

## Extended Abstract

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<b>Paper/Poster Title</b>	<b>A Discounted Cash Flow analysis of producing silage as a feedstock for Anaerobic Digestion in Ireland</b>
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<b>Abstract</b>	<i>200 words max</i>
<p>The economic case for the production of silage for Anaerobic Digestion (AD) can only be established by analysis of the potential costs and returns at farm level. This paper uses farm level data from Ireland to provide a Discounted Cash Flow (DCF) analysis for production of silage for an off farm AD facility.</p> <p>The preliminary results show that production of silage for Anaerobic Digestion can be more profitable than some existing farm enterprises, based on average performance levels for superseded farm enterprises. In particular preliminary results to date indicate that the average cattle rearing enterprise has scope to increase economic returns by way of an alternative farm enterprise which could supply silage production for a regional AD plant. Conversely the average specialist dairy enterprise, consistently provides economic returns far exceeding the returns from growing silage for AD purposes.</p> <p>Sensitivity analysis was also carried out to examine the effects on the returns generated, by altering key input variables. Dedications of land to producing silage for AD will require consistent higher returns than existing enterprises for widespread adoption within Ireland.</p>	
<b>Keywords</b>	Anaerobic Digestion, Bioenergy, Biomethane
<b>JEL Code</b>	Q12 Micro Analysis of Farm Firms, Farm Households, and Farm Input Markets, Q420 Alternative Energy Sources see: <a href="http://www.aeaweb.org/jel/guide/jel.php?class=Q">www.aeaweb.org/jel/guide/jel.php?class=Q</a> )
<b>Introduction</b>	<i>100 – 250 words</i>
<p>The use of grass silage for AD is considered a second generation biofuel in EU's Renewable Energy Directive II and is a renewable alternative to fossil fuels. AD has the potential to contribute to the circular bio economy and reduce Green House Gas (GHG) emissions particularly the codigested of wastes such as animal slurries. Agriculture is currently responsible for 32% of GHG emissions in Ireland and has committed as part of COP26 to reduce emissions by 20% to 33% by 2030.</p> <p>Agriculture in Ireland is dominated by grassland accounting for over 90% of the utilizable agricultural area (UAA). The majority of this forage is utilized by grazing animals in a pasture based systems but there is a requirement to preserve silage for the winter housing period. Conversion of grassland to growing <u>annual</u> crops for AD</p>	

would constitute a land use change and potentially increase carbon emissions due to release of soil carbon. Conversely, silage would not constitute a land use change and has pre-existing knowledge and experience in the farming community thereby reducing the perceived risk of adoption.

A discounted cash flow model is used to examine the existing costs of producing silage in Ireland based on data produced by Teagasc, National Farm Survey. The economic performance of exporting that silage for Anaerobic Digestion is then compared at farm level to existing enterprises to assess the viability and competitiveness of the alternative enterprise.

### **Methodology**

*100 – 250 words*

This paper employs discounted cash flow method to evaluate growing silage for AD as an alternative farm enterprise. The analysis also evaluates the variation in key parameters on the performance of enterprise.

The analysis was based on unbalanced farm-level data for 2019 from Irish farms that produced silage, based on data from the Teagasc, National Farm Survey. The costs of the main forage silage produced in Ireland was examined on a per hectare basis. This dataset was then used to examine economic efficiency and drivers of performance.

The opportunity cost of land is accounted through the inclusion of market rate of land rental as a superseded activity. The issues of scale are abstracted by evaluating on a per hectare basis while also assuming use of contractors for work carried out.

It was assumed that the entire area of the farm isn't superseded. In the case of cattle rearing it is possible to maintain the existing enterprise by increasing the productivity and therefore increase the overall output of the farm.

### **Results**

*100 – 250 words*

The preliminary data from the discounted cash flow analysis shows that growing silage for AD in Ireland can provide a positive Net Present Value (NPV) depending on the nature of superseded farm enterprise.

The analysis shows that for a farm with a superseded dairy enterprise, the NPV is negative, highlighting farmers potential unwillingness of adopting from an economic sustainability perspective. These enterprises have high average stocking densities without capability of improving yields, however may benefit from exporting animal slurries for regulation requirements.

In the case of the average cattle rearing and cattle other enterprises, a positive NPV demonstrates that growing silage for AD facilities could improve economic sustainability viability of these farms.

Sensitivity analysis shows that there is variation of performance in the production cost of silage and the key input variables for the superseded farm enterprises whereby the least efficient will not return a positive NPV. This highlights the technical efficiency will be a key driver of profitability. There are also practical limitations in certain regions, soils and terrains which will impact on the suitability of the alternative enterprise in specific regions.

**Discussion and Conclusion**

*100 – 250 words*

The economic case for growing silage for AD was evaluated using a DCF analysis showing positive NPV for the majority of enterprises. The main exception is dairy farming which has a definite negative net present value to convert to this alternative enterprise.

Whilst this paper focuses on economic sustainability criterion, the adoption of AD could have additional environmental sustainability benefits to the agriculture industry, by reducing farm level GHG emissions and reducing dependency on artificial fertilisers. The use of digestate as a fertiliser could stimulate the circular bio-economy while reducing the GHG emissions from fertiliser manufacture and the needs for imports.

Finally, the socio-cultural elements also need to be evaluated in the context of a developing AD industry in Ireland. The potential to increase the farm productivity to supply AD while increasing the viability levels of original enterprises could potentially prove attractive.