



LIFE ENVIRONMENT Programme



# ***OILPRODIESEL***

**„Integrated waste management system for the reuse of used frying oils to produce biodiesel for municipality fleet of Oeiras“**

Project co-funded by the LIFE Environment programme under contract  
LIFE05 ENV/P/000369



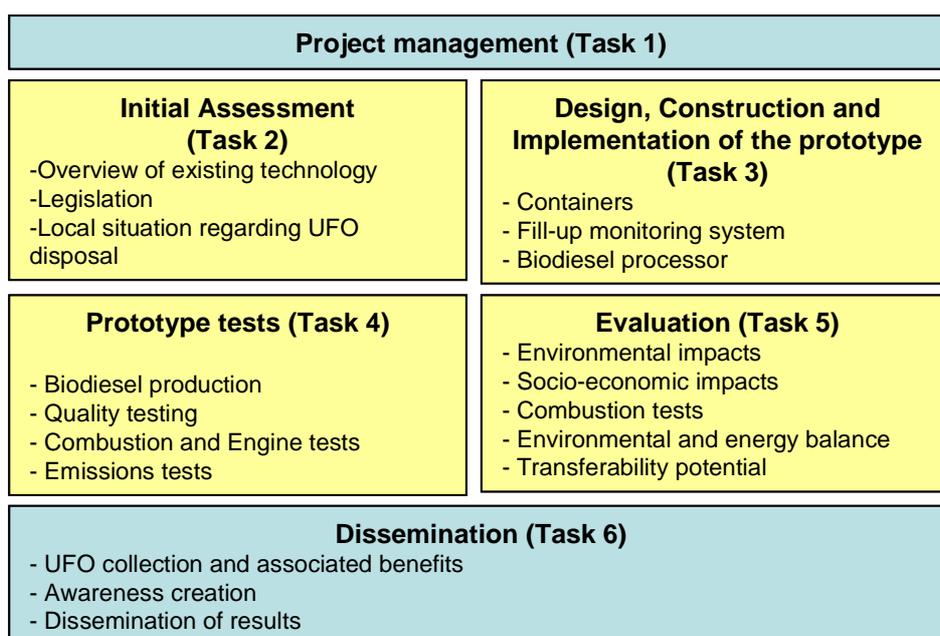
Project duration: 30/10/2005 to 31/03/2009  
Total budget: €1.202.411  
EC contribution: €588.150

## PROJECT SCOPE AND OBJECTIVES

The purpose of OILPRODIESEL was to develop an integrated system for the collection of used frying oils (UFO) produced in the domestic sector that will be used to produce biodiesel that will serve to fuel the vehicle fleet of the municipality of Oeiras.

The overall objective is to solve the uncontrolled problem of UFO disposal into the waste water collection system, through an adequate waste management system. Using UFO for producing biodiesel also plays the simultaneous role of reducing the demand for primary energy by the Municipality vehicles and the consequent cutting of greenhouse gas emissions. In this manner, the project implementation is based, step by step, from an estimation of available UFO for collection, to a definition of the process logistics and a definition for the final use of biodiesel.

A correct management of UFO as waste and the best final use of the product (biodiesel) will complete the oil cycle in the implementation area (Oeiras), and demonstrate the feasibility and the transferability to other municipalities and/or regions across the countries involved.



## TECHNOLOGY AND METHODOLOGY

### Collection

Collection of the UFO originated in the domestic sector was made with 20 specially designed containers placed in selected places all over the municipal territory. The specifications for the container design included robustness, attractiveness and UFO to be deposited in plastic bottles. The



container has two parts, an outer shell and an interior, replaceable, container where the bottles are actually deposited. When full this container, provided with wheels, is moved to the transport truck and taken to the processing facility. A clean container is then put inside the outer shell.

## Fill-up monitoring system



In order to implement an efficient routine for the collection of recyclable waste, it was deemed necessary to implement a remote monitoring system, such that containers would only be emptied when a significant level of waste had been collected.

The system consists of two main components: remote monitoring units, installed within the UFO containers, and a Control Centre, installed at the waste collection operator's premises. The monitoring unit measures the level of waste within a container, and

transmits readings to the Control Centre, where they are displayed together with the location of the relevant container on a digital map. The monitoring unit is installed in a support inside the UFO container.

In order to facilitate monitoring of containers by any interested party, a Web-based application was developed allowing anyone with an Internet connection to access the relevant data. The application was developed based on Google Earth, which provides an attractive map or aerial view over which are overlaid the locations of the containers. By clicking on the appropriate icon, data for a specific container (such as fill level, last reporting time and street location) may be accessed.



