Funding Gap

- The Feasibility Study has demonstrated that biomethane has the potential to be the lowest cost option for the decarbonisation of high thermal loads as found in the Irish agri-food sector.
- While there exists a current economic gap between biomethane and natural gas prices, the feasibility study has demonstrated a long-term pathway to economic equivalence.
- Project Clover has concluded that direct exchequer revenue support is unlikely to be available, and has therefore proposed an alternative funding structure for the initial eight pilot plant roll-out whereby fixed government grants, combined with commercial construction loans, facilitate industry meeting the residual funding gap through voluntary socialisation of the incremental gas cost across multiple off-takers. This funding structure will demonstrate the viability of the technology in the short-term, without committing Government to long-term funding support.
- In the medium-term, it is proposed that a national socialisation scheme, known as Article 23 (national heat obligation scheme), will be introduced to support the longer-term ambitions of Project Clover. This will see the incremental cost socialised across a wider pool of energy users. We understand DECC intends to consult on the introduction of Article 23 in Q2 2021.
- ISIF has agreed in principle to provide commercial lending of €24m towards the initial eight pilot plant roll-out, and has indicated a willingness to extend this to facilitate the longer-term 2030 roll-out.
- Project Clover is currently seeking the balance of the capital funding from Government.
- The Feasibility Study sets out how additional revenue streams will be generated by the AD plants over time. Commercialisation of digestate as a bio-fertiliser and soil carbon sequestration income will allow biomethane costs to fall in the medium-term.
- Furthermore, there exists the opportunity for significant economies of scale to capital and operations as the sector matures. This includes clustering and standardisation of the AD plants and their funding.
- Over time, the combination of rising carbon tax, economies of scale and maturity, and additional income streams will provide a pathway to economic equivalence with natural gas for the Irish biomethane sector.
- An overarching body with a formal co-ordination mandate will be required to lead this standardisation, detailed design, funding and will provide ongoing support to the AD operations.
- A significant component of the infrastructure required to facilitate Project Clover is already under development by Gas Networks Ireland, with the first grid injection station having now received full planning permission (Project Graze).

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Benefits of Project Clover to Ireland Inc.

- Project Clover has the potential to displace at least 680k tn CO_2 per annum by 2030.
- Contributes towards meeting the 51% decarbonisation target in national, sectoral (especially agriculture) and local authority Climate Action Plans, in line with the Paris Agreement, European Green Deal and Farm to Fork Strategy.
- Provides independent, scientific and economic assessment and business analysis aligned with Teagasc as well as Irish Government strategy and policy under Ag-Climatise and the Climate Action Bill.
- Biomethane can contribute to achieving the 40% renewable heat target by 2030.
- Delivers the wider vision to benefit regenerative and sustainable agriculture, the rural circular bio-economy and a quality, resilient environment.
- Will create and sustain 3,000 jobs across rural Ireland. This can include the wider manufacturing and processing industries to contribute to decarbonising and sustaining Ireland Inc.
- Promotes community engagement and their direct involvement in meeting their renewable energy needs, in line with RED II requirements.
- Places Ireland at the forefront of renewable energy innovation in terms of its fully integrated, industry led approach, economic assessment, informed by science and engaging with stakeholders, and communities.

Key Requirements to Enable Project Clover

Industry is poised to implement Project Clover pending declared government policy and capital funding support - including :

- Declared policy support from Government for the long-term strategy and roadmap of Project Clover.
- Implementation of Article 23 in 2021/2022, with a biomethane target of 11% by 2030.
- Government support with match capital funding of €24m for a pilot scheme between 2020 and 2023.
- Development of a charter to underpin environmental commitments of Project Clover participants.
- Develop Teagasc Grange as centre of excellence, knowledge transfer and ongoing research & development to sustainable farming.

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Alignment with EU and national policy agendas

Alignment of Project Clover to Farm to Fork goals	
Ensure food production has a **neutral or positive environmental impact.**	
EU Carbon Farming Initiative. Implement new green business models that remove CO_2 from the atmosphere.	
Promote a **circular bio-based economy.**	
Reduce **pesticide use** and **excess nutrients** in the environment by 2030. Includes a **50% reduction in nutrient losses** without reducing soil fertility and a **20% reduction in fertiliser use**.	
Increase the proportion of **organic farming** to 25% by 2030.	
Implement a **sustainable food labelling framework**	

Alignment of Project Clover to Programme for Government goals	
Seek reforms to CAP to reward farmers for **sequestering carbon**	
Continue to support farmers to embrace farming practices that are **beneficial environmentally**, have a lower carbon footprint and better utilise and protect natural resources	
Encourage investment in **renewable infrastructure** on farms	
Explore opportunities for farmers from **anaerobic digestion**	
Deliver an incremental and ambitious reduction in the use of **inorganic nitrogen fertiliser** through to 2030	

Alignment of Project Clover to Ag-Climatise	
Action 1 reduce chemical nitrogen use to 325,000 tns by 2030	
Action 9 - Increase organic production to 350,000 ha by 2030	
Action 12 – promote a sustainable bio-economy in agri-food	
Action 17: Develop a pilot scheme in relation to on-farm carbon trading	
Action 20: : Engage with stakeholders to maximise the potential opportunities from Anaerobic Digestion for the agriculture sector	

Fully aligned **Partially aligned**

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Acknowledgements

We would like to thank all of those who have participated in Project Clover over the past six months. We acknowledge the spirit of collegiality and trust between stakeholders from diverse backgrounds, who have provided substantial feedback on our research outputs.

We would like to thank the various Irish Government departments – in particular the Department of Agriculture, Food and the Marine and the Department of Energy and Climate Change who have engaged consistently throughout the course of our work. We acknowledge the support of the state agencies, including in particular ISIF, Teagasc, IDA and Enterprise Ireland

In aligning with the policy leadership from the European Commission, we acknowledge the support of officials in DG Agri and DG Clima who gave generously of their time.

Given the significant role that the Irish agri-food supply chain has to play in decarbonisation we consulted with the farming organisations, ICOS and Dairy Sustainability Ireland, to explore opportunities for the sector to play a leadership role in addressing this nexus of challenges. The Farmers Journal Trust provided leadership, support and we also want to thank individual members of the farming community for their interest, as well as those community groups who engaged with us through Community Power.

Project Clover SteerCo

This feasibility study has been undertaken through the leadership and support of the Irish dairy and food industry steering committee:

- Danone Ireland – Donal Dennehy and Paul Kennedy
- Dairygold - Liam O Flaherty.
- Glanbia Ireland - Sean Molloy, John Kealy, John Finlay.
- Carbery - Enda Buckley.
- Lakeland – Kathryn O Flynn.
- Tipperary Co-operative – Margaret Cronin.
- Wyeth Nutritionals – Ian Ryan and Brian Shiel

Project Delivery Team

A delivery team, led by RGFI and supported by KPMG, was commissioned by the SteerCo to deliver the Feasibility Study and produce this Report. Gas Networks Ireland and Devenish provided technical input. RGFI and Authenticity provided stakeholder engagement and communications support.

Renewable Gas Forum Ireland | KPMG Sustainable Futures | Gas Networks Ireland | DEVENISH Beyond Nutrition | Authenticity

Section 2

Detailed Analysis

Workstream 1 Conclusions - Biomethane Plant Roll-Out

Scale of Ambition	▪ The feasibility study has concluded that the overall ambition of 125 x 20GWh plants remains an appropriate long-term level of ambition for Project Clover and Ireland. ▪ The study has however concluded that this should be progressed through an initial pilot phase of 8 x 20GWh plants to establish the sector in a measured manner.
Scheme Design	▪ The feasibility study has concluded that 20GWh is the optimum scale of AD plant for the scheme, and they should be designed to primarily utilise silage and slurry feedstock. ▪ The plants will principally utilise a virtual (tanker) transportation model for the gas, however where possible, direct grid connections should be adopted.
Sustainability Requirements	▪ The proposed AD plants are able to meet REDII sustainability requirements, both under 2021 and 2026 emission limits. ▪ The feasibility study recommends the development of an AD Charter, which will govern all plants developed under the Clover model to ensure no unintended consequences.
Capital Funding	▪ Project Clover has secured support in principal for €24m of commercial loan from ISIF to funding the initial eight pilot plants, subject to commercial loan terms and conditions. ▪ We are seeking to support this capital funding with c.€24m of matching funding, which is currently being sought from a variety of sources.
Ownership Model	▪ Final ownership model to be developed within a phase 2, however the feasibility has concluded that it is vital farmers have strong economic alignment to the plants including direct equity ownership. ▪ Potential economic involvement of dairy co-ops to be considered further

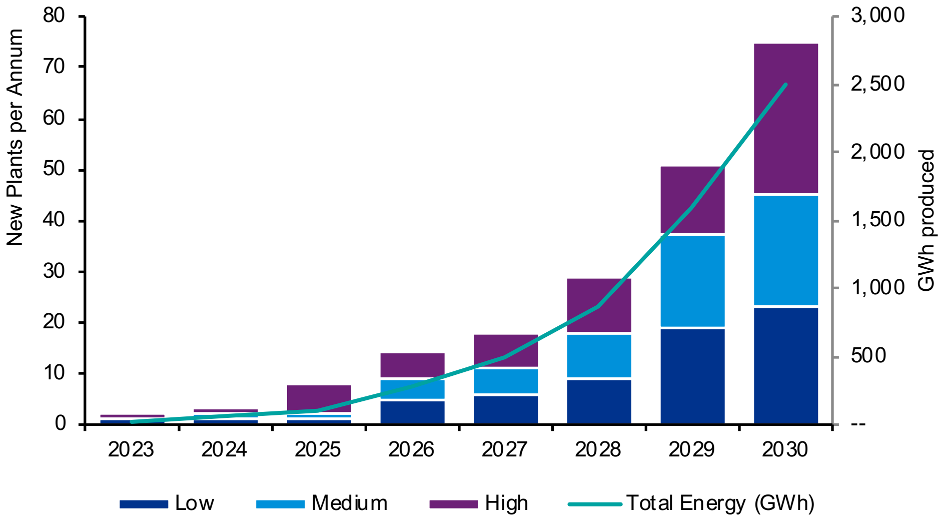
Workstream 1 - Scale of Ambition

- The feasibility study initially considered three levels of ambition, a low, medium and high scenario.
- Following conclusion of the feasibility, we have concluded that the medium scenario, of 125 plants, to be the most appropriate and achievable. This proposed ambition is in line with experience in Northern Ireland, which developed an AD industry of c.90 plants over a 5 year period, without disrupting the local agriculture dynamics. Given ROI's agriculture sector is three times the size of NI, this suggests 270 plants over 5 years is feasible.

