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| Searching for a Coordinator/Partner for | **The Green Deal – Farm to Fork** |
| Topic | **LC-GD-6-1-2020:** **Testing and demonstrating systemic innovations in support of the Farm-to-Fork Strategy** |
| Subtopic | **Subtopic A.         Achieving climate neutral farms by reducing GHG emissions and by increasing farm-based carbon sequestration and storage.** |
| Organisation Details | The MeSSO (<https://messo.cit.ie/>) is an applied Research Group in theCork Institute of Technology. MeSSO research group is primarily concerned with the advancement of knowledge in the renewable energy systems research field. The group has expertise in mechanical, thermal and energy systems modelling, simulation, and the development of web-based decision support tools specialising in areas such as energy technology, grass based agricultural systems and dairy processing. MeSSO carries out applied research projects with national and international collaborators in the areas of agricultural energy optimisation, carbons emissions modelling, grass growth modelling, demand side management optimisation, renewable energy systems, machine-learning, mechanistic modelling and optimisation.  |
| How we can contribute to this topic | Using knowledge and experience gained through several years of R&D practice, the MeSSO research group can contribute to achieving climate neutral farms through offering expertise in:1. Mitigating agricultural related GHG emissions through the proliferation of sustainable energy systems.
2. Optimising the selection and sizing of renewable energy technologies to cost effectively minimise GHG emissions
3. Demand side management of energy consumers on farms to reduce and offset GHG emissions.
4. The application of machine-learning and optimisation algorithms in the agricultural domain. Our research in these areas have focused on milk production forecasting, dairy energy and water prediction modelling using machine-learning methods, and applying multi-objective optimisation algorithms for identifying optimal economic and environmental investment strategies on dairy farms.
5. Disseminating research outputs to practitioners/farmers and liaising with a wide range of key stakeholders when adopting new technologies. Additionally, ensuring maximal user experience of developed decision support tools through the creation of user manuals and embedded informational tutorial videos.
6. Developing highly popular open-source web applications such as the National Agricultural Energy Optimisation Tool (<https://messo.cit.ie/agri-energy>). With our experience in data analysis, data visualisation and systems modelling, we can develop web-based platforms such as this for any agri-system (such as carbon sequestration and storage) focused on reducing and/or offsetting GHG emissions. If applicable, machine-learning and/or optimisation functionality can be integrated into these tools to show researchers/farmers optimal strategies to minimise GHG emissions. These web-applications have been an incredibly valuable medium to disseminate research outputs, while providing the wider agricultural community access to cutting edge decision support information regarding the sustainability of their agricultural processes.
7. Creating open-source research tools such as the Grass Measurement Optimisation Tool (GMOT), which was on output from a previous Horizon2020 project MeSSO recently completed. GMOT allows farmers to maximise their on–site grass utilisation, which in turn lowers GHG emissions and increases profitability. (<https://messo.cit.ie/gmot>)
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| Other information | Relevant Research Publications:* [A decision support and optimization platform for energy technology investments on dairy farms](https://elibrary.asabe.org/abstract.asp?aid=50566&t=3&redir=&redirType=)
* [Annual electricity consumption prediction and future expansion analysis on dairy farms using a support vector machine](https://www.sciencedirect.com/science/article/abs/pii/S0306261919309626?via%3Dihub)
* [Development of a dairy multi-objective optimization (DAIRYMOO) method for economic and environmental optimization of dairy farms](https://www.sciencedirect.com/science/article/abs/pii/S0306261919304647)
* [GrassQ - A holistic precision grass measurement and analysis system to optimize pasture based livestock production](https://elibrary.asabe.org/abstract.asp?JID=5&AID=50456&CID=bos2019&T=1)
* [Development of a discrete infrastructure optimization model for economic assessment on dairy farms (DIOMOND)](https://www.sciencedirect.com/science/article/abs/pii/S0168169917315272)
* [Electricity & direct water consumption on Irish pasture based dairy farms: A statistical analysis](https://www.sciencedirect.com/science/article/abs/pii/S030626191730898X?via%3Dihub)
* [Machine-learning algorithms for predicting on-farm direct water and electricity consumption on pasture based dairy farms](https://www.sciencedirect.com/science/article/abs/pii/S0168169917315259?via%3Dihub)
* [Multiple linear regression modelling of on-farm direct water and electricity consumption on pasture based dairy farms](https://www.sciencedirect.com/science/article/abs/pii/S0168169917315247?via%3Dihub)
* [Photovoltaic systems on dairy farms: Financial and renewable multi-objective optimization (FARMOO) analysis](https://www.sciencedirect.com/science/article/abs/pii/S0306261920310461)

**National Agricultural Energy Optimisation Tool:**Figure 1 - National Agricultural Optimisation Tool HomepageFigure 2 - National Agricultural Optimisation Tool DashboardFigure 3 - National Agricultural Optimisation Tool Data Analysis & VisualisationThe National Agricultural Energy Optimisation Tool dashboard allows farmers to visualise their respective energy consumption and carbon emissions. Suitable energy technologies are assessed and automatic algorithms optimise the infrastructure to reduce costs and carbon emissions. **Grass Measurement Optimisation Tool (GMOT):**image.pngFigure 4 - Grass Measurement Optimisation Tool DashboardThe grass measurement optimisation tool (GMOT) is designed to optimise grass measurement practices on livestock grazing platforms by increasing measurement precision and curtailing measurement time and effort. Thus benefiting sustainable grassland management practices.  |
| Previous Horizon 2020 projects | “Grass Q” ERA-NET, ICT – AGRI. Partner Institute. Completed September 2019. |
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