



The Dairy Carbon Navigator

Improving Carbon Efficiency on Irish Dairy Farms




The Farm Carbon Navigator was developed by Teagasc and Bord Bia as an advisory tool to support the Sustainable Dairy Assurance Scheme (SDAS)

www.qas.bordbia.ie

Lowering Agricultural Greenhouse Gases

Facts and Figures



Agriculture accounts for approximately 30% of Irish greenhouse gas production with most of the remainder being contributed by the transport and domestic sectors. Ireland is committed to reduce GHG emissions by 20% by 2020.

- Agricultural emissions are in steady decline and are 9% lower than the 1990
- The Irish grass based dairy and beef production systems are relatively carbon efficient. An EU study rated Irish Dairy Production as the most carbon efficient in the EU.
- The three main greenhouse gasses from agriculture are:

Methane - From rumen fermentation and slurry storage. Methane is 25 times more potent than carbon dioxide. It accounts for almost 2/3 of agricultural GHGs.

Nitrous Oxide - From organic and chemical nitrogen fertiliser and excreted N. It is 300 times more potent than carbon dioxide. It accounts for almost 1/3 of agricultural emissions

Carbon Dioxide - Associated with the use of fossil fuels for energy and the manufacture of fertiliser. It accounts for a relatively small proportion of agricultural emissions

With the expected increase in dairy cow numbers and dairy output post 2015 the dairy industry faces a challenge to reduce its carbon footprint. While agricultural GHG emissions are difficult to reduce farmers who adopt a number of practices and technologies can significantly improve efficiency, improve profitability and lower GHG emissions.

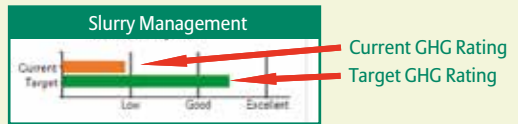
Using the Carbon Navigator



Increases dairy efficiency reduces GHG footprint and increases income

Agricultural GHGs are difficult to reduce. However, plans for increased production after 2015 make it essential for all farmers to achieve GHG reductions. This can be done by improving farm efficiency. The DairyCarbon Navigator focuses on the 5 win-win efficiency measures.

- **Increased EBI**
- **Longer grazing season**
- **Improved nitrogen use efficiency**
- **Improved Slurry Management**
- **Energy efficiency**



The Dairy Carbon Navigator collects a small amount of information from the dairy enterprise and uses this to assess the performance of the farm against peers. It rates performance from poor to excellent as shown in the graphic above. The orange bar reflects current performance.

The Carbon Navigator estimates the % reduction in enterprise GHG emissions that will result from the achievement of the targets which are set. While the individual amounts for each measure may seem very small the overall impact can be very significant. The final column deals with the financial benefit from reaching the target.

Achieving Targets

A key aspect of the programme is the advice on what the farmer needs to put in place to achieve the targets. This is set out in a pre-populated page highlighting the key actions in respect of each of the measures





CARBON NAVIGATOR

The Carbon Navigator Report

Overall Impact

-16.3% +€13880

Year 2014		Current	Target	Chart	GHG Change	€ Benefit
Grazing season length	Turnout Date - Part Time	10/Mar	01/Mar		-2.9%	+€4590
	Turnout Date - Full Time	20/Mar	15/Mar			
	Housing Date - Part Time	01/Nov	07/Nov			
	Housing Date - Full Time	01/Nov	07/Nov			
EBI	EBI	80	115		-6.0%	+€3900
Nitrogen Efficiency	Stocking rate (Kg N / Ha grass)	160.00	200.00		-6.2%	+€4192
	Chemical N used (Kg N / per Ha) Urea	20.00	80.00			
	Ammonium N	200.00	170.00			
	Import (+) or Export (-) of Org Manure N/ha					
	Mgt feeding Kg / Cow	800.00	800.00			
Milk output / cow (Kg milk solids)	400.00	420.00				
Slurry Spread Timing	% in Spring	20	90		-0.7%	+€507
	% Summer following 1st cut	80	80			
	% Later in Summer	0	0			
Energy Efficiency	Application Method	Splash Plate	Band Spreader		-0.5%	+€691
	Plate Cooler Present	X	0			
	Average Temperature of Milk after Plate Cooler	20.0	14.0			
	Variable Speed Vacuum Pump	X	N			
Method of Water Heating	Electricity	Electricity				



Extended Grazing

How does a longer grazing season lower the Carbon Footprint?


