

Quality Presentation



Green Biofuels Ireland

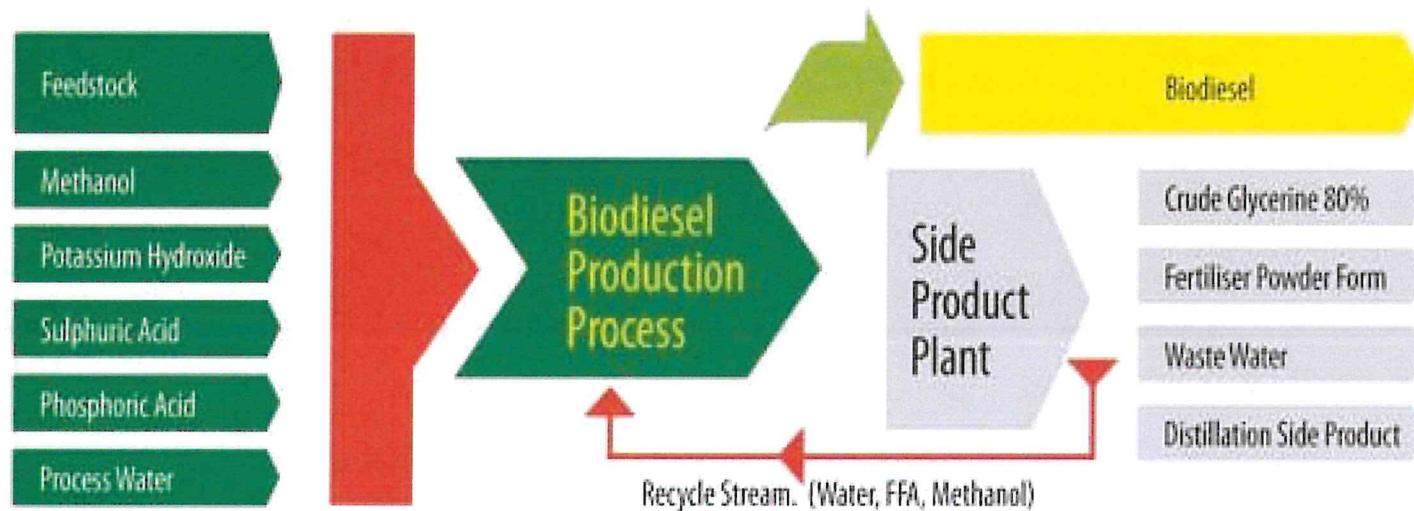
CREATING POSITIVE ENERGY



Green Biofuels Ireland

Overview of Green Biofuels

BIODIESEL PRODUCTION PROCESS - MASS BALANCE



Technology



- Advanced 2nd Generation Technology designed by internationally renowned company, BDI BioEnergy International.
- 40 plants built across 4 continents.
- Multi-Feedstock process



Accreditations & Licences

The Irish biodiesel market is highly regulated, especially in relation to the handling of Category 1 Tallow which is governed by the Animal By-Products (“ABP”) Regulations

Licensing / Audits

- Department of Agriculture, Food and the Marine
CAT1 / UCO licencing, biannual audits
- Biofuel Obligation Scheme Account Holder -
Monthly independent ISAE 3000 verifications, regular National Oil Reserve Agency audits
- IE (Industry Emissions / EPA) unannounced spot audits
- Dublin City Council – Trans Frontier Shipment (TFS) – unannounced spot audits
- ISCC certification – Annual audit
- HSA – Unannounced spot audits
- ISO 9001, 14001 and 45001 - Annual audit
- Customs & Excise - Tax Warehouse Keeper (bonded warehouse) – weekly verifications



GBI Feedstock Used



- Cat 1 (BSE) tallow from Ireland
- Used cooking oil from Ireland
- International Sustainability & Carbon Certification (ISCC) certified and sustainable suppliers
- GBI is arguably the most climate-friendly and sustainable biodiesel production currently in industrial-scale production in Ireland.
- 84 % Greenhouse Gases (GHG) savings



http://www.nora.ie/fileupload/File/Directive_2009_28_EC_-_Promotion_and_use_of_energy_from_renewable_sources_96522587.pdf