Low scenario:
1.3TWh by 2030 (65 plants)
8% of industrial and commercial gas usage

Medium scenario:
2.5TWh by 2030 (125 plants)
15% of industrial and commercial gas usage

High scenario:
4TWh by 2030 (200 plants)
24% of industrial and commercial gas usage



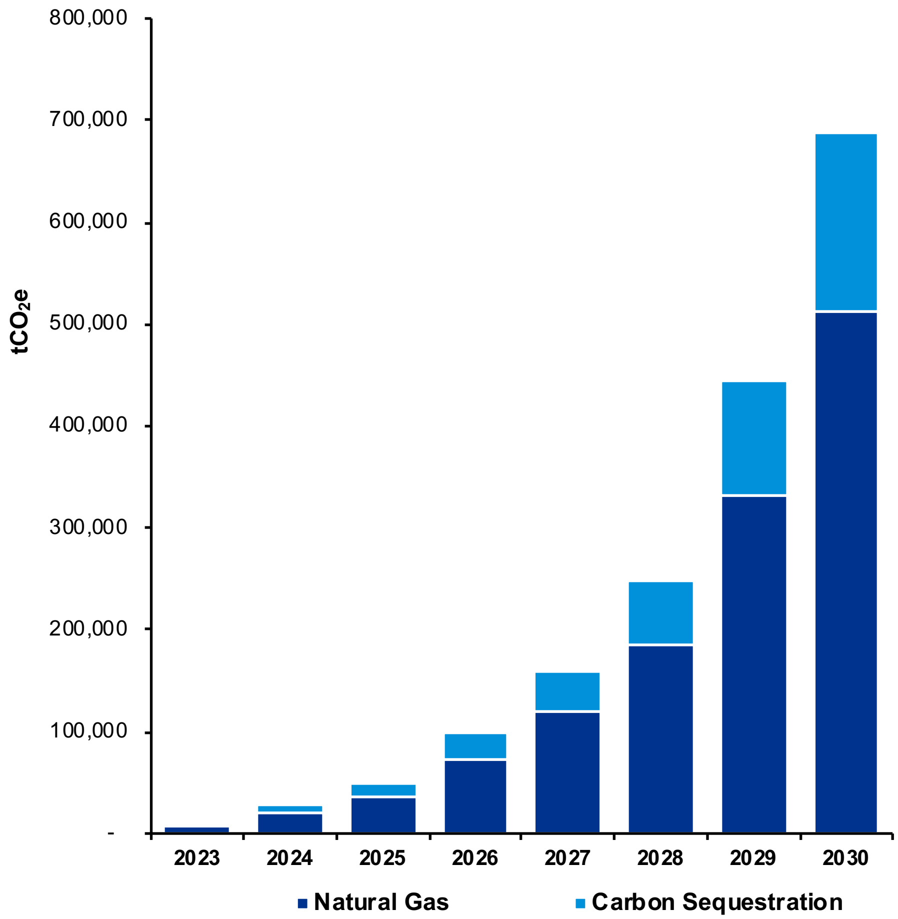
Each individual plant is assumed to produce 20GWh of biomethane

- While the feasibility study has concluded on a long-term ambition of 125 biomethane plants, members concluded that there should be an initial pilot development of eight AD plants prior to a wider national commitment. Such a pilot phase will allow the concept to be proven, design parameters to be optimised, while providing a more manageable scale to secure initial capital funding and biomethane offtake commitment.

Workstream 1 - CO_2e Abatement Potential

Project Clover has the potential to displace over 680k tn CO_2 per annum by 2030

- This calculation assumes that biomethane displaces natural gas (204g/kWh).
  - We understand rom a national carbon accounting perspective, if biomethane meets the RED II sustainability criteria, it can be considered as a zero emission factor renewable gas.
- Based on enhanced agricultural practices implemented as part of Project Clover, carbon sequestration is estimated at 1 tC/ha (3.67 tCO_2/ha).
  - As discussed in p.24 the volume of carbon is subject to uncertainty. It is expected that improved carbon sequestration levels will vary between areas and across years – with some areas having the capacity to sequester more carbon and some areas acting as carbon sources.
- Estimated savings from avoided slurry emissions and the displacement of chemical fertiliser are excluded from the adjacent figure, to avoid the risk of double counting in the RED II LCA calculation.
  - However, as discussed on p.24 avoided slurry emissions could equate to c.870 tCO_2e/plant.
  - Emission savings from the displacement of chemical fertiliser assume c.3.5 $kgCO_2e$/kg N savings in line with research by Timonen (2019)[1].
  - These estimates are subject to uncertainty depending mainly on the quality of feedstock used, processing and application technology implemented and soil quality.
- Some LCA variables can quality for re-allocation to non-energy carbon savings/credits where sufficient GHG savings are achievable without them, but only where verified Tier 3 measurement is available. Utilising default allocations from RED II will not support this option



[1] https://www.sciencedirect.com/science/article/pii/S0959652619320402

Workstream 1 - Biomethane Scheme Design

Introduction

As part of the feasibility study, the advisory team has made a significant number of design recommendations which will influence the structure and nature of the proposed scheme. In doing so, the team has considered a wide range of factors including feedback from local promoters and farmers, best practice from other markets, feedback from stakeholders, the local dynamics of the Irish agricultural sector, and the current level of ambition of Project Clover members.

This section provides an overview of the most significant scheme design recommendations from Phase 1 feasibility study.

Standardisation

A key findings from the feasibility study is that the initial pilot programme, as well as longer-term national roll-out, should seek to achieve a significant degree of standardisation across the AD plants.

Based on engagement with Irish farmers who are already progressing early-stage AD developments, each is developing their project under very different scale ambitions, using a variety of technology providers and adopting different feedstock mixes and contracting approaches. Based on KPMG's experience from the Northern Ireland ("NI) market, such an approach will lead to significant delay or potentially market failure, with individual projects struggling to secure finance on bespoke or one-off solutions, while losing any development or operational economies of scale.

Clustering and standardisation of project development and procedures, equipment and funding packages would help achieve economies of scale by preventing each promoter from 'reinventing the wheel' and allow them to leverage scale in the negotiation of contract pricing and terms with suppliers. Furthermore, it would ensure efficient technical, legal and financial due diligence processes with funders thereby reducing administrative costs and thus transaction and finance costs.

In order to drive and deliver such standardisation and co-ordination, it will be necessary to introduce an appropriate co-ordinating body which has a formal mandate, credibility and industry knowledge to provide the appropriate project management and competencies to support industry..

There are a number of potential entities which could undertake such a coordination role, including a formal Project Clover corporate body, RGFI or a fund manager overseeing capital deployment.

The following section provides detail of the key commercial recommendations and standardisations which are recommended by the feasibility study:

Agricultural-led Feedstock

While it is feasible to produce biomethane from a wide variety of feedstocks, including municipal and commercial waste, organic materials and agricultural crops, our analysis suggests that the establishment of an agricultural industry led approach represents the scenario most capable of supporting the development of a robust, scalable and sustainable industry which has the capacity to make a meaningful impact on decarbonisation.

In particular, the Irish agricultural sector has significant opportunity to utilise currently under utilised land to produce sustainable feedstock, such as multi species grass and clover silage that could displace more than 11% of Ireland's current natural gas demand without impacting existing animal feed levels. A sustainable AD industry would also provide commercial diversification for currently loss-making or marginal income farms, without materially impacting existing farm practices.

Additionally, the utilisation of animal slurry as a co-feedstock would provide one of the few options available for farms to reduce their carbon emissions and improve their overall sustainability. It is anticipated that a 20GWh AD plant would reduce CO_2 emissions by c. 5,500 tns per annum.

While the business case remains supportive of the utilisation of other commercial and food waste materials where available, the increased costs of operating and maintaining waste plants, as well as the relatively limited volume of suitable materials available, means overall economics are not significantly lower, while the volume of AD roll-out would remain a fraction of that achievable using agri feedstock.