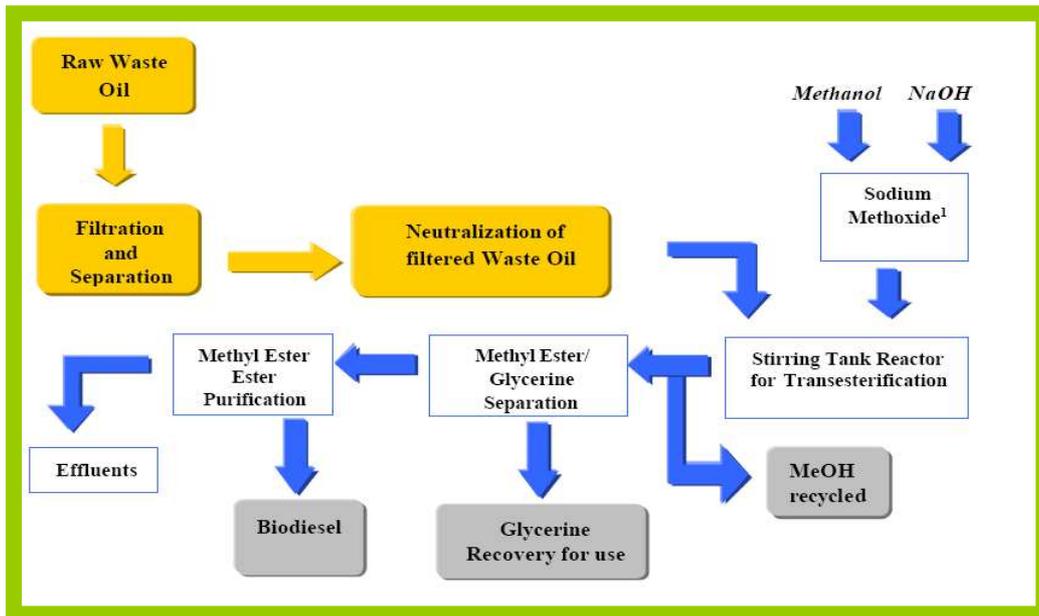
## Biodiesel processor

The processor is composed of four types of stainless steel tanks, one pre-heater tank, one 1000 L process tank, one condensation tank and one water tank for the vacuum pump.

A heat pump carries out the heating and cooling of the process with the assistance of an electrical heater. The processor is situated on a steel frame to allow easy transportation. The process is run by a Programmable Logic Controller (PLC) that controls the process parameters.



## The Trans-Esterification Process



## RESULTS

In order to have a clear understanding of the general population's attitude towards recycling and general practices related to UFO handling and management, a field survey was directed at citizens. From the analysis of the answers, it was clear that the vast majority of the interviewed (89%) utilizes vegetable oil to cook at home, most commonly, to fry potatoes and other types of food.

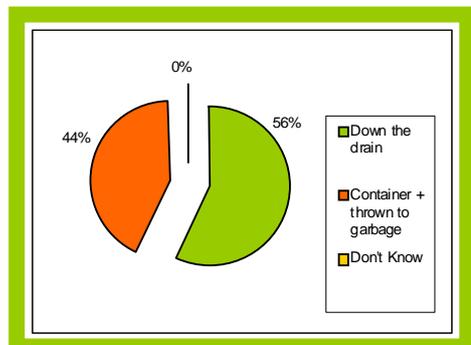
Further, concerning UFO destination, it was possible to realize that the public waste water system is the main target for disposal (56%), though there is also an expressive amount that opts for garbage disposal (44%).

The inquired citizens demonstrated a positive approach to the idea of UFO recycling. An expressive majority was willing to participate in a proposed collection system.

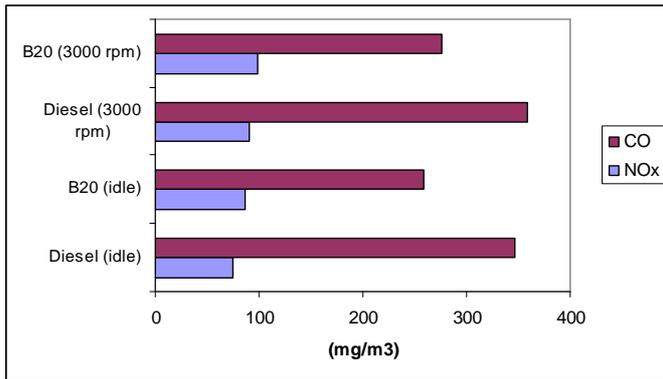
A system to collect and produce biodiesel was designed and put in place. A 1000L biodiesel processor prototype was built and assembled in the selected site. The fill-up monitoring system was designed and was installed in the collection containers. These were designed, built and placed in 20 selected locations of Oeiras Municipality.

Until March 2009 8.340 Kg of UFO was collected with an additional 2.815 Kg collected until end of June 2009, totalling 11.155 kg.

