

Biodiesel Production from Waste Cooking Oil

USEK-IPTEC Partnership 2018



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MOU Signature

The Holy Spirit University of Kaslik (**USEK**) and **IPT Energy Center (IPTEC)**, with the support of the **United Nations Development Programme (UNDP)** in Lebanon signed an MOU to install a pilot plant for the production of biodiesel from Waste Cooking Oil (WCO), on the 16th of July, 2018 at **USEK** campus in Kaslik, in the presence of **USEK** President Father Professor Georges Hobeika, **IPTEC** President Dr. Toni Issa, and the Energy and Environment Programme Manager at **UNDP** Ms. Jihan Seoud.



In his speech, Dr. Issa stated that this project is aligned with the strategy of **IPT** and **IPTEC**, **IPT's** specialized research center in the field of energy, oil and gas. He shed light on the achievements realized by **IPTEC** under the "National Campaign for Air Pollution Reduction in Lebanon through Efficient Energy Use in Land Transportation" launched by the center in 2012 in collaboration with International organizations and several partners in the public and private sectors, which included a number of programs and activities to raise awareness on air pollution reduction and efficient energy use in land transportation. He also announced that this partnership with **USEK** on the production of biodiesel from waste cooking oil is an integral part of the National Campaign that **IPTEC** is still leading. Dr. Issa wished for this project to become a role model in Lebanon, and to deliver tangible results through the effective use of biodiesel as a new source of energy in **USEK** generators and in selected **IPT** stations as a first step. He also promised to ensure its sustainability and development while acknowledging the important role of the **UNDP** in supporting it and providing it with the best prospects for success.

In his intervention, Father Hobeika congratulated Dr. Issa on **IPT's** outstanding activities not only in the sales and promotion of petroleum products but also in preserving the environment and energy sources. He stated that **USEK** was ranked the first green university in Lebanon and among the top ten universities in the Middle East, which reveals **USEK's** commitment to energy conservation and environmental sustainability. **USEK** also received the GAIA International Award for its diligent work in the field of environmental conservation and sustainable development, especially in terms of waste

sorting, the use of solar energy to generate clean energy, and the use of electric vehicles to reduce pollution. He then confirmed the importance of transforming the used cooking oil into a clean energy (biodiesel) especially in light of the growing waste crisis in Lebanon, and wished for this step to be the base for a promising collaboration between the university and the private sector. He concluded on the benefits of this partnership in educating the youth on the preservation of the environment and planet Earth for the sake of future generations.



About the Project

The main objective of this project is to encourage and promote sustainable biodiesel production from WCO by collecting household WCO in storage tanks available at key **IPT** gas stations and at the **USEK** campus, and processing it into biodiesel in a pilot plant installed at the **USEK** campus. The quantity of biodiesel produced will be equally shared between **USEK** and **IPTEC**. **USEK's** share will be mixed with the green diesel currently used in the university generators, while **IPTEC's** share will be sold at selective **IPT** gas stations for commercial use.

The major outputs of this project are to offer biodiesel as an alternative fuel with the same performance as that of conventional diesel, that is ecologically safer and cheaper, raise public awareness about the importance of WCO recycling, reduce the greenhouse gas emissions, upscale the collection, disposal and reuse of waste cooking oil as an alternative fuel, set the technical parameters and specifications for biodiesel from WCO, and promote its use as a clean source of fuel in all sectors while abiding by all national regulations and guidelines in coordination with the **UNDP** and specialized public institutions.

This project will be supported by awareness campaigns and incentives to encourage participation. It follows quality standards and will be assessed for its replicability at the national level in coordination and with the support of the **UNDP**. Moreover, **USEK** and **IPTEC**, supported by **UNDP** and in coordination with concerned public institutions, will lobby for and support the regularization of the use of Biodiesel in Lebanon.

Biodiesel Production Process

Waste Cooking Oils in households and restaurants are being poured into city sewers without knowing the big impact they have on the environment. One Liter of waste cooking oil discharged in sewers can pollute 1 million square meter of sea water.

Through this project, people will now be able to dispose of their cooking oils in WCO Collecting Machines at **IPT** gas stations and **USEK** campus, to be treated in a mini plant for the production of high-quality biodiesel according to the following process:

A Disposal of WCO

- Households and restaurants dispose their WCO in collecting machines installed at **IPT** gas station and **USEK** campus.

B Quality Detection of Disposed WCO

- The machines detect the quality of waste oil poured. Contaminants will be separated automatically and discharged in a waste container and the remaining oil will be collected in a separate tank inside the machines.



C Processing Cycle

- The waste cooking oil collected will then be transported to the mini biodiesel plant located at the **USEK** campus for processing, where three storage tanks are connected to the mini plant; one dedicated for waste oil, one for methanol and one for the catalyst.
- The operator fills the three storage tanks with initial products (oil, alcohol, catalyst) according to the pre-calculated proportions.