Workstream 1 – Biomethane Scheme Design

Farm-Scale Plants

Following discussions with developers, technology providers and considering the local rural context and proposed feedstock mix, the project team has concluded that 20GWh AD plants represent the optimum plant size for Project Clover (being 20GWh of biomethane available for grid injection, net of the plants own parasitic gas usage).

A 20GWh plant represents a medium-scale agricultural AD facility, and would utilise approximately 21,000 tns of silage feedstocks per annum (around 1,000 acres of land capacity) and approx. 14,000tns of slurry.

This scale is approximately twice the size of farm-scale AD plants developed in Northern Ireland (the scale of which was largely driven by subsidy scheme design) and provides significant capital economies of scale over the NI equivalents (c.30%). Such a scale is considered necessary due to the proposed use of gas clean-up technology, which does not scale below 20GWh and would be uneconomic on a smaller plant.

This scale of plants is considered to achieve the appropriate balance between economies of scale and appropriateness for the local surroundings, including feedstock availability and digestate land spreading. Such a scale will also minimise planning permission challenges and fall below environmental impact assessment requirements.

While further (diminishing) economies of scale can be achieved from larger 40GWh plants, we feel such a scale moves closer towards industrial, rather then farm-scale operations and will be challenging to achieve in advance of local community acceptance of AD generally and maturity of the Irish AD supply chain.

Transportation and Logistics

Plants will typically have two core options for transporting their biomethane to the gas network for injection – a direct physical pipeline or a virtual pipeline consisting of specialist gas road tankers.

We expect a mixture of plant connection methods to be utilised, and would encourage the use of direct grid connection where economically viable. We understand over 100 projects have made enquiries to Gas Networks Ireland concerning direct connection to date.

While plants utilising a virtual pipeline could in theory purchase its own specialist tankers and trailers, we consider this inefficient and uneconomic and would strongly recommend that such a transportation service is procured and undertaken on a consolidated basis.

While its ongoing appetite would need to be confirmed, GNI has previously expressed appetite to provide a contract tankering service, under which it would purchase and operate the fleet in exchange for a per unit fee. Our base case financial model assumes an indicative cost for such a service.

For context, each plant is likely to require two gas tanker movements per day, not dissimilar to a milk collection service.

Standardised Funding

None of the developers we have engaged with to date have access to sufficient capital of their own and will require third party external funding. None have lined up the appropriate capital at this date.

Based on our experience of the early stage AD funding market in Northern Ireland, and the Promoters' consistent request for non-recourse funding and to retain a sizeable equity involvement in the project, we are strongly of the view that it will be necessary to establish a common and standardised funding proposition which is specifically designed to accommodate the AD scheme and the objectives of the Promoters.

A common, standardised funding approach will provide sufficient scale to attract project finance lenders (most of which will not be interested in funding a single, bespoke plant) and provide significant economies of scale in terms of funding costs such as due diligence and contract development.

Workstream 1 - Biomethane Scheme Design

Common Technology

A key part of the proposed standardisation is the utilisation of common technology providers across the cluster.

While individual promoters are likely to have their own views on technology, it is vital from a due diligence and operational economies perspective that similar technology is used across the cluster. In particular, in discussions with the technology providers, there was consistent feedback that they would only be able to establish a local servicing office if they were confident that there would be at least 5 – 6 plants in a locality.

We also queried technology provider on purchase price economies for a local cluster. All noted that there could be savings achieved, of between 10% - 15% of capex, if multiple plants were procured, however noted that this would only work if the plants were committed in a similar timeframe and that construction could be scheduled in a linear manner. Given the number of elements which need to be achieved to reach financial close on an individual plant, this may be challenging.

Feedstock Procurement Model

Each plant will require c. 38,000 tonnes per annum of feedstock, including cattle slurry, excess grass silage, rotation and catch crops.

While each of the promoters has an ability to provide a proportion of the feedstock, all will need to supplement this from third party sources.

The promoters all expressed strong confidence that they could source the required feedstock under bilateral contracts, however they agreed that some form of collective feedstock approach could be helpful.

While such a cooperative approach was not utilised for NI plants, we believe the establishment of some form of creditworthy aggregating feedstock entity could represent a key sector enabler and provide feedstock suppliers with additional comfort to embrace the sector, while significantly lowering perceived risk profile for funders, thus reducing financing costs.

Accordingly we would recommend exploring a suitable entity to undertake this aggregation role, with this party contracting with local farmers to supply a proportion of an AD plants feedstock requirement.

Common Documentation

A number of the promoters are in the process of submitting planning and permitting applications for their plants. Based on experience from NI, where the quality and applicability of planning applications was highly variable, there would be significant benefit from a standardised approach to applications, where a common, high quality submission, optimised for the preferred technology and socialised with council planners, were utilised.

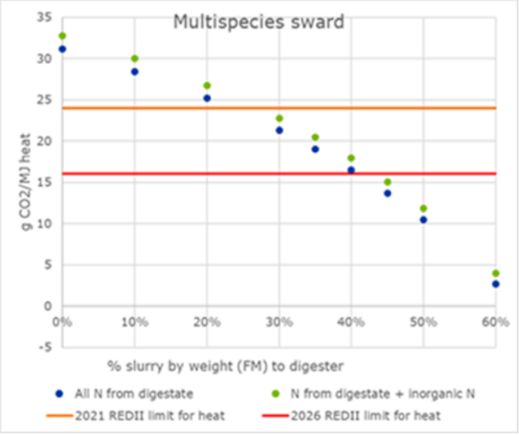
The same approach should also be used for any permit requirements of the plants, as well as the actual underlying contracts needed for the project including EPC contracts, feedstock agreements and funding documents.

Workstream 1 - Sustainability Considerations

In order for a successful agri-based AD industry to be established in Ireland, it must be done so in a sustainable manner without adversely impacting existing farming practices and dynamics.

Ability to meet REDII Sustainability Requirements

As outlined in the graph below, using a multi-species sward, with a mix of slurry c.45% (by mass) has the ability to meet both 2021 and 2026 RED II criteria. These preliminary results are part of ongoing work by Ricardo, SEAI with data input from Devenish Nutrition Limited.



Ability to grow Incremental Feedstock

A key tenet of Project Clover is the use of incremental feedstock production only, without impacting feedstock availability for existing uses.

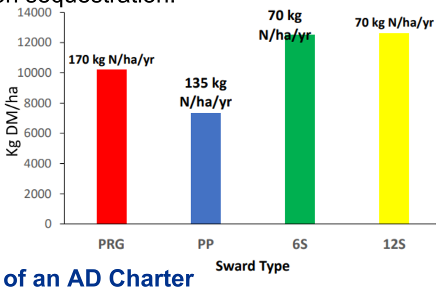
Teagasc research has confirmed capacity within the Irish agri-system to increase fodder production by improving average land productivity. Average land currently produces 6 tnDM / ha, while this land is capable of achieving 12+tnDM / ha. Research conducted by Devenish at Dowth Farm shows potential for multi-species swards to improve yields further (c.20%) using c. 60% less fertiliser compared to conventional swards – as summarised in the adjacent figure.

(Please also refer to subsequent report: *Sustainability of Biomethane Production in Ireland - KPMG / Devenish, Oct 2021, commissioned by GNI).*

Ability to grow Incremental Feedstock

It is envisaged that surplus yields could be diverted as feedstock for AD without impacting the provision of feed whilst reducing the overall requirement for chemical fertiliser.

Results from Dowth farm (Shackleton, 2020) also show that multi-species swards can have positive impacts on biodiversity and may improve carbon sequestration.



Development of an AD Charter

To ensure the successful roll-out of an agri-based AD industry, it is proposed to develop an AD Charter. The aim of this will be to provide a general outline of key requirements participants in Project Clover must adhere to. It is suggested that the Charter be developed in line with existing frameworks and regulations, such as the RED II sustainability criteria and EU Farm to Fork Strategy.

The Charter may have varying levels of compliance i.e. General or Enhanced. Those adhering to the Enhanced requirements may be expected to displace a proportion of their chemical fertiliser with processed digestate, for example.

An additional aspect under consideration is the potential local limit on farmers supplying feedstock into an AD to ensure demand doesn't wholly shift from livestock feed production should the AD be considered more attractive. This will need to be assessed as the Charter is not expected to be too restrictive.