GBI's ISCC Certificates



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Certificate ▲	Certificate Holder ▲	Scope* ▲	Raw Material ▲	Add-Ons** ▲	Valid From ▼	Valid Until ▲	Issuing CB ▲	Map ▲	Certi... ▲	Audit Report ▲
EU-ISCC-Cert-DE119-35381401	Green Biofuels Ireland Ltd, New Ross, Ireland	BP	UCO, AF 1		08.06.18	07.06.19	ASG			
EU-ISCC-Cert-DE119-35371401	Green Biofuels Ireland Ltd, New Ross, Ireland	BP	UCO, AF 1		08.06.17	07.06.18	ASG			
EU-ISCC-Cert-DE119-35361401	Green Biofuels Ireland Ltd, New Ross, Ireland	BP	UCO, Tallow Cat ...		08.06.16	07.06.17	ASG			
EU-ISCC-Cert-DE119-35351401	Green Biofuels Ireland Ltd, New Ross, Ireland	BP	UCO, Tallow (Cat ...		08.06.15	07.06.16	ASG			
EU-ISCC-Cert-DE119-35341401	Green Biofuels Ireland Ltd, New Ross, Ireland	BP	UCO		08.06.14	07.06.15	ASG			
EU-ISCC-Cert-DE119-35331401	Green Biofuels Ireland Ltd, New Ross, Ireland	BP	UCO, Animal Fat		08.06.13	07.06.14	ASG			
EU-ISCC-Cert-DE119-353315121401	Green Biofuels Ireland Ltd, New Ross, Ireland	BP	UCO, Animal Fat		08.06.12	07.06.13	ASG			
Certificate	Certificate Holder	Scope*	Raw Material	Add-Ons**	From To	From To	Issuing CB			



<https://www.iscc-system.org/>

Other ISCC Certificates

 **International Sustainability In Carbon Certification**


About Process **Certificates** Trainings & Events Stakeholders Smallholder Academy

Certificate	Certificate Holder	Scope*	Raw Material	Add-Ons**	Valid From	Valid Until	Issuing CB	Map	Certi...	Audit Report
EU-ISCC-Cert-DE100-28752018	Anglo Beef Processors Ireland T/A Waterford Proteins, Waterford, Ireland	PO	AF 1		20 07 18	19 07 19	SGS			
EU-ISCC-Cert-DE100-28752017	Anglo Beef Processors Ireland T/A Waterford Proteins, Waterford, Ireland	PO	AF 1		20 07 17	19 07 18	SGS			
EU-ISCC-Cert-DE100-28752016	Anglo Beef Processors Ireland T/A Waterford Proteins, Waterford, Ireland	PO	animal fat (cat		20 07 16	19 07 17	SGS			
EU-ISCC-Cert-DE100-20152379	Anglo Beef Processors Ireland T/A Waterford Proteins, Waterford, Ireland	PO	Animal Fat/Tallow		21 07 15	20 07 16	SGS			
EU-ISCC-Cert-DE100-20141503	Anglo Beef Processors Ireland T/A Waterford Proteins, Waterford, Ireland	PO	Animal Fat Cat		22 07 14	21 07 15	SGS			

 **International Sustainability In Carbon Certification**

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Certificate	Certificate Holder	Scope*	Raw Material	Add-Ons**	Valid From	Valid Until	Issuing CB	Map	Certi...	Audit Report
EU-ISCC-Cert-DE105-85311803	Greenery Fuels Ltd., Widnes, United Kingdom	CP, TRS	Food waste, UCO		13 04 19	12 04 20	PCU			
EU-ISCC-Cert-DE105-86289601	Greenery Biofuels Amsterdam BV, Amsterdam, Netherlands	BP, TR	Brown grease, Crude		05 12 18	04 12 19	PCU			
EU-ISCC-Cert-DE105-81655410	Greenery Fuels Ltd., Immingham, Hull, United Kingdom	BP, RE	Crude glycerine, Food		15 11 18	14 11 19	PCU			
EU-ISCC-Cert-DE105-83035406	Greenery Fuels Ltd., London, United Kingdom	TRS			15 11 18	14 11 19	PCU			
EU-ISCC-Cert-DE100-09902018	Greenery Biofuels Teesside Limited, Middlesbrough, United Kingdom	PO, BP	Rape/canola, UCO		12 08 18	11 08 19	SGS			