Increasing the grazing season length lowers GHG emissions in two ways

- *Grazed grass in the early and late season is a higher quality, more digestible feed than grass silage leading to improvements in animal productivity and a reduction in the proportion of dietary energy lost as methane.*
- *The shorter housing season leads to reduced slurry methane (CH₄) and nitrous oxide (N₂O) emissions from slurry storage. Energy use from spreading is also cut*

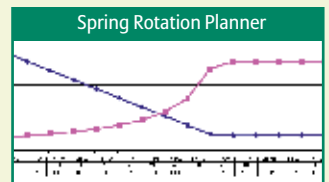
It is estimated that for every 10 Day Increase in grazing season there is a 1.7% reduction in GHGs and profitability is boosted by €27 / Cow.

Increasing Grazing Season Length on your Farm

Based on your location and soil type, you may have an opportunity to extend your grazing season by improving your grassland management.

 *Effective autumn and spring grassland management with attention to minimising damage. Backfence if necessary to limit poaching*

- *Early nitrogen is essential for early grass. Spread 33 Kg/Ha from mid-February weather permitting*
- *Carefully manage early spring grazing, limiting grazing time in wet conditions*
- *Manage soil fertility - sample your soil and apply P, K and lime as required*
- *Monitor grass covers to ensure that good quality grass is available at all times*



Excellent grassland management is the key to the profitability and sustainability of Irish dairy farms. Sharing experiences in a dairy discussion group is the most effective way to improve skills.

Improved EBI

How does EBI lower the Carbon Footprint?

Increasing genetic merit via EBI has the capacity to reduce emission intensities through four mechanisms

- *Improving fertility reduces calving interval and replacement rate, thus reducing enteric CH₄ emissions per unit of product.*
- *Increasing milk yield and composition increases the efficiency of production, which decreases emissions per unit of product*
- *More compact calving can increase the proportion of grazed grass in the diet and reduces culling and replacement rates.*
- *Improved survival and health reduces deaths and the incidence of disease leading to higher productions levels and lower replacement rate.*

Increasing EBI on Your Farm

Target to increase your Herd EBI by at least €10 each year for the next 5 years

- *Identify the key traits you need to improve, focusing especially on milk production and fertility.*
- *Choose a panel of 5 high EBI bulls that compliment your herd. For most farmers fertility is the main weakness that needs to be improved. Select your team from the **ICBF Active Bull List***
- *Order sufficient straws, e.g. 55 straws per 10 heifers required*
- *Focus on your heifers - breeding heifers to carefully selected high EBI bulls is the fastest way to improve herd EBI and profitability*
- **Join Herd Plus** and use their reports to guide breeding policy and to monitor progress



Nitrogen Efficiency



How nitrogen efficiency lowers the Carbon Footprint

Nitrous oxide (N_2O) is a greenhouse gas which has almost 300 times more global warming potential than CO_2 . It is lost to the atmosphere from the breakdown of organic and chemical fertiliser. The higher the proportion of fertiliser that is absorbed by plants the lower the losses to the environment



- *Improving nitrogen efficiency leads to improved utilisation of N by plants and lowers losses to the air and water*
- *The timing and method of slurry application has a significant effect on N utilisation.*
- *Urea requires less energy (and CO_2) to produce than CAN*

A reduction in N fertiliser of 10Kg per Ha will reduce farm GHG emissions by 1% and improve income by €10 / Ha.