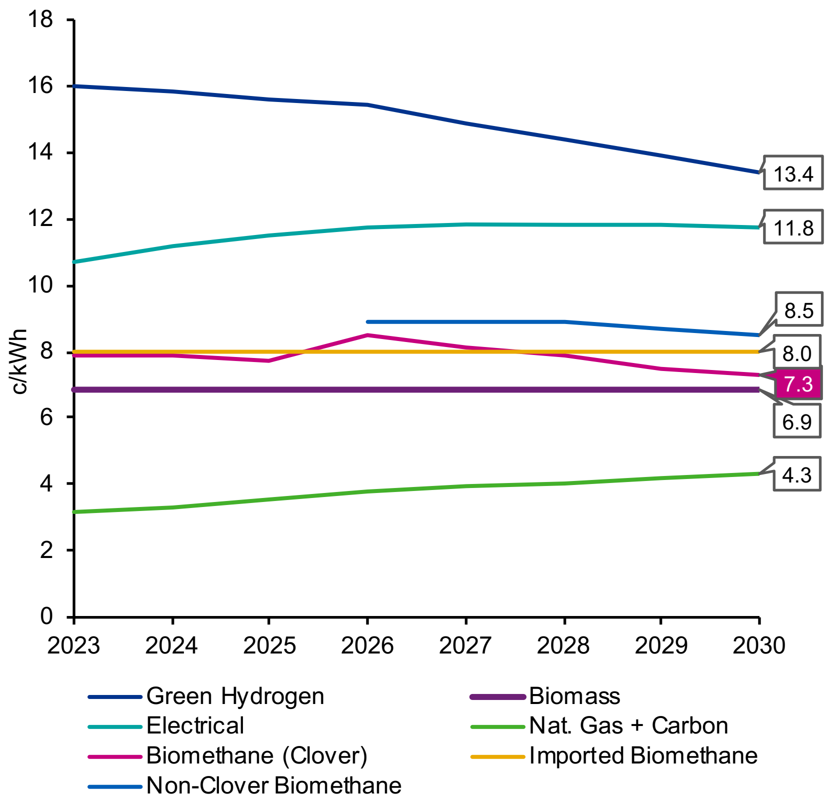
[1] 2020 - The Signpost Series - proactively improving human and environmental health through good science - Teagasc | Agriculture and Food Development Authority

Workstream 1 - Comparison to Alternative Technologies

The feasibility study has analysed a number of alternative decarbonisation technologies for industry and concluded that biomethane delivered through the Project Clover model has the potential to be one of the lowest-cost sources of decarbonised high temperature thermal energy by 2030.

- **Natural Gas:** Natural gas is the reference price for most industrial consumers today. The trajectory that underpins this analysis is based on carbon reaching €60/t by 2030.
- **Green Hydrogen:** depends on the cost of electrolysers and the electricity used to power the process but it is likely to be among the most expensive options for process heat.
- **Direct Electrification:** Where the process runs for 6,000hrs or more per annum direct electrification will likely result in costs in excess of 10c/kWh. This may change if part electrification is pursued.
- **Biomass:** Results in a lower c/kWh cost than biomass, however it brings additional operational considerations and is less suitable for 24/7 processes due to significant maintenance outage requirements.
- **Biomethane:** Clover's additional income streams from carbon sequestration and fertiliser sale are expected to give rise to the market's lowest costs by 2030 – without the need to make any changes to existing process configurations.

Alternative Thermal Options (c/kWh)



Workstream 2 Conclusions - Organic Fertiliser

Policy, legislation & certification

- Policy developments at an EU and national level support the use of organic fertilisers
- EU Fertiliser Regulations extended to integrate organic fertilisers
- Use of digestate can displace Nitrates Directive issues for farmers

✓

Processing technologies

- Assessed a number of innovative technologies to process digestate into a more usable form
- Key technology under consideration is Valordig – which is a mobile unit capable of dewatering the digestate and producing nutrient selective fertiliser products

✓

Environmental, climate & fertiliser performance

- Digestate can displace emissions associated with chemical fertiliser production and slurry
- Digestate can reduce pathogen load to the environment compared with slurry
- Digestate has the potential to displace up to c.80-90% chemical fertiliser (over time)

✓

Commercialising digestate

- Identified potential to commercialise digestate but still in a developing stage
- Value of digestate depends on NPK content (variable) and nutrient availability (variable)
- Lack of dedicated market for digestate and barriers to overcome with farmers

- **Agronomic value**
- **Pathway to commercialisation and uptake uncertain**

Policy, Legislation & Certification

- Large scale, farm-based AD meets many of the objectives set out in the EU's **Farm to Fork Strategy**, including:
  - Improving the environmental impact of food production and increasing organic farming
  - Helping to reduce artificial fertiliser and pesticide use
  - Promoting a circular bio-based economy
  - Encouraging balanced regional development

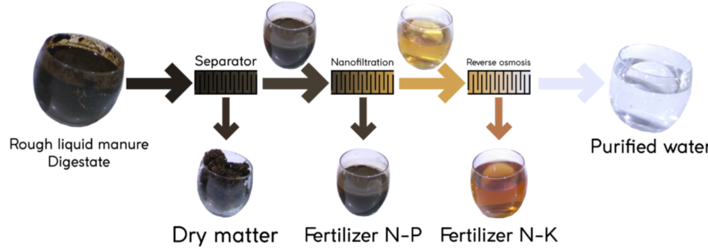
- **Programme for Government** target of 7% reduction in GHG emissions per annum from 2021 – 2030
- **Ag-Climatise** Action 1 (reduce chemical nitrogen use) Action 9 (organic farming) Action 12 (bioeconomy)

- The revised **European Fertiliser Regulations** signal a shift towards the promotion of organic based fertilisers, such as digestate
- The use of slurry as co-feedstock for biomethane and its subsequent processing for use as an organic fertiliser has the potential to displace **Nitrates Directive** issues for farmers

- There are opportunities to achieve **independent third party verification** over the chemical and biological composition of digestate. This will provide buyers with assurance over their purchase and over what is applied to land
- Engaged with potential verifiers, SGS and Celignis, who have the capability to analyse the composition of digestate

Processing Technologies

- From our engagements, we believe there are a number of innovative solutions that have sufficient **technical capability** to process digestate into a more valuable fertiliser product while producing a clean water.
- A key technology being assessed in the French **Valordig technology** – mobile unit, mechanical process (low GHG) to remove 45-60% of water. As shown below, Valordig produces nutrient selective fertiliser products.
- Valordig can be used both to dewater slurry at the front-end of AD and process the digestate at the back-end of AD.



Example Valordig output

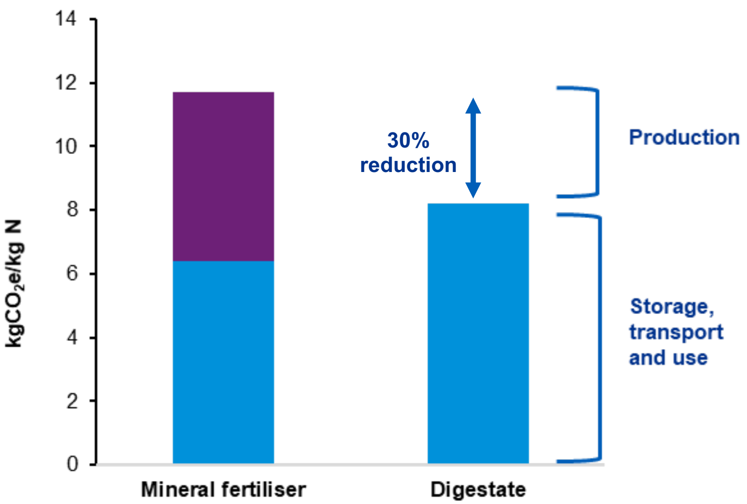
	tn
Grass	19,144
Slurry	15,900
Other	3,281
Total	**38,325**
Total post AD	**32,193**

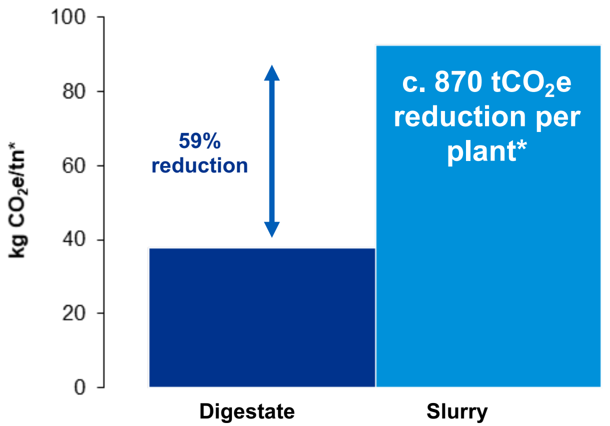
N	P	K	
148,920	**32,722**	**192,886**	**kg total**
4.63	**1.02**	**5.99**	**kg/tn**

	tn	N	P	K	
Separated Solid Fraction					
tn	3,219	5,957	1,309	7,715	**kg**
Separated Concentrate Fraction 1					
tn	4,829	104,244	31,413	73,297	**kg**
Separated Concentrate Fraction 2					
tn	6,439	38,719	-	111,874	**kg**
4- Separated Water Fraction					
tn	17,706	*low ppm*	*low ppm*	*low ppm*	

Environmental, Climate & Fertiliser Performance

Emission savings





*Assuming 1 m^3 slurry = 1 tn slurry

Environmental benefits & challenges

- Digestate contains significantly less volatile organic acids and therefore **less odour emissions** than untreated slurry
- **Reduced pathogen** load to environment compared with land spreading of slurry
- Improved **soil health** and structure
- Given the increased NH4-N content of digestate compared with slurry, it can result in **higher ammonia losses.** The application technique for digestate should minimise the surface exposed to air and have contact with the topsoil

Fertiliser performance

- Digestate value depends on its **nutrient content and nutrient availability** - which can **vary significantly with feedstock used, processing technology, application method** and **soil quality** where is it applied.
- **Nutrient effects of digestate have a lag time** compared to the quick impact of chemical fertiliser, as such it can only be expected to displace chemical fertiliser over time, as the quality of land improves and gets used to repeated applications of digestate.
- Project Clover engaged with an AD operator in NI who has displaced up to 80-90% of chemical fertiliser with digestate – after improving the quality of land, particularly soil pH.
- Digestate has **NPK** in addition to **micronutrients and trace elements** and can **regulate soil pH** to displace lime.

