



EUROPEAN BIOMASS INDUSTRY ASSOCIATION

Transformation of Used Cooking Oil into biodiesel: From waste to resource

UCO TO BIODIESEL 2030

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1. Introduction

The Waste framework Directive 2008/98/EC classifies Used Cooking Oil (UCO) in the category “edible oil and fat” (EWC 20 01 25). According to this directive, Member States (MS) shall take measures to encourage the separate collection and the treatment of bio-waste in a way that fulfils a high level of environmental protection. Nevertheless, while restaurant generated UCO is collected and treated by authorized service providers, most of European countries lack drives and motivation for widespread efficient collection systems to recover UCO produced by households. Consequently, over 60% of the UCO produced is improperly disposed of with associated harmful impact in terms of sewage clogging and water contamination. On the other hand, there is great potential in the recycling of UCO, which increases the interest in the collection process, in particular for the production of biodiesel. Biodiesel produced through the transformation of UCO, besides avoiding competition with agricultural food products, has the lowest Greenhouse Gas (GHG) emissions among biofuels, ensuring 88 % GHG emissions savings. Biodiesel produced from UCO could replace 1.5% of the EU28 diesel consumption, thus contributing to achieve the EU goal of reducing CO₂ emissions by 20% by 2020. The CO₂ emissions avoided by biodiesel utilization produced from UCO are double counted.

2. Household UCO

UCOs can originate from both vegetable and olive oils and animal fats. Once they have been used for cooking or frying, they can be collected and recycled for other uses.

Estimated amounts

The amount of used cooking oil generated in each country varies quite a lot depending on its cooking traditions. According to the BioDieNet project, the total UCO potential in the EU-27 is 3.55 million tonnes, which is equivalent to 8 litres of UCO per capita. This estimate includes the HORECA sector, food processors and households, and was based on an assessment of both collected and discarded UCO in ten EU Member States, which was then extrapolated to the whole EU. The contribution of the domestic sector is 1.748 million tonnes per year, of which it is estimated that over 60% is improperly disposed.

Pollution power

The frying process modifies vegetable oils from both a physical and a chemical point of view resulting in the creation of harmful compounds. Although these compounds are classified as non-hazardous waste, they are highly harmful for human and animal health and especially for the environment.

The common method of depositing the oils in the sewage system is an illegal practice that causes many problems. The oils clog the sewage systems causing malfunctions in the filters and oil/water separators. The most important consequence is the contamination of massive quantities of water that comes into contact with the oils due to the difficulty of separating the two fluids. In practice this increases the cost and the energy consumption of domestic waste water treatment as well as the GHG emissions associated with its biodegradation (non-CO₂ emissions). The estimated increment of the water treatment cost due to the oil fraction is up to 25%.

Common collection practices

The establishment of a household UCO collection system requires the participation of several actors. The project promoter is usually a local authority such as a municipality or a local energy agency while private or a public/private companies can be selected as service providers delegated to collection and transport activities. The most typical collection method is by far the installation of public collection points placed in easily reachable places (e.g. schools, supermarkets, parking lots, municipal buildings, amenity sites etc.).

The majority of the UCO collected is used for production of biodiesel, though in some cases it can also be used for industrial applications or for other energy production. In the most cases, the biodiesel produced is sold on the market or partially provided back to the promoting organizations to be used in the public transport fleets. The price of the UCO depends on its quality, its quantity and the certification system applied.

Promotional campaigns are an important tool for the successful launch and implementation of UCO recycling processes. It is vital to motivate the citizens and all the stakeholders involved by raising their awareness on the importance of recycling and providing them with accurate and detailed information on how to take part in the UCO collection project and how to deliver the oil correctly.

3. Policy framework

Household UCO policy framework

The UCO supply chain has not been highly regulated; a few European provisions regulate the UCO collection and recovery systems.

The **Waste framework Directive 2008/98/EC**¹ classifies UCO in the category “edible oil and fat” (EWC 20 01 25). Member States must control the companies responsible for the collection and handling or treatment of UCO. This means that all operators collecting or treating UCO must obtain a permit from their country's authorities, specifying the type and quantity of waste to be treated, any necessary technical requirements, precautions to be taken, and information to be made available at the request of the competent authority (origin, destination and treatment of waste and the type and

1 Waste framework Directive 2008/98/EC <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098>

quantity of such waste).

