

## STRATEGIES FOR OPTIMIZATION OF THE DOMESTIC USED COOKING OIL TO BIODIESEL CHAIN. THE EUROPEAN PROJECT RECOIL

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**ABSTRACT:** The energy potential of household used cooking oil (UCO) is practically unlimited. Its disposal, in some cases illegally, increases the cost and the energy consumption of domestic wastewater treatment, as well as the GHG emissions associated with its biodegradation (non-CO<sub>2</sub> emissions). In this, it should be added the heavy environmental pollution load. The European initiative RecOil (Promotion of used cooking oil recycling for sustainable biodiesel production), co-funded by the Intelligent Energy Europe programme of the European Commission, aims to increase sustainable biodiesel production and its market intake by enhancing the household used cooking oil (UCO) collection and transformation at local and regional level. RecOil will assess the “UCO to biodiesel” chain best practices, through a household survey, the industry expertise, and local/regional authorities’ cooperation, to develop an on-line decision-making guide in order to assist stakeholders in developing a chain adjusted to local specificities (geographic, social, economic, legislative, and climate). Pilot projects will also be implemented, according to the most promising practices identified, for validation. The RecOil implementation will result in primary energy savings estimated in 1.300 toe/year and the reduction of GHG emissions 14.413 tCO<sub>2</sub> eq/year.

**Keywords:** biodiesel, biofuel, urban wastes, used cooking oils, alternative fuel, **sewage treatment**.

### 1 INTRODUCTION

Biodiesel produced from used cooking oil (UCO) could replace 1,5% of the EU27 diesel consumption, supporting Member States to reach the target of 10% of renewable energy in transports in compliance with the RED Directive and to reduce CO<sub>2</sub> emissions by 20%, by 2020.

Nowadays over 60% of the UCO produced is improperly disposed. The domestic sector, where there are no wide spread collection systems, is the main source of UCO in some EU countries, especially in the Mediterranean. The energy potential of household UCO is practically unlimited. Its disposal, in some cases illegally, as garbage or in drainages increases the cost and the energy consumption of domestic wastewater treatment, as well as the GHG emissions associated with its biodegradation (non-CO<sub>2</sub> emissions). In this, it should be added the heavy environmental pollution load. This paper analyses the methodology approach in order to increase sustainable biodiesel production and its local market intake, by enhancing the household UCO collection.

### 2 THE RECOIL INITIATIVE

#### 2.1 Integrated approach

The project RecOil - Promotion of used cooking oil recycling for sustainable biodiesel production, co-funded by the Intelligent Energy Europe programme of the European Commission, presents an integrated assessment of the “UCO to biodiesel” chain best practices, and aims

to encourage new efficient collection, transformation, commercialisation UCO chains at local or regional level.

An extended survey to households has been planned in order to identify the most convenient and effective methods of UCO collection and to record factors, barriers or facilitators for a wider use.

The key actors, regional/local authorities and private operators, will be actively involved through meetings and workshops to integrate their expertise and achieve their support and cooperation on the identification and definition of the best practices.

Pilot projects to test methodology sets will be implemented, according to the most promising practices identified, for validation and demonstration of the results.

Activities to raise public awareness for UCO disposal, UCO collection, transport and transformation and to motivate households to be part of the chain are also planned.

An integrated assessment - through a multi-criteria analysis - will be conducted and an on-line guide will be developed to present an implementation methodology and a decision making support tool for interested stakeholders. This tool will assist existing actors, and also newcomers who want to be involved in the “UCO to biodiesel” chain, providing guidance as regards the process, requirements, best practices and methods adapted to the specific features of their region.

#### 2.2 Scientific innovation and relevance

The household survey -carried-out across different EU regions- is based on behavioural psycho-sociology methodologies and statistical analysis. Till now the UCO household collection process is not adequately studied

taking into account social parameters and citizens attitude and perceptions. The data analysis will provide input as regards the waste disposal behaviour, recycling preferred methods as well as motivation factors, which will be used to determine the best methods taken also into account the consumer, as an important link to the “UCO to biodiesel” chain.

The pilot projects will be monitored during the different phases of their development as regards all critical parameters at local/regional level, and will undergo a final independent assessment for the identified best practices.

An on-line decision-making support tool, supported by a database and multi-criteria matrix, will be developed. This tool will assist stakeholders in developing an “UCO to biodiesel” chain adjusted to the local characteristics (geographic, social, economic, legislation, and climate), and will include recommendations for effective communication strategies.