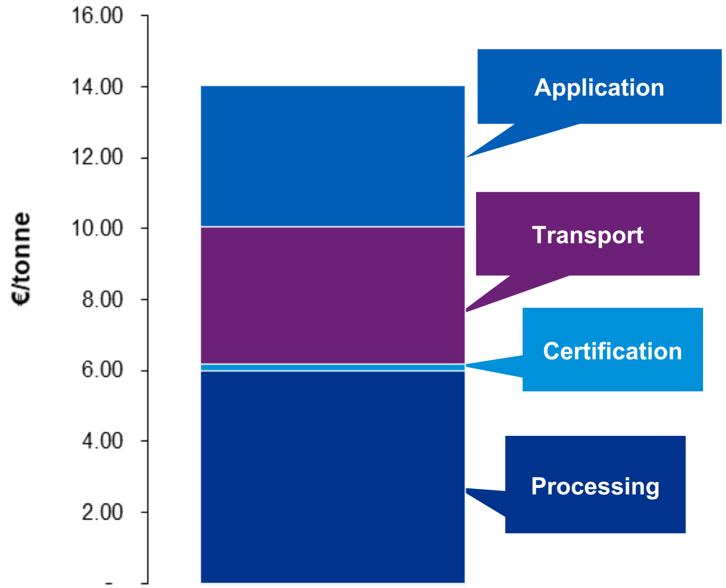
(See also subsequent report - *Sustainability of Biomethane Production in Ireland - KPMG / Devenish Oct 2021, commissioned by GNI).*

Emissions data: https://www.sciencedirect.com/science/article/pii/S0959652619320402
http://nsits.yingxiaoli.com/download/feigiwu-wenxian/wenshi/methane-nitrous-oxide-and-ammonia-emissions-during-storage-and-after-application-of-dairy-cattle-slurry-and-influence-of-slurry-treatment2.pdf

Commercialising Digestate

Digestate costs

- The estimated **costs of commercialising** digestate:

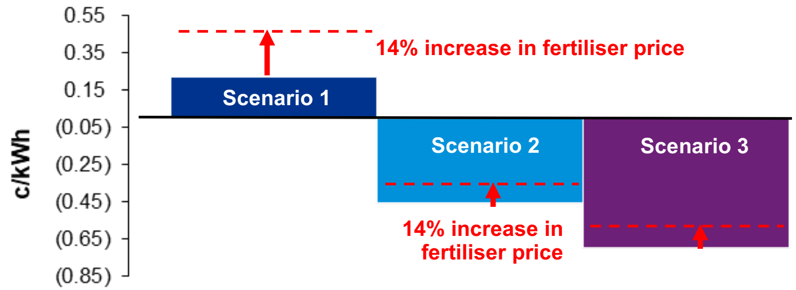


- **Processing costs**: estimated €6/tn (Valordig quote) (AD output tonnes)
- **Transport costs (10 miles):** Liquid fraction €4.13/tn; Solid fraction €2.95/tn (WRAP UK estimate) (Post digestate processing tonnes)
- **Applications costs**: Liquid fraction €4.13/tn; Solid fraction €3.54/tn (WRAP UK estimate)1 (Post digestate processing tonnes)
- **Certification costs**: €2,500 per plant (based on Celignis quote)

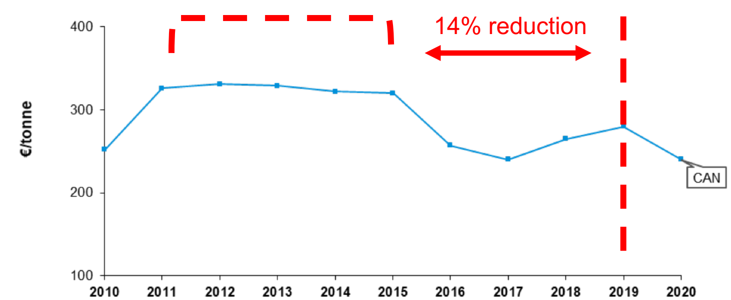
[1] https://wrap.org.uk/sites/default/files/2020-08/WRAP-Digestate-compost-good-practice-guide-reference-version.pdf

Estimated net income

- The estimated **net income**[2] per plant:



- **Revenue:** S1 €24/tonne; S2 €15/tonne; S3 €12/tonne (Post digestate processing tonnes)
- **Fertiliser prices:** N 0.90 €/kg; P 2.00 €/kg; K 0.80 €/kg – subject to change as indicated in the price variation[3] below



- Historical fertiliser prices show a decline over the last 5 years. Expected net income from digestate is sensitive to price variation as summarised in the above graph showing the impact of a 14% increase in fertiliser prices.
- Assumptions provided in **Appendix 1.**

[2] **Net income** = revenue less costs

[3] **CSO data**

Workstream 3 Conclusions – Soil Carbon Sequestration

Policy

- Soil carbon sequestration is gaining increased attention across both EU and national policy
- Farm to Fork Strategy, Programme for Government and Ag-Climatise support soil carbon sequestration

✓

Routes to monetise soil carbon

- It is unlikely that soil carbon would gain recognition under the EU ETS
- Two alternatives assessed are the voluntary carbon market and insetting
- Existing methods and guidance developed for soil carbon in the voluntary market

✓

MRV framework

- Proposed a high-level MRV framework based on Australian ERF guidance and experience, and the voluntary market
- It is proposed to adhere to the most detailed IPCC method – Tier 3

✓

Volume of soil carbon sequestration

- Existing research varies significantly on baseline sequestration rates and increases from improved land management.
- It is expected that there is capacity to improve current sequestration.
- **Additional carbon** stored is relevant for carbon credits i.e. potential to improve beyond baseline

!!

Value of soil carbon sequestration

- Value of soil carbon function of market price and additional carbon sequestered.
- ETS price unlikely
- International voluntary market price varies significantly, averaging at c. €10 /tCO_2e – regional EU market c. €30 /tCO_2e

!!

Policy

- EU **Farm to Fork Strategy** aims to roll-out an EU Carbon Farming Initiative to reward farmers for sequestering carbon – from engagements with DG CLIMA and DG AGRI understand this is likely to form part of the CAP
- EU **Circular Economy Action Plan** plans to develop a regulatory framework for certifying carbon removals

- **Programme for Government** aims to seek reforms to the CAP to reward farmers for sequestering carbon.
- **Ag-Climatise Action 17:** *Develop a pilot scheme in relation to on-farm carbon trading to reward farmers for the public goods they are providing*

- The Government announced the establishment of a **National Agricultural Soil Carbon Observatory** to reflect the climate impact of agriculture in the National Inventory and to capture the benefits in ESR obligations.
- Teagasc will monitor soil carbon using between 10 and 15 flux towers which estimate the net CO_2 exchange or the difference between photosynthesis (uptake) and respiration (loss) from soils

Routes to Monetise Soil Carbon - Options

Voluntary carbon market

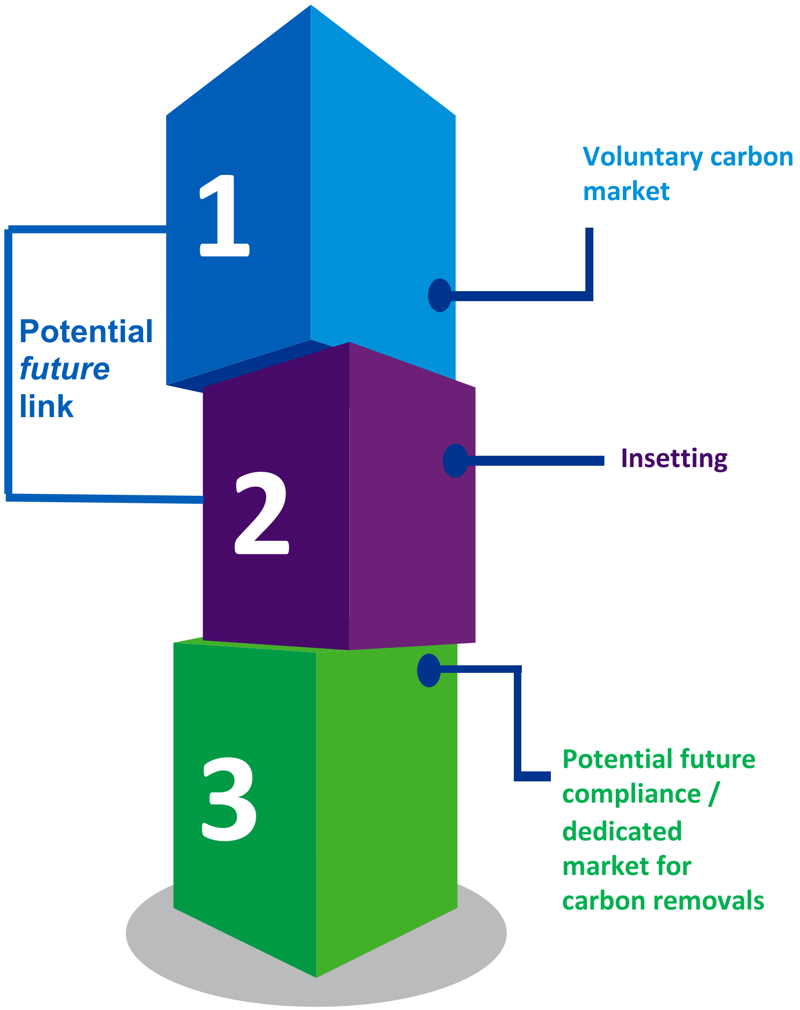
- Growing interest in soil carbon projects, with major carbon crediting mechanisms releasing methodologies and guidance for developing fungible soil carbon credits.
- These credits can be used as **offsets**
- **Prices vary significantly** and there are high registration costs.
- Regional markets are developing across Europe which could be a potential alternative to the voluntary market.