Directive 2004/35/CE² establishes a framework for environmental liability based on the “polluter pays” principle, with a view to preventing and remedying environmental damage. The polluter-pays concept could be the common ground to distribute responsibilities among the various actors playing a role into the UCO production/collection/recovery system.

The **Animal By-Products Legislation 1774/2002**³ forbids the use of UCO (originating from restaurants, catering facilities, and kitchens) as an ingredient in animal feed. This measure is intended to protect both animal and human health, since some toxic compounds could affect final consumers as a result of bioaccumulation. UCO may only be used to produce biodiesel and oleo chemical products.

The EU Implementing Regulation 142/2011⁴ defines the conditions under which UCO is a suitable starting material for biodiesel production and the process to be followed, case by case. The EU Regulation 1069/2009⁵ lays down health rules as regards animal by-products and derived products not intended for human consumption and repeals the EU Regulation 1774/2002.

Biodiesel policy framework

The Renewable Energy Directive 2009/28/EC (RED)⁶ introduces the mandatory use of renewable energy in the EU transportation sector. According to this Directive, MS must meet at least 10% of the national energy demand in transport through renewable energy sources by 2020. In parallel, the Fuel Quality Directive 2009/30/EC (FQD)⁷ requires European energy suppliers to reduce lifecycle GHG emissions (per unit of energy from fuel and energy supplied) by at least 6% by the end of 2020 – assuming as baseline 2010.

Article 7b of the FQD along with Article 17 of the RED set out the sustainability criteria that biofuels have to meet in order to count against the GHG savings target. The RED encourages the development of biofuels produced from “wastes, residues, non-food cellulosic material, and ligno-cellulosic material” which can be counted double against the emissions reduction target. As for ordinary biofuel chains, biofuels produced from waste need to show compliance with sustainability criteria via third-party certification according to any of the EC approved certification schemes like ISCC. There are ongoing discussions within the administration of different EU MS if UCO should continue to be eligible for double counting or if certification of UCO collectors should include the inspection of a sample with respect of their UCO suppliers.

The EU28 have implemented different measures to support the biofuel sector. While tax reliefs for biofuels have been abolished gradually by the greatest part of the MS, mandatory biofuel incorporation targets are one of the strongest and most applied support measure. The FQD and the CEN technical standards regulate both the properties and the amount of biofuels that can be blended into fossil fuel.

2 Directive 2004/35/CE on health rules concerning animal by-products non intended for human consumption <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32004L0035>

3 Animal By-Products Regulation 1774/2002 <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1421749928719&uri=CELEX:32002R1774>

4 EU Implementing Regulation 142/2011 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:054:0001:0254:EN:PDF>

5 EU Regulation 1069/2009 <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1421750223329&uri=CELEX:32009R1069>

6 Renewable Energy Directive 2009/28/EC <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1421750499234&uri=CELEX:32009L0028>

7 Fuel Quality Directive 2009/30/EC <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1421750554532&uri=CELEX:32009L0030>

There are ongoing discussions concerning a new Directive amending the RED, the so-called Indirect Land Use Change (ILUC) Directive. This should address the environmental and social problems that the production of first generation biofuels has created due to its indirect impact in food prices, greenhouse gas emissions, or land use. The growing production of biofuels based on food crops has caused additional land-use changes since farmers have been forced to expand their cultivated areas in order to maintain the supply of food, causing additional greenhouse gas emissions and endangering ecosystems.

The European Council and Parliament have different views regarding advanced biofuels and UCO. The Parliament approved a mandatory sub-target for advanced biofuels of 1.25% but left UCO out of it, making the use of UCO only eligible and double counted for the 10% renewable energy goal. On the other hand, the Council agreement does not provide a binding incorporation target for advanced biofuels. It establishes a much less ambitious sub-target of just 0.5% for advanced biofuels, excluding UCO issued biodiesel. This sub-target would not be mandatory and would work as a reference for Member States to define their national objectives. These can be lower than 0.5% as long as Member States offer a suitable explanation. However, they have to justify any setting of a lower target than 0.5 percentage points and to report any reasons for non-achievement of their national target.

Best practices

Germany has introduced a mandatory certification system of all double-counting materials (BimschV). As for ordinary biofuel chains, biofuels produced from waste need to show compliance with sustainability criteria via third-party certification according to any approved certification schemes like ISCC.