After the products are charged to the tank, the operator turns on the transfer pump. The

- pump transfers the mixture to the cavitation reactor where the cavitation processing of the mixture begins.

When the temperature of the mixture reaches the preset

- temperature, the operator turns off the machine and the pumps transfer the processed mixture into the separation tanks.

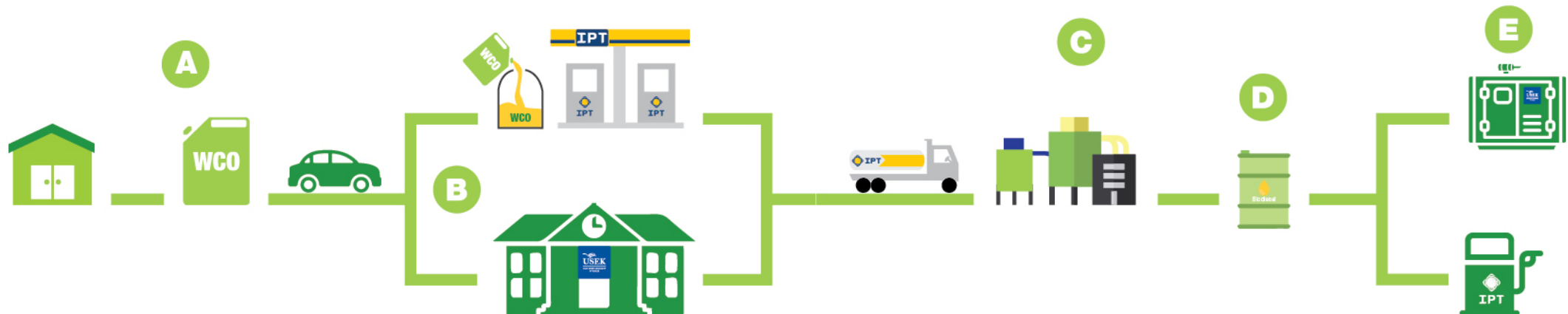


D Separation of Biodiesel and Glycerol

- Depending on the properties of source oil, it takes 30-60 minutes to separate the mixture between biodiesel and glycerol.
- After the separation of biodiesel and glycerol is completed both products are discharged to the storage tanks and the separation tank is ready to receive the next charge of processed mixture.
- The biodiesel produced from this process will be tested in **USEK** laboratories to confirm the quality and usage.

E Biodiesel Usage

- The final product will be used in power generators at the **USEK** campus and will be also available at **IPT** gas stations for commercial use.



What is Biodiesel?

Biodiesel is a renewable and clean burning fuel that is produced from new or waste vegetable oils (such as waste cooking oils), animal fat or recycled restaurant grease for use in diesel engines. It can be used in pure form (named as B100) or can be blended with petroleum diesel in the form of B5 (5% biodiesel, 95% petrol diesel) or B20 (20% biodiesel, 80% petrol diesel). With a blend up to B20 fuel it can be used directly in current diesel engines without any modification required on the engines.

The Benefits of Biodiesel Produced from WCO

Biodiesel produced from WCO has several benefits over petroleum diesel:



Renewable: Biodiesel reduces dependence on finite fossil fuel reserves and provides an alternative energy source.



Biodegradable: Biodiesel degrades faster than petroleum diesel.



Clean and non-toxic: Biodiesel emits less air pollutants, has a less harmful impact on human health, is free of sulfur and aromatics, and reduces GHG emissions.



Safe: Biodiesel is safer to handle, store, and transport because it is less combustible. It causes less damage than petroleum diesel if accidentally spilled or released into the environment.



Efficient: Biodiesel offers a better fuel economy, improves fuel lubricity, prevents against engine wear, reduces maintenance costs and has the same energy efficiency as petroleum diesel.



Affordable: Biodiesel is an affordable option as compared to petroleum diesel.

About USEK



The Holy Spirit University of Kaslik (USEK) is a private Catholic higher education institution founded by the Lebanese Maronite Order (LMO) in 1966. Since its founding, USEK's remit was to provide university teaching, in conformity with the requirements of the labor market and in close association with scientific research. In this regard, USEK has sought new partnerships and collaborations with the industry, in order to diversify its education and to be aligned with the constantly changing professional needs. Additionally, USEK seven engineering programs have earned specialty accreditation by the Engineering Accreditation Commission of ABET, the global accreditor of college and university programs in applied science, computing, engineering, and engineering technology.

About IPTEC



IPT Energy Center (IPTEC) is a specialized research center in Lebanon established by IPT in 2012, committed to carrying out research, studies and scientific programs on energy, oil and gas, as well as organizing awareness campaigns falling under energy conservation and the efficient use of energy, the reduction of environmental pollution resulting from the use of energy sources, and the promotion of the use of clean, alternative and renewable energy solutions. In this framework, IPTEC collaborated with national and international organizations, including the Ministry of Environment, Ministry of Energy and Water, ESCWA and UNDP, in several projects and workshops and contributed to the publishing of a number of studies and reports in its field of expertise.



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