Insetting

- Provides an opportunity for companies to **invest within their value chain** to reduce their carbon footprint.
- Opportunity for companies to market low carbon products.
- Appetite for insetting will depend on **internal carbon price.**

Potential future compliance / dedicated market for carbon removals (excluded from further analysis)

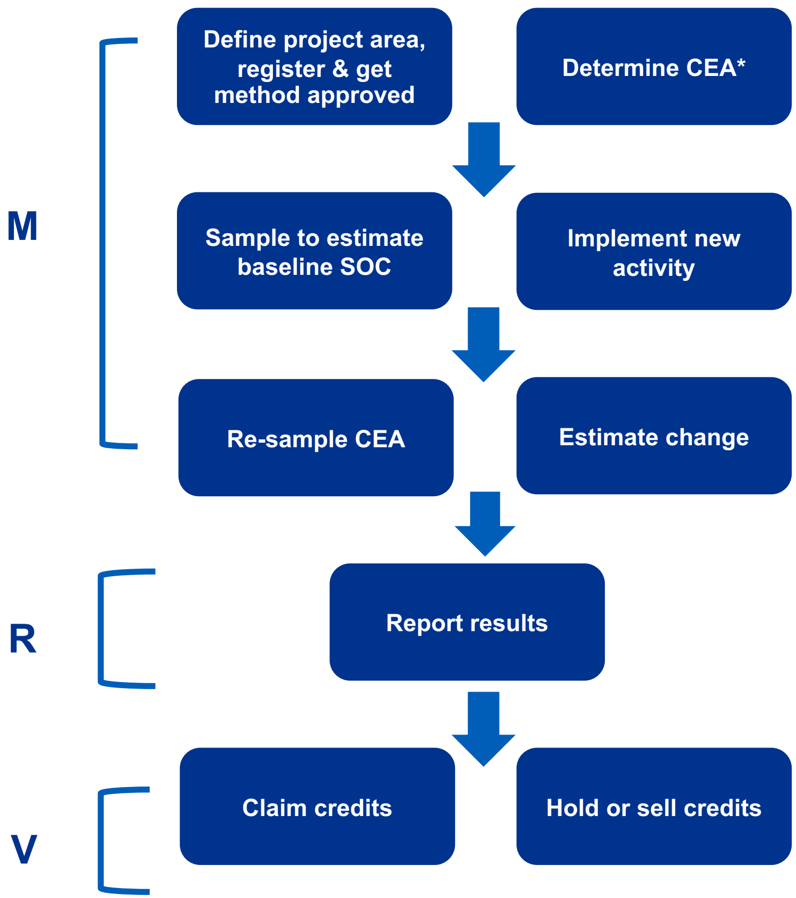
- European Commission is currently developing an EU Carbon Farming Initiative to reward carbon sequestration. This scheme is likely to form part of the CAP.
- In the future, carbon sequestration projects could be integrated into the EU ETS, or a separate trading mechanism.
- However, there has been no formal announcement or plan to do so in the coming years. As such, this option is excluded from further analysis.



MRV Framework

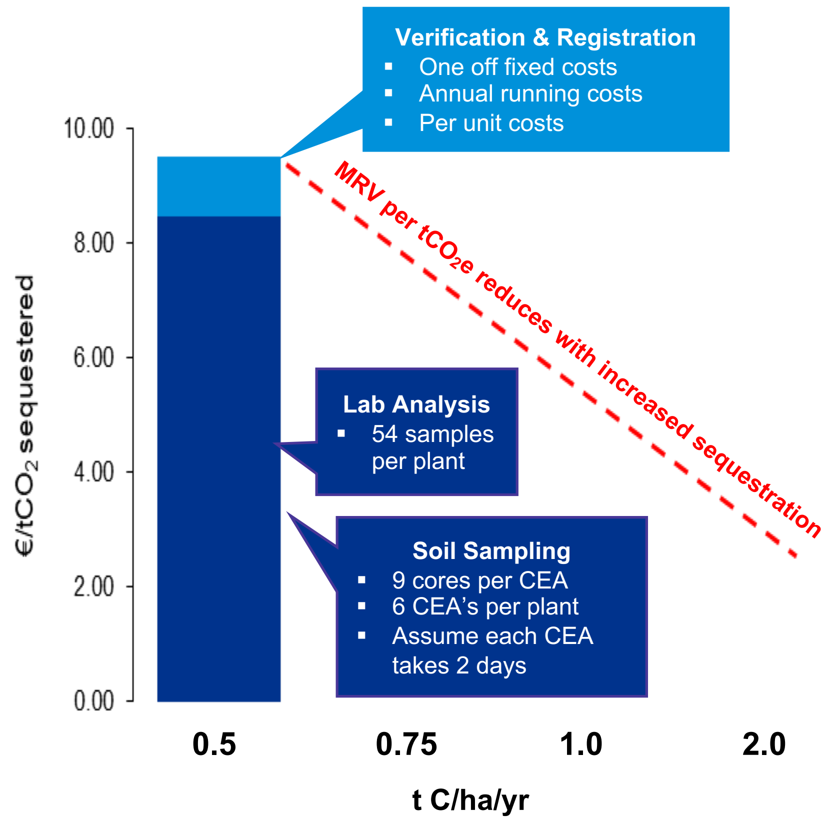
MRV framework

- A high-level summary of a potential MRV framework:



Estimated MRV costs

- Costs will mainly stem from soil sampling, laboratory analysis and registering / getting independent verification with a recognised carbon crediting mechanism.
- Estimated costs are based on Australian ERF guidance[1] and VCS fee schedule[2]. MRV costs per tCO_2e will vary depending on the amount of carbon sequestered.



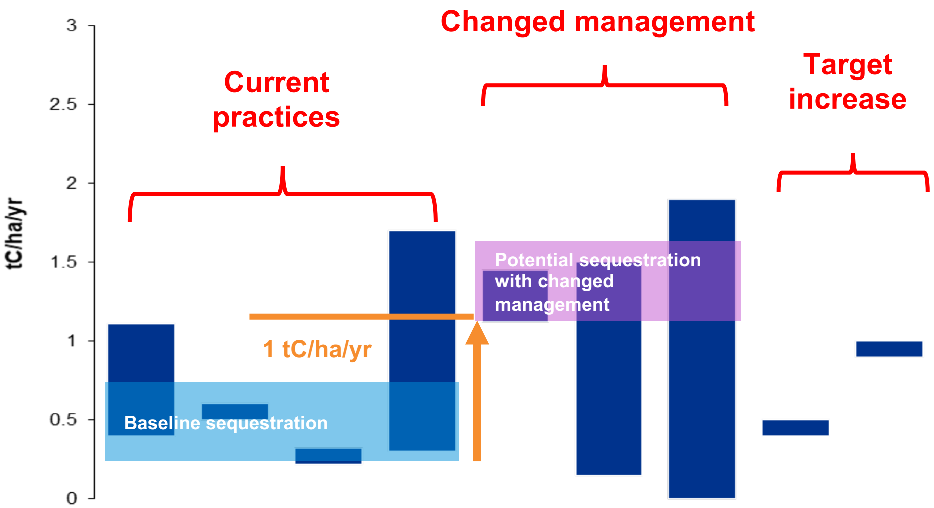
* CEA = carbon estimate area – sampling area

[1] Understanding your soil carbon - Simple method guide (cleanenergyregulator.gov.au)
[2] Program-Fee-Schedule_v4.1.pdf (verra.org)

Volume of Soil Carbon Sequestration

- It is the **additional carbon sequestered beyond baselines** that is relevant for Project Clover.
- **Value from carbon (credits)** is only gained from **additional carbon** sequestered above the baseline
- The level of carbon sequestered by soils largely depends on **land management, soil type and climate**.
- It is understood that soil carbon does not increase without limit, but eventually reaches a saturated level. Research from the EPA estimates that **Irish grasslands** maintain an average carbon **saturation of 48%** and **cropland soils** have an average **saturation level of 38%**[1]
- Best practice agricultural management interventions have the potential to increase sequestration beyond baseline levels.
- **Further research** must be done to understand the expected **sequestration improvements** and **permanence** from improved land management.
- The development of a robust baseline and understanding the impact of improved land management is anticipated to take place over a **minimum 5 year time** period.
- Given the heterogeneity across Irish soils, it is expected that there will be **significant variances** in **improved carbon sequestration between areas** and **across years**
- Some soils are expected to have the capacity to sequester more carbon and some areas may continue to act as carbon sources.

- The figure summarises a range of studies looking at the carbon sequestration rates of agricultural soils
- Unless noted, the estimates are **total carbon sequestered, not additional**.
- The orange arrow provides a target increase (i.e. **additional) for soil carbon** sequestration. This estimate is subject to uncertainty.