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Certificate	Certificate Holder	Scope*	Raw Material	Add-Ons**	Valid From	Valid Until	Issuing CB	Map	Certi...	Audit Report
EU-ISCC-Cert-DE105-81730611	Biodiesel Kampen BV, Kampen, Netherlands	BP, TR, WH	UCO		09 12 18	08 05 19	PCU			
EU-ISCC-Cert-DE105-81730610	Biodiesel Kampen BV, Kampen, Netherlands	BP, TR, WH	UCO		09 12 17	08 12 18	PCU			
EU-ISCC-Cert-DE105-81730609	Biodiesel Kampen BV, Kampen, Netherlands	BP, TR, WH	UCO		09 12 16	08 12 17	PCU			
EU-ISCC-Cert-DE105-83543201	Salland Olie Maatschappij BV, Kampen, Netherlands	TRS, WH			22 04 16	21 04 17	PCU			
EU-ISCC-Cert-DE105-81730608	Biodiesel Kampen BV, Kampen, Netherlands	BP, TRS, WH	UCO		10 12 15	08 12 16	PCU			

 **International Sustainability In Carbon Certification**

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Certificate	Certificate Holder	Scope*	Raw Material	Add-Ons**	Valid From	Valid Until	Issuing CB	Map	Certi...	Audit Report
EU-ISCC-Cert-DE105-82769506	Frylite Ltd., Strabane, United Kingdom	CP	Food waste, UCO		06 07 18	05 07 19	PCU			
EU-ISCC-Cert-DE105-82769505	Frylite Ltd., Strabane, United Kingdom	CP, LC	UCO, Food waste		06 07 17	05 07 18	PCU			
EU-ISCC-Cert-DE105-82769504	Frylite Ltd., Strabane, United Kingdom	CP, TRS, WH	UCO, Food Waste		06 07 16	05 07 17	PCU			
EU-ISCC-Cert-DE105-82769503	Frylite Ltd., Strabane, United Kingdom	CP, TRS, WH	UCO		06 07 15	05 07 16	PCU			
EU-ISCC-Cert-DE105-82769502	Frylite Ltd., Strabane, United Kingdom	CP, TR, LC	UCO		11 07 14	05 07 15	PCU			
EU-ISCC-Cert-DE105-82769501	Frylite Ltd., Strabane, United Kingdom	FG, TW, WR, TR, LC	UCO		12 07 13	11 07 14	PCU			

Advanced Biofuels

1st generation

- Food crops only
- Settling purification
- No distillation
- Single certified

Advanced Biofuels

- Cat 1 tallow
- Used cooking oil
- POME
- SBE
- WHEY Permeate



<http://www.nora.ie/>



Process

- Multiphase continuous batch process with over 30 tests over 10 stages of production.
- Biodiesel is washed and purified with a Final step of distillation, this removes all contaminants and purifies the Biodiesel.
- The result is an extremely pure, crystal-clear and almost colourless product compliant with the EN 14214 standard



GBI within the EN 14214 Standard

TEST	UNITS	SPECS	GBI	Industry
Ester Content	%m/m	96.5 min	99	98.7
Monoglyceride	%m/m	0.7 max	<0.01	0.43
Total Glycerol	%m/m	0.25 max	0.02	0.14
Water Content	mg/kg	500 max	48	114
Oxidation Stability	hours	8 min	9.2	10
Total Contamination		24 max	1	7.1



Key Quality Indicators

Filter Blocking Test (FBT)

- FBT IP 387, Cold FBT, Cold soak FBT
- EN 590 requirement
- UK specification: 2.5 max
- GBI typical results: 1 max

Cold Filter Plugging Point (CFPP)

Fuel Type	Typical Values
Tallow methyl Ester (TME)	+10°C to +14°C
UCO Methyl Ester (UCOME)	0°C to +5°C
EN590 Diesel	Winter: -20°C to -25°C Summer: -5°C to -20°C



Saturated Monoglycerides (SMG)

- Calculation based on Annex C of EN 14214
- Specification: Northern Europe 55 max
- High SMG content can cause filter plugging at low temperatures
- SMG EN 17057 new method 2018
- GBI Typical results: <200 mg/kg



SMG Index Calculation

Recommended SMG Index Max 55

	Density	MG	Cloud Point	Smg	Smg Index	EN 590 Dilution
Biodiesel Example 1	880	0.25	8	0.089103	56	7%
Biodiesel Example 2	880	0.43	7	0.14359	88	7%
GBI Biodiesel Example	880	0.01	17	0.005587	3	7%