Italy has recently passed a law requiring a minimum of 0.6% advanced biofuels in petrol and diesel by 2018, rising to 2% by 2022. This target will give investors more certainty and incentives to invest.

In Portugal, regulation PEM 2009 makes local administrative units responsible for domestic UCO collection. It also establishes objectives to be accomplished in the immediate future and sanctions to be paid in case of non-compliance. Furthermore, the Portuguese NREAP specifies targets for Biodiesel issued by UCO.

4. Identified Barriers

UCO side

The major technical challenge of recycling household UCO is its collection, mainly due to the high costs in the logistics. Even if several solutions exist which can be efficiently adapted to different contexts, they are not applied on a large scale. For this reason, the RecOil project records and makes available best practices and suggestions for newcomers who would like to implement a household UCO collection project. Furthermore, a behavioural survey in five EU MS (Greece, Spain, Denmark, Italy and Portugal) was developed in order to assess the predisposition of householders to participate in UCO collection. It revealed the importance of information and raising awareness campaigns with specific content in order to reach a high UCO collection among citizens. Once an

information campaign clearly shows how the collection system works, specifying the benefits for the environment and for the community and once the collection system is implemented in a way that is easy and practical for the users, many citizens are willing to give their contribution to the UCO recycling.

It was found that the main obstacle is not on the technical or on the social level rather than on the policy one. In fact, the potential benefits of UCO recycling are too often unknown to the public institutions who should promote it. Consequently, there is a big ambiguity in the definition of the UCO as a waste or as a by-product resulting in uncertain treatment pathways.

There is a real need to frame consistent rules focussed on UCO collection, treatment and recycling.

Biodiesel side

Despite the RED aims to establish a complete harmonization of biofuel sustainability criteria, both the certification procedures and the lists of eligible material for double counting are non-harmonized across the EU-28, creating obstacles to the international market.

In addition, fraudulent activities in the production and trade of biodiesel from UCO are a relevant menace to the establishment of a transparent and fair market of double counting commodities. Sustainability schemes do not require reporting of the outcomes of the controls of the double counting material streams until the biodiesel is sold to the fossil fuel producer. This lack of a more strict control throughout the UCO collection and production chain leads to an artificially increased demand of virgin oil, which is used exclusively for the generation of biofuels, a fraudulent practice that highly impacts the vegetable oil market.

Furthermore, double counting may add further problems if its value is not bankable and adds unnecessary complexity to any business model, adding unnecessary risks. Finally, multiple counting effectively reduces the requirements for renewable energy without actually reflecting a real increase in renewable sources and reduction of GHG while actually diminishing the actual amount of biofuels.

To this purpose traceability of UCO biodiesel is a crucial issue, requiring well-determined certification pathways as well as slim procedures and simple bureaucracy.

Poor synergies with the transport sector limit the development of higher blends of biofuels in the market. A higher share of biofuels in oil might generate extra pollutants and damage motors that are not prepared for these higher blends. Thus, stronger cooperation between the biofuels and the automobile industry, and the essential role of the European Committee for Standardization, should facilitate the addition of higher shares of biofuels into fossil fuels without affecting the vehicle's performance or a deterioration of pollutant emissions.

5. Identified Opportunities

The use of waste for energy purposes is today a very relevant topic. Recycling UCO into biodiesel offers a genuinely sustainable alternative for a problematic waste product, creating a significant income source and simultaneously reducing environmental pollution and fossil fuel dependence. These benefits should be understood and considered by the policy makers who can encourage and

facilitate the implementation of the UCO to biodiesel chain. The policy driver is crucial to ensure a wider affirmation of the UCO recycling practice.

The debate on the “Circular Economy package” and the review of Directive 2008/98/EC⁸ (the Directive proposal is planned for the autumn of 2015), are good opportunities to introduce and raise awareness on the important benefits of UCO recycling. Firstly, the reviewed Directive should classify UCO as a food waste rather than as a by-product, eliminating any kind of legal ambiguity. This measure would lead to the creation of clearer treatment, collection and recycling pathways. Furthermore, the new legislative proposal should include ambitious goals on the recycling of wastes such as UCO.