Current practices	Teagasc (2020); Truc et al. (2018); O'Brien et al. (2014); Soussana et al. (2007)
Changed management	Watson *et al*. (2007); Vleeshouwers and Verhagen (2002) **(net effect of measures);** European Climate Change Programme (2004)
Target increase	Minasny *et al.* (2017) **(Irish agricultural & forestry land target increase to achieve 4p1000 initiative)**

[1] https://www.epa.ie/pubs/reports/research/climate/EPA%20RR225_web.pdf

Section 3

Farmer Proposition

Farmer Benefits

Macro Benefits

- Assist in decarbonising the agri supply chain – further supporting the global marketing of Irish food and drinks products.
- Delivering improved air, water and soil quality.
- Providing rural investment and income diversification

Commercial

- **Benefit to dairy farmers and pig farmers:**
  - Decarbonisation of slurry and removal of potential Nitrates Directive limitations / derogations.
  - Secure supply of organic fertilisers from AD SPV and reduced chemical fertiliser and herbicide reliance.
  - Help decarbonise the diary processing sector.
- **Benefit to tillage and beef farmers**:
  - Opportunity to earn a guaranteed income from the implementation of improved land management practices:
    - Revenue from feedstock provision to AD plant
  - Secure supply of organic fertilisers from AD SPV, and reduced chemical fertiliser and herbicide reliance.
  - Improved soil quality and productivity.
- **Other complementary farm incomes:**
  - Potential for operator fees, land-leasing income (farms where AD plant is sited), equity ownership and carbon farming.

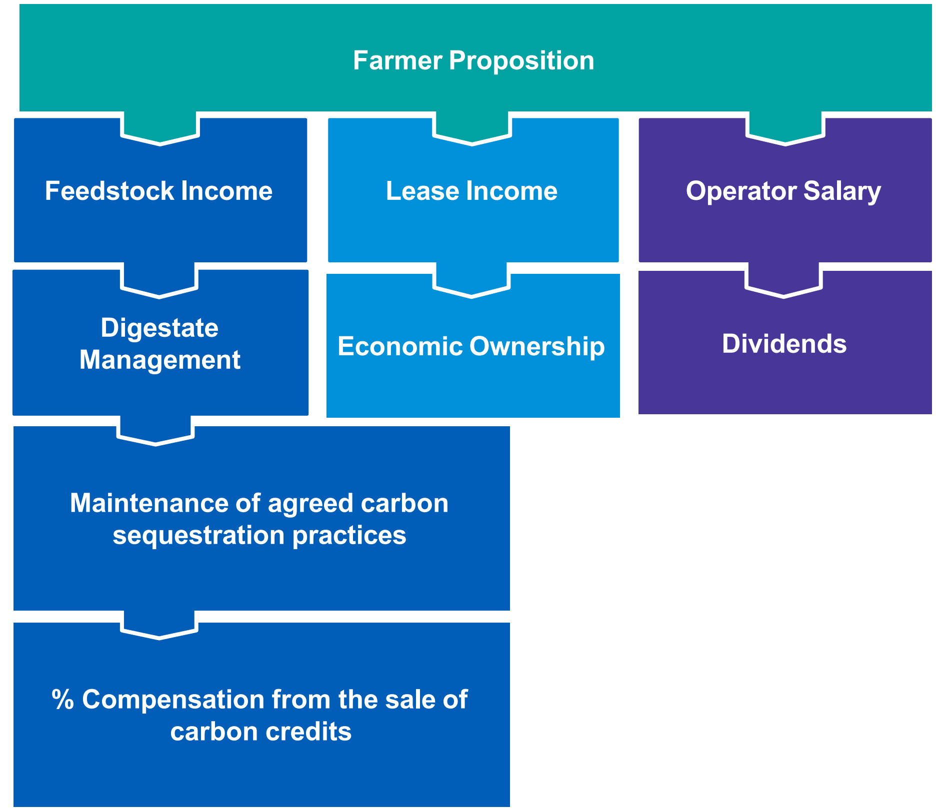
Digestate as an organic fertiliser

- Processed digestate is a zero carbon source of organic fertiliser.
- Digestate will be available in different homogenised nutrient forms – efficient compliance with Nutrient Management Plans
- Less emissions (GHG and odour) compared to slurry.

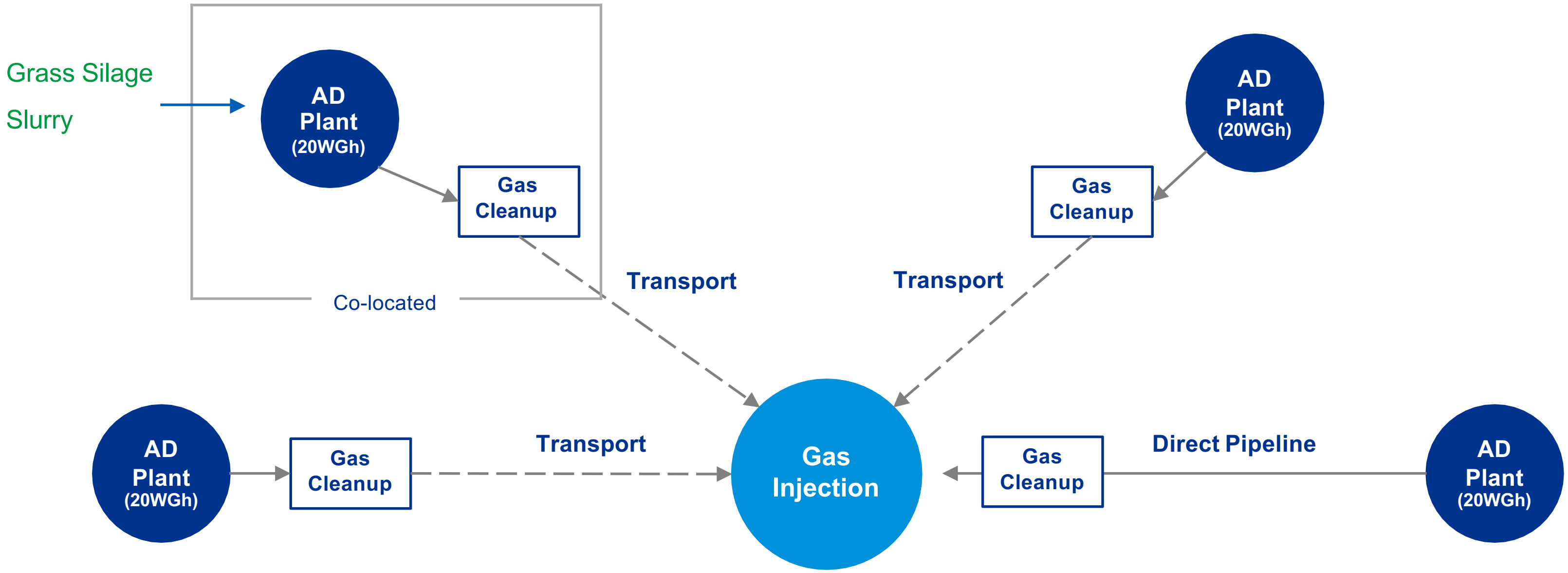
Farmer Benefits

Farmer Opportunities	
Feedstock Income	▪ The farmer enters into a medium-long term agreement to provide up to 100% of the feedstock requirement for the AD plant. ▪ The farmer guarantees feedstock obligations to a reasonable cap. ▪ The farmer may be required to provide financial guarantees over the performance of the feedstock contract.
Lease Income	▪ The farmer provides the AD plant site.
Operator Salary	▪ The farmer will be responsible for the day to day operations of the plant, supported by a third party maintenance and support company.
Digestate	▪ The farmer will be responsible for managing digestate produced by the AD plant.
Carbon Sequestration	▪ The farmer implements agreed practices to enhance soil carbon sequestration. ▪ % compensation from sale of carbon credits.
Economic Ownership	▪ A core finding of research conducted is the need for famers to have "skin in the game" to deliver a high performing AD plant. ▪ Famers should have equity ownership.
Dividends	▪ The farmer carries out the required tasks and ensure the plant is performing optimally.