Increasing N efficiency on your Farm

Increasing N efficiency can be achieved through

- *Increased use of clover in swards reduces the amount of N fertiliser used.*
- *Match N application to grass growth and stocking rate*
- *Ensure that other elements of soil fertility are optimised. Utilisation of N will be reduced if P or K levels or pH are too low.*
- *Managing grazing effectively, focusing on high levels of grass production and utilisation, leads to increase milk output per unit of N applied*
- *Applying Urea early in the year when conditions are appropriate reduces the GHG emissions associated with fertiliser manufacture and cost*





Slurry Management

How Slurry Management lowers the Carbon Footprint

Improving manure management can reduce the GHG emissions. Moving from summer to spring application and the use of low-emission application methods can significantly reduce emissions.

- *Spring application reduces emissions following land spreading due to the more favourable weather conditions (cool, low sunlight) at that time of year.*
- *Storage losses of methane are reduced due to the shorter storage period*
- *Reduced Ammonia losses increases the fertiliser replacement value, reduces fertiliser N and associated manufacture and spreading emissions*
- *Low emissions application technologies such as trailing shoe lead to reduced Ammonia losses and increases the fertiliser replacement value of slurry*



A 20% shift to spring application can reduce farm GHGs by 1.3% while a shift to of trailing shoe can reduce GHGs by 0.9%

Improving Slurry utilisation on your Farm

Get better value from your slurry and reduce GHG emissions

- *Increase the proportion of slurry spread in spring*
- *Ensure that slurry is spread in appropriate conditions - a cool, still day and if possible avoiding direct sunlight by applying in the evening minimises losses*
- *Factor in the N value of slurry and reduce chemical N accordingly*
- *Do not apply chemical Nitrogen for 2 weeks after slurry application.*
- *If possible use band spreading or trailing shoe*



Energy Efficiency



Improve Energy efficiency & lower your Carbon Footprint

Energy usage accounts for a relatively small amount of total system emissions on dairy farms. However, they can be significantly reduced. In a trial conducted by Teagasc Moorepark electricity consumption ranged from 53 to 108 Watts per litre and cost from 0.23 to 0.76 cent per litre produced. Three key areas were identified as having significant potential to reduce energy costs and energy related emissions.



- *Ensure that you have effective pre-cooling of milk through a Plate Heat Exchanger*
- *Use of variable speed drive (VSD) Vacuum Pumps*
- *Use energy efficient water heating systems*

For a 100 cow herd improving the performance of the plate cooler, installing a variable speed vacuum pump and changing the water heating to gas or oil can reduce enterprise GHG emissions by 1.1% and lead to electricity savings of €1400 which can provide a return on the investment in approximately 5 years.

Improving energy efficiency

Conserve energy, save money and reduce emissions

- Make sure your plate cooler is working effectively. Measure the temperature of your milk entering your bulk tank and make sure it is not being pumped through too quickly.
- For most farms installing a variable speed vacuum pump will significantly reduce electricity consumption for milking with the savings offsetting the capital cost.
- Water heating with gas or oil reduces carbon emissions by 50% and the use of solar power can reduce it even further.
- Ensure that all lights are energy efficient.



CARBON NAVIGATOR

Other ways to reduce GHG emissions on your farm


Animal Health: Working with vet in a proactive programme on bio-security, vaccinations and herd health improves productivity and reduces the replacement rate

Lighting: Make sure you use effective low energy lighting

Fuel usage: Have machinery in good working order. Consider fuel efficiency in relation to farm tasks and transport.

Age at first calving: Reducing first calving age reduces GHG emissions by cutting the 'idle time' in the cows lifetime

Prevention of soil compaction and soil damage. Compacted and damaged soils remain wetter and are subject to increased N losses

Hedgerows: Establishment and effective maintenance of hedgerows act as a sink for carbon 

Trees: Planting of trees on the farm provide shelter, a carbon sink and other ecological benefits on the farm



Emerging cost effective technologies

Sexed Semen

Sexed semen is currently being investigated as a potential technology to improve the profitability of dairy farms. It also has the capacity to significantly reduce the carbon footprint of both the dairy and beef sectors through reducing the number of dairy bull calves and increasing the proportion of beef progeny which are more carbon efficient due to faster growth rates and higher output.

Fertiliser with nitrification inhibitors

Current Teagasc research suggest that the addition of nitrogen stabilizer products and/or DCD has the capacity to reduce gaseous losses from fertiliser, increase nitrogen utilisation and increase income.