Secondly, the Directive revision could stimulate the regional/municipal administrations to establish new UCO collection systems. In fact, as local authorities are usually the main project promoters, any policy action should take them into account. EU level directives could work in parallel with the Covenant of Mayors to push dissemination of best practices, information campaigns and recycling targets, within the context of local sustainable energy action plans. For example, these plans could establish commitments to use UCO based biofuels in public transport or design collection and recycling programmes. Moreover, at the EU level the Commission could do much more to inform and raise awareness about the importance of recycling used cooking oil and the benefits of this biodiesel source. Following the example of other initiatives as the efforts to reduce the use of plastics, the Commission could support high level events focussed on UCO recycling or sponsor European campaigns for the collection of household UCO.

From the biodiesel side, an ambitious mandatory goal for advanced biofuels could be a great boost for the UCO industry. An advantageous target, as the one suggested by the European Parliament, should of course include UCO in the list of eligible sources for the advanced biofuels national goals. Regarding double counting, the best option would be to keep it but solving the problems it generates as it has been mentioned in the previous section. Moreover, it is necessary that a Directive’s revision provides an annex with an exhaustive list of wastes and residues and more information on how to implement the double counting system, with clear and homogeneous custody rules, procedures, and documents. Therefore, a higher sub-target for advanced biofuels, including UCO, and a comprehensive list of feedstocks would be the best options. In fact, MS should complement any possible EU level sub-target by establishing their own goals for advanced biofuels.

Furthermore, UCO can also be used to produce biokerosene, kerosene for aviation derived from biomass. This could be a new opportunity and should be further researched and supported as there have been already a few flights powered by UCO (blended in a 10% with traditional kerosene) and some big companies are studying its use. The EC is part of the European Advanced Biofuels Flight Path, an initiative that promotes the production, use and storage of sustainable biofuels within the aviation industry. The possibility of producing UCO based renewable jet fuel should be taken into consideration as a new option and thus more incentives should be set up in order to make this a competitive and viable alternative.

In relation to other Directives, the new Parliament and Commission should keep on working on the

8 Directive 2008/98/EC on Waste <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1421750841397&uri=CELEX:32008L0098>

revision of the Energy Taxation Directive⁹, right now withdrawn by the Juncker Commission due to the lack of consensus in the Council. Any legal change should take into account the carbon and energy content of fuels as the basis for establishing the minimum tax threshold.

Member States shall have an essential role in the support of UCO based biodiesel. The EU will maintain its support to advanced biofuels after 2020, but according to the Commission, it will limit the scope of its actions and thus, will leave space for more national initiatives. For example, within the context of the Alternative Fuels Infrastructure Directive¹⁰, national governments will have to design and establish national frameworks for the development of alternative fuels, among them advanced biofuels. Thus, governments could define ambitious goals and incentives to further promote the development of UCO based biodiesel. These incentives would go in line with the Directive and the competition rules recently approved. In fact, the Guidelines on State aid for environmental protection and energy 2014-2020¹¹ do not limit the capacity of MS to keep public financial support for the production of advanced biofuels.

Moreover, consumption could be stimulated by higher mandatory biofuels blending targets, in particular for heavy transports which do not have any other feasible alternative to fossil fuels but biofuels and are already technically able to use them. This measure would also require a stronger collaboration with car makers so that motors would be compatible with higher levels of biofuels in the fossil fuels. Actually, Italy has recently passed a law requiring a minimum of 0.6% advanced biofuels in petrol and diesel by 2018, rising to 2% by 2022. The definition of an ambitious, mandatory, and clear target for the post-2020 period with penalties high enough to prevent buy-outs could greatly help market uptake for UCO based biofuel. The Commission decided not to include any goals for the transportation sector in its 2030 framework for climate and energy policies adding extra uncertainty to a sector that has been suffering from too much legal and policy inconsistency. A long-term goal and policy coherence and consistency would foster investment facilitating the production and deployment of advanced biofuels.

Finally, there should be stronger investment support on EU, national and regional levels for research and production at a non-commercial level and support for-of-its-kind plants. Horizon 2020, Structural Funds or NER 300 can facilitate the investments and research efforts in these fields, but also other kinds of measures like government loan guarantees, BEI loans and other financial products (e.g. Joint European Support for Sustainable Investment in City Areas) can foster public and private funding for the production of UCO based biofuels.

9 Energy Taxation Directive 2004/74/EC <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:157:0087:0099:en:PDF>

10 Directive 2014/94/EU on the deployment of alternative fuels infrastructure <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0094>

11 Communication 2014/C 200/01 Guidelines on State aid for environmental protection 2014-2020 [http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014XC0628\(01\)](http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014XC0628(01))