The on-site systems of the pilot projects will demonstrate best practices, and will benefit local communities economically and environmentally.



**Figure 1:** ReCoil methodological approach

### 2.3 Main Barriers

The main barriers to UCO collection, recycling and resulting to biodiesel market, are:

- Inexistent / insufficient / inadequate UCO collection systems;
- Lack of awareness / insufficient information / promotion of UCO collection and recycling and biodiesel use;
- Low UCO collection threatens the economic viability of the systems;
- Low potential for the sale of higher biodiesel blends in public filling stations;
- Legislative/normative framework;

## 3 METHODOLOGY

The RecOil project aims to address these barriers and to increase sustainable biodiesel production in local/regional level.

The development methodology is structured in five stages to achieve significant increase of the collection of used cooking oil for biodiesel production.

### 3.1 Identification of the best methods for UCO collection, promotion, and transformation - Phase 1

This phase intends to collect and analyse useful information to characterize the UCO chain, and is composed of four basic steps:

- Compilation of good practices from EU and international as regards efficient communication tools;
- Population surveys to evaluate the most appropriate method of collection, taking into account the predisposition of householders and their preferences;
- Preliminary analysis of the best oil collection, transformation and motivation methods taking into account the several dimensions of the used cooking oil collection problem (safety, health, comfort, investment, proven results, etc.);
- Comparative legal framework analysis and barriers/opportunities identification in 5 participating countries (Portugal, Italy, Spain, Greece, Denmark)

### 3.2 State of the Art analysis and Pilot Projects - Phase 2

During this phase all the available information about the state of the art “UCO to biodiesel” chains will be collected. A number of pilot projects on UCO collection and transformation will be implemented to validate/demonstrate the effectiveness of the proposed methods.

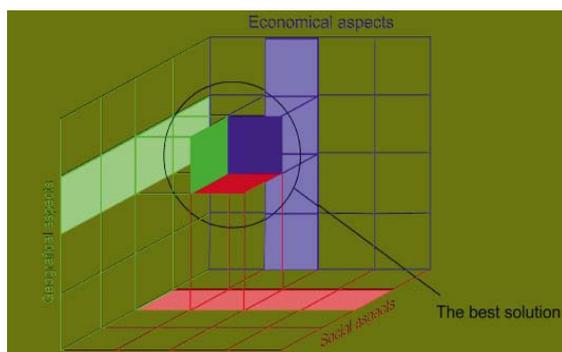


### 3.3 Pilot Project results assessment – Phase 3

In this phase the results of the pilot project will be evaluated and quantified according specific indicators. These indicators are critical to demonstrate the effectiveness of the proposed methodologies to the local actors (“UCO to biodiesel” operators and local authorities). The involvement of biodiesel producers to this process will validate the feasibility of the proposed best practices.

### 3.4 Development of the on-line guide - Phase 4

This step involves the development of an on-line tool for UCO collection, transformation and commercialization, as a practical guide for local/regional authorities and market actors. This guide includes an implementation methodology and a decision making support tool that will be valuable to the replication of good practices throughout Europe. This tool will guide all the interested actors in the implementation and/or improvement of an effective UCO chain.



### 3.5 Exploitation and replication of results – Phase 5

As a final step the results will be widely communicated in order to encourage stakeholders to adopt the best practices identified and to use the on-line guide as a decision making support tool.

## 4 RESULTS

The on-site systems of the pilot projects will demonstrate best practices, and will benefit local communities economically and environmentally.

The transferability of the results and the wide distribution of the online guide will also encourage new operators and other regions to implement efficient collection, transformation, commercialization UCO chains, and will effectively contribute to reduce the amount of oil disposed into the wastewater drainage and treatment systems and also to increase the amount of UCO collected for biodiesel production. This will contribute to reduce the energy consumption by the wastewater treatment systems and to substitute diesel with biodiesel, reducing CO<sub>2</sub> emissions. This work also aims to encourage new legislation or supporting measures to promote the collection, transformation and commercialization of UCO to biodiesel.

This project will increase public awareness about the importance of recycling UCO and will motivate householders' behavioural change. The implementation guide of the "UCO to biodiesel" chain will be a valuable tool for the replication of the best practices throughout Europe. The project implementation will result in primary energy savings estimated in 1.300 toe/year, the reduction of greenhouse emissions 14.413 tCO<sub>2</sub> eq/year, and a cumulative investment by European stakeholders in sustainable energy of 1.850.000,00 €

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## 7 LOGO SPACE