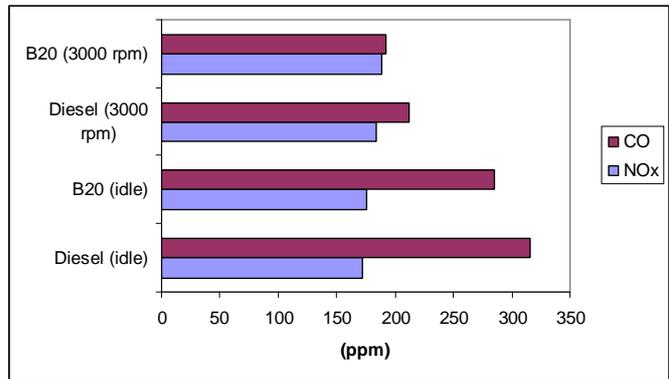
Emissions testing on selected vehicles were carried out. These tests were made with vehicles filled with diesel and with B20 (20% biodiesel incorporated). Results show a decrease in CO emissions and a slight increase in NOx emissions, which is in accordance with



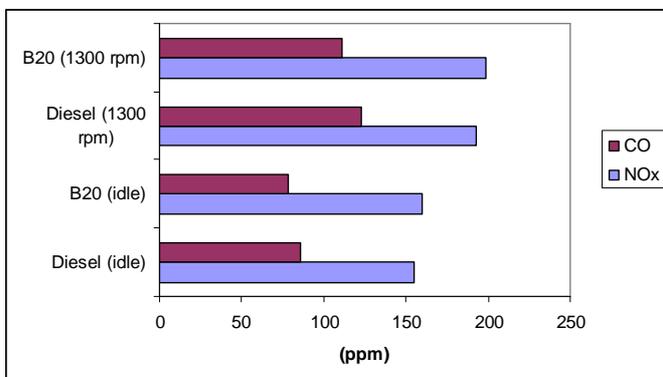
data from literature.



**Emission results - Opel Corsa Eco 1500 Tdi (1997), passenger car**



**Emission results - Toyota Dyna 250-3.5 (1997), light commercial vehicle**



**Emission results - Mercedes 2024 K30 (1997), heavy truck**

## ENVIRONMENTAL IMPACT

The collection of used frying oils (UFO) from the domestic sector has a positive impact in the environment as it avoids deposition of the UFO in landfills or its discharge in the sewer system, the most chosen option before the project. This last option causes many problems in the operation of the wastewater treatment plants causing loss of efficiency and increasing operational costs.

By using the collected UFO to produce biodiesel also brings several benefits to the environment namely by allowing a reduction of CO<sub>2</sub> emissions from the transport sector when it is used to fuel the vehicles. The effect of CO<sub>2</sub> saving is significantly higher when using UFO as feedstock, because here the effects of the agricultural production of vegetable oils has not to be taken into consideration.

The OILPRODIESEL project demonstrated that it is possible to collect the UFO from the domestic sector with success and therefore reduce the environmental impact caused by that waste.

## ECONOMIC AND ENVIRONMENTAL BENEFITS

The direct environmental benefit that this project has contributed for is giving a solution to the UFO produced in the domestic sector that until the project started was sent to the sewer system or to landfills. When sent to the sewer system that causes many problems to wastewater treatment plants (WWTP) operation. Sending it to landfills also cause environmental problems. If all the UFO produced in the domestic sector is adequately collected and transformed in biodiesel, the environmental benefits will be quite large as many problems of the WWTP will be avoided and therefore their efficiencies will increase as well as the quality of the treated water returning to the environment.

The collection of used cooking oils from the households leads to a significant decrease in the maintenance costs of the urban sewage system and sewage treatment plants. Estimations calculate additional maintenance costs of €0.36 per Kg of used frying oil, which is disposed down the drain. This means that in the case of Oeiras, with a collected amount of 11.000 kg used cooking oil during 8 months of the project, the savings are about €4.000. If all the UFO produced in the domestic sector in Oeiras estimated in 619 tons was collected, around 222.000 Euros could be saved.

Transforming the UFO in biodiesel and using it to fuel vehicles has many environmental benefits namely by helping to reduce the CO<sub>2</sub> emissions from transport a major contributor to climate change. The average quantity of diesel consumed in the municipal fleet by year has estimated in 890.000 litres. Using B20 in the fleet would mean that, 178.000 litres less diesel would be burned meaning a cutting of approximately 530 tonnes CO<sub>2</sub> being emitted per year.

Using biodiesel also helps reducing the dependency of oil imports. Operating costs of a fleet can also be reduced as biodiesel is cheaper than diesel.

OILPRODIESEL also had a significant impact in the promotion of job creation at regional level. For example, the company that was chosen for the design and development of the container had a surge of requests from other Municipalities willing to acquire the same containers to install in their regions. This has allowed the creation of a new market niche. Also, the internal modules to monitor the filling level of the containers have been widely presented as a solution both for UFO containers, as well as for containers destined to other collectable materials.

On the long run, a project like this allows the continuing labour of professional workers connected to all the logistics regarding the collection and processing of the raw material.

## TRANSFERABILITY OF PROJECT RESULTS

Project results can be easily transferred to other regions willing to implement a system to collect UFO from the domestic sector. The developed UFO collection system that comprises the UFO collection containers, the fill-up monitoring equipment and the prototype processor have all technical and commercial application after some improvements and adaptations in their design. Actually the UFO collection containers have been improved technically and are being marketed by a Portuguese company, RESOPRE. Several municipalities have already purchased containers. TECMIC has also improved the technical specifications of the fill-up monitoring equipment and is now offering that type of equipment for waste management companies. Regarding the biodiesel processor, AGERATEC since the project started has grown as a company and has now on the market biodiesel processors that are technically more advanced, gaining from their experience with the OILPRODIESEL prototype.

## PARTNERSHIP



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