Sustainability and the marketing of Irish Dairy Products



Sustainable production is becoming a key part of the business strategies of leading supermarkets, foodservice customers and manufacturers. This has seen them set out 5-10 year plans with ambitious improvement targets. Such customers are heavily dependent on their suppliers to achieve many of these targets. This offers opportunities for suppliers with strong sustainability credentials. Ireland is very well placed in this regard. Ireland enjoys a strong international reputation as a source of natural, high quality food in the marketplace. In relation to sustainability, research from the EU Commission shows our livestock sector performs very well with Irish milk production the most carbon efficient in Europe with beef in the top five.

This is a great starting point. However, increasingly customers are asking us to prove our sustainability credentials and show how we are improving over time. This led Bord Bia to launch the Origin Green Sustainability Programme in 2012. The programme, which is the first of its kind at a national level anywhere in the world, aims to prove our credentials at both farm and food manufacturing level.



Farms are a key element of Origin Green. This has seen Bord Bia roll out sustainability programmes for both beef and dairy through our Quality Assurance infrastructure. To date more than 65,000 farm assessments have been undertaken. This allows us credibly market the sustainability credentials of Irish farms in export markets.

While collecting information is important to identify any potential for improvement, being able to demonstrate how we are striving to be as good as possible is vitally important. This led to the launch of the Teagasc/Bord Bia Carbon Navigator. The Navigator is designed to help farmers engage with practical measures that can improve on farm profitability while at the same time enhancing environmental performance.





Using the Carbon Navigator

Dairy Carbon Navigator Input Sheet

Farmer & Plan Details

Herd Number	<input type="text"/>
Farmer Name	<input type="text"/>
County & Region	<input type="text"/>
Soil Type	<input type="text"/>
Area Farmed (Ha)	<input type="text"/>
Plan Year	<input type="text"/>

Av. no. of Dairy Cows

Current	<input type="text"/>
Planned (+3 Years)	<input type="text"/>

Av. no. of Livestock Units

Current	<input type="text"/>
Planned (+3 Years)	<input type="text"/>

		Current	Target
Grazing Season Length	Turnout Date - Part Time	<input type="text"/>	<input type="text"/>
	Turnout Date - Full Time	<input type="text"/>	<input type="text"/>
	Housing Date - Part Time	<input type="text"/>	<input type="text"/>
	Housing Date - Full Time	<input type="text"/>	<input type="text"/>
EBI	EBI	<input type="text"/>	<input type="text"/>
Nitrogen Efficiency	Stocking Rate (KgN/Ha Grass)	<input type="text"/>	<input type="text"/>
	Chemical N (Kg/Ha) Urea	<input type="text"/>	<input type="text"/>
	Ammonium N	<input type="text"/>	<input type="text"/>
	Import (+) or Export (-) of Organic N (Kg/Ha)	<input type="text"/>	<input type="text"/>
	Meal Feeding (Kg/Cow/Year)	<input type="text"/>	<input type="text"/>
Slurry Spreading	Milk Output/Cow (Kg Milk Solids)	<input type="text"/>	<input type="text"/>
	% in Spring	<input type="text"/>	<input type="text"/>
	% in Early Summer (after first cut silage)	<input type="text"/>	<input type="text"/>
	% in Late Summer / Autumn	<input type="text"/>	<input type="text"/>
	Application Method (Splash plate, trailing shoe or band)	<input type="text"/>	<input type="text"/>
Energy Efficiency	Plate Cooler Present (Yes/No)	<input type="text"/>	<input type="text"/>
	Average Temp of Milk after plate Cooler	<input type="text"/>	<input type="text"/>
	Variable Speed Vacuum Pump (Yes/No)	<input type="text"/>	<input type="text"/>
	Method of Water Heating (Electric, Gas or Oil)	<input type="text"/>	<input type="text"/>

'Sustainable dairying' protects our environment and boosts the income of dairy farmers. Your Teagasc dairy adviser can assist you in assessing your potential to become more carbon efficient.