Farmer Opportunities (cont'd)



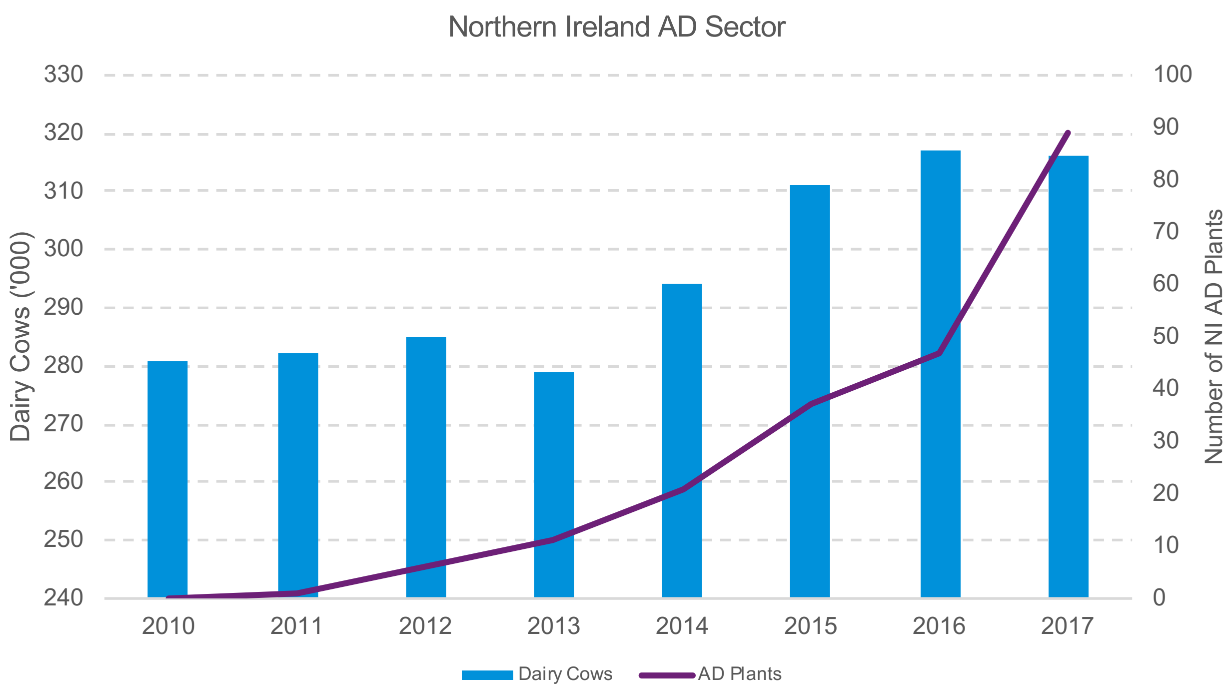
Proposed Project Structure



Cookstown, Northern Ireland, 15GWh

Northern Ireland Case Study

Northern Ireland AD Sector had no negative impact on animal numbers



NI AD Sector Statistics

- 90 AD Plants
- Consumes 700,000 tns silage annually
- Dairy numbers grew 12%, overall cattle 4% during period of deployment
- Grass production area expanded by 3%, while consumption increased by 10%, showing productivity gains

Section 4

Conclusion

Conclusion

- Due to our forage -based agricultural system, Ireland has the potential to be a leader in biomethane production, using on-farm Anaerobic Digestion (AD).
- Project Clover addresses Agri food sustainability and competitiveness - will enable industry to decarbonise thermal energy requirements and also supports the decarbonisation of the wider supply (Scope 1, 2 and 3).
- Industry is committed to a long-term, scalable solution but requires Government support – specifically match funding of €24m is required for the pilot phase and a willingness to support a long term pathway.
- While the study has successfully demonstrated the feasibility of Project Clover's three workstreams, before moving to Phase 2, industry members require clarity from Government in support of the long term funding model.
- Specific asks of Government are :
  - Capital Funding of 50% to match and complement the ISIF funding, subject to commercial loan terms and conditions.
  - the early implementation of Article 23, which requires suppliers to socialise the cost through a renewable heat fuel obligation scheme.
  - Additional revenue streams are realistic and achievable – commercialising bio-fertilisers. Monetising carbon sequestration is considered to be worth pursuing in the longer term. Both require further work in Phase II.

Section 5

Appendices

Appendix 1 - Commercialising Digestate - Scenario Assumptions

- Digestate is **typically considered as a cost** for AD plants with operators commonly paying farmers to take it offsite.
- With the incoming **EU Fertiliser Regulations in 2022** which recognises digestate as a fertiliser product and the specific requirements to reduce chemical fertiliser and nutrient losses in the EU Green Deal **Farm to Fork Strategy**, it is anticipated that the uptake of organic fertiliser will increase.
- Land is likely to require a few years of continuous digestate application to become used to the lag effect in its fertiliser performance.
- Further work on **communicating the benefits** and getting **farmer buy-in** for the use of digestate as a replacement fertiliser **is required**.
- The table below provides a summary of two scenarios used to estimate the expected revenue from digestate.
- The nutrient values were provided by an NI AD plant operator as well as using default estimates for agricultural digestate from the UK's Agriculture and Horticulture Development Board RB209. Each scenario was modelled through the use of Valordig technology – which dewaters digestate reducing its weight by c.55%.
- Figures below are subject to uncertainty – mainly depending on the quality of feedstock, processing technology and soil quality. Results may vary impacting the expected revenue from the sale of digestate.
- In terms of the chemical fertiliser replacement value (%) – Scenario 2 and 3 adhere to guidance provided by the UK's Agriculture and Horticulture Development Board RB209 – assuming 55% N availability, 60% P availability and 90% K availability[1].
- Scenario 1 is a higher assumption, taking **a longer term outlook** on the potential for digestate to displace chemical fertiliser. Not all of the nutrients applied in digestate are expected to be immediately available for plant uptake. They are estimated to be released slowly over a period of time[1,2].
- From our engagement with an NI AD operator, digestate may have the potential to displace between 80-90% of chemical fertiliser over time with repeated applications. However this varies with the type of feedstock used, soil quality, application method and processing technology implemented.
- The European Biogas Association notes that typical digestate has levels of 75-85% available N which can be increased to 90-95% using separation[3]. The variability in the N fertiliser replacement value of digestate ranges in literature from 54 – 102% [1,4]
- The availability of P and K in digestate also varies with soil quality, digestate quality and application technique - ranging from 50-100%. Teagasc guidance notes that organic fertilisers can supply 100% of the crop P and K requirements on soils with medium P and K index (3-4))[5].
- Any digestate application strategy will have to comply with the NAP regulations.

		Scenario 1			Scenario 2			Scenario 3		
	€/kg	kg/tn	% chemical fertiliser replaced	total	kg/tn	% chemical fertiliser replaced	total	kg/tn	% chemical fertiliser replaced	total
N	**0.90**	5.46	84.8%	4.63	4.53	55%	2.49	3.6	55%	1.98
P	**2.00**	1.02	100%	1.02	0.88	60%	0.53	0.7	60%	0.45
K	**0.80**	5.99	100%	5.99	4.82	90%	4.34	3.7	90%	3.29

Appendix 2 - Commercialising Digestate - References

1. Agriculture and Horticulture Development Board Nutrient Management Guide (RB209) Organic Materials; https://projectblue.blob.core.windows.net/media/Default/Imported%20Publication%20Docs/RB209%202021/RB209_Section2_2021-210208_WEB.pdf

2. Teagasc (2020) MAJOR AND MICRO NUTRIENT ADVICE FOR PRODUCTIVE AGRICULTURAL CROPS; https://www.teagasc.ie/media/website/publications/2020/Major--Micro-Nutrient-Advice-for-Productive-Agricultural-Crops-2020.pdf

3. European Biogas Association (2014); https://www.europeanbiogas.eu/wp-content/uploads/2014/12/Digestate-in-the-Nitrates-Directive_EBA-Position-paper-1.pdf

4. SYSTEMIC (2020) Mineral Concentrate PowerPoint Presentation (systemicproject.eu)

5. Teagasc Organic Manures; https://www.teagasc.ie/crops/soil--soil-fertility/organic-manures/

Glossary of Terms

AD	Anaerobic Digestion
CBA	Cost Benefits Analysis
CGI	Central Grid Injection
CHP	Combined Heat and Power
CO2	Carbon Dioxide
DAFM	The Department of Agriculture, Food and Marine
DAFI	Directive for Alternative Fuelling Infrastructure
DCCAE	The Department of Communications, Climate Action and Environment
DM	Dry Matter
EPA	Environmental Protection Agency
EPC	Engineering, Procurement and Construction
ETS sector	Any company or body within the EU that emits a large amount of greenhouse gas emissions is included in the Emissions Trading System
EU	European Union
FY	Financial Year
GB	Great Britain
GGCS	Green Gas Certification Scheme
GHG	Greenhouse Gas
GNI	Gas Networks Ireland
GWh	Gigawatt Hours
Ha	Hectares

IRR	Internal Rate of Return
ISIF	Ireland Strategic Investment Fund
kWh	Kilowatt Hours
LESS	Low Emissions Slurry Spreading
MACC	Marginal Abatement Cost Curve
MJ	Megajoule
MRV	Measurement Reporting and Verification
MSA	Management Service Agreement
MT	Million Tonnes
MWth	Megawatts Thermal
NI	Northern Ireland
NECP	National Energy & Climate Plan
Non ETS sector	All greenhouse gas emissions that are not from companies in the ETS sector
OSI	Organic Soil Improver
PA	Per annum
PSO	Public Service Obligation Levy
RGFI	Renewable Gas Forum Ireland
RED II	Renewable Energy Directive II
SEAI	Sustainable Energy Authority of Ireland
SPV	Special Purchase Vehicle
Tn	Tonne
TSO	Transmission System Operator
TWh	Terawatt Hours

Important Notice

Important Notice

KPMG wish you to be aware that the work it carried out for RGFI was performed to meet specific terms of reference agreed with them, and that there were particular features determined for the purposes of the engagement and the needs of RGFI at the time. The report should not therefore be regarded as suitable for use by any other person or for any other purpose. Should you choose to rely on the report you do so at your own risk. KPMG will accordingly accept no responsibility or liability in respect of it to persons other than RGFI.

We have not verified the reliability or accuracy of any information obtained in the course of our work, other than in the limited circumstances set out in our Engagement Letter with RGFI

Project Clover –
Feasibility Report Summary

November 2021

Prepared on behalf of

Core Contributors