Biological Contamination

- Biological growth is only possible in the presence of free water.
- GBI Tanks Independently tested.
- No movement by shipping, a common source of water contamination.
- High water and sediment content





Green Biofuels Ireland

CREATING POSITIVE ENERGY

For further information please contact:

Email: admin@gbi.ie

Web: www.gbi.ie



CFPP / FAME PRESENTATION

Presented by : David McLellan SGS Lab Manager Dublin Port

In association with GBI Green Biofuels Ireland Ltd

GBI Representative: Tony Hennebry

WHEN YOU NEED TO BE SURE



WHAT IS CFPP? : COLD FILTER PLUGGING POINT

- CFPP is part of EN590 Derv specification;
- Derv: Diesel Engine Road Vehicles
- Diesel : Generic term for Gas oils and derv
- Standard method is IP 309 or equivalent EN116
- Sample is cooled progressively in a bath at -34° and at every degree the sample is passed through a filter of 0.45 microns, 45millionths of a meter, or thousandths of a millimetre, pore size. The time is taken to do this exercise.
- When the time exceeds 60 seconds the start temperature is considered to be the CFPP.



- Raw materials 1st Generation: Pure Vegetable oils
- Advanced Biofuels: Cat 1 Tallow and Used Cooking oils
- Chemically referred to as Lipids or Fatty acids
- Acids are chemically treated with Na or K Hydroxides and Methanol to change the acid portion of the Lipids to Fatty Acid Methyl Esters (FAME). Esters are a group of organic compounds that has the ester characteristic. $O=C-O-R$
- Similar to the brewing industry at this point after the business has taken place a whole reaction vessel of products, by products and unreacted raw product and chemicals are all in one mix. Separation must occur to produce a raw finished product.
- How is this achieved?

- We are all familiar with distillation processes. It has been used for centuries legally or illegally for alcohol production.
- The same principle applies here with one important difference. A vacuum is applied and this allows the product to evaporate and cool and condense at much lower temperatures. Water boils at much lower temperatures and at higher elevations due to a lower air pressure.
- Alternative separation methods are available such as centrifugal separators and possibly filtration systems but the most efficient is Vacuum distillation.
- In SGS OGC labs tar based products can be distilled under vacuum until nothing is left. Crude oils are regularly done this way.

HOW GOOD IS VACUUM DISTILLATION

- As only pure product is evaporated, the contaminants are left behind due to the differing boiling points of different compounds. By setting the distillation unit to allow only the FAME products to evaporate this allows for the quality product that producers are interested in to be produced.
- The test results show very little of the contaminating compounds to a point of being undetectable ie $<0.01\%$
- Glycerides and glycol are the main contaminants and these are kept below the maximum threshold.
- Vacuum Distillation is very good at achieving this.

ISSUES WITH FAME IN DIESEL FUELS

- Cloud point the lowest temperature at which the first precipitates appear in any fuel product.
- Cloud point is therefore the lowest temperature at which filter blocking issues will start to occur.
- CFPP temperature is lower than cloud as cloudy product will still pass through the filter (0.45 micron/ IP309) or 5 to 10 micron fuel filter on vehicles.
- CFPP typical FAME values are plus +10 to +15°C. See cert.
- This FAME is then blended with fossil fuels in delivering EN590 fuel grade product to the forecourt.
- See finished EN590 cert.

- The Saturated monoglyceride content (SMG) of FAME is calculated from Cloud point, Monoglyceride content, and total Saturated fatty acid content.
- SMG content is also currently a calculated figure in EN590 Fuel. It is envisaged that a laboratory method will be developed to estimate the content in the not too distant future. This is because SMG is a major concern for blocking filters.
- With very low SMG contents in FAME being diluted further in finished EN590 fuel it is then Cloud and CFPP that becomes the focus on finished product quality.

- 1: CFPP can be high on the finished FAME product but blending will depress the CFPP value to an acceptable level in the finished EN590 fuel. The CFPP of the fossil fuel then becomes a critical concern when buying the fuel.
- 2: Companies regularly check that CFPP meets the seasonal changeover criteria in October each year. This is on finished retail product available to the consumer.
- Any questions