【欧州】【自動車】

Road/Railways - Environmental friendly vehicles: Lisbon bus project uses 100% used cooking oil to replace fossil fuel

Andrea Antolini Former Researcher JTTRI

【概要：Summary】

Heavy-duty vehicles (HDVs), including buses and coaches, will also need to significantly reduce their GHG emissions in order to contribute to the necessary decarbonisation of the EU's transport sector. In order to reduce the heavy-duty vehicles' GHG emissions and other pollution, alternative fuels or propulsion systems are needed. Considering alternative fuels in public transport, the main attention is on replacing buses with internal combustion engines with electric battery or hydrogen based fuel cell buses. However, such a system change to alternative technologies like battery and fuel cell technology usually requires very high investments and further technology development. Furthermore, it is also time-consuming, to plan, order and introduce the necessary new buses and infrastructures.

Therefore, in particular in the public transport, other, less costly viable solutions are considered in the meantime, like the utilization of used cooking oil (UCO) as biofuel for public transport buses. The Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources (RED II) raises the overall EU target for renewable energy sources consumption by 2030 to 32%. The REDII also includes a transport sub-target, requiring the supply of a minimum of 14% of the energy consumed in road and rail transport by 2030 to be based on renewable energy. However, regarding UCO-based biodiesel, while each tonne of UCO derived biodiesel is expected to save almost its entire equivalent in fossil fuel, the EU's REDII limits the amount of UCO biodiesel. The REDII directive does allow the counting of biofuel derived from UCO against the renewable energy target for the transport sector, but it also provides a 1.7% cap on UCO. The reason for this measure is that there could exist a hidden link between UCO and palm oil. The EU has decided to phase out palm oil as recognised biofuel due to the palm oil's high risk of causing indirect land use change (ILUC). In the light of on-going fraud investigations into the practice of mixing palm oil with UCO, the REDII does not distinguish between different types of UCOs. It considers UCO as if feedstocks were used for the production of biofuels. This does not affect the amounts of such fuels consumed in the Member States but it sets a limit of 1.7% on UCO for the counting against the renewable energy target in transport.

However, considering alternative fuels in public transport, the utilisation of UCO could have some importance as a transition solution on the way towards the introduction of zero emission technologies. Promoting the use of advanced biofuels is one of the best ways to ensure a faster and cheaper energy transition, as it is not only using advanced biofuels, based on UCO, but it also offers a method to recycle the UCO.

Therefore, the "Powered by Biodiesel" (Movido a Biodiesel) project of the public transport company

CARRIS and the biofuels' producer PRIO in Portugal's capital Lisbon intends to promote sustainable mobility by using UCO derived biodiesel for the city's public transport buses. This is considered a viable alternative to the more costly introduction of fuel cell or electric buses for the time being.

【記事：Article】

1. Background of the utilization of UCO

In order to meet the long-term GHG emission reduction target as set out in the 2011 Transport White Paper, the CO2 emissions from transport need to be reduced by 60% until 2050, compared to 1990 levels. The transport sector is not included in the EU's Emissions Trading Scheme (EU-ETS) and it is the responsibility of EU Member States to reduce transport emissions through national policies. Individual EU Member States have different available resources and their own unique energy markets. Consequently, they will have different approaches also regarding the meeting of their obligations under the Renewable Energy Directive I and REDII.

Heavy-duty vehicles (HDVs) including trucks, buses and coaches play a significant role for achieving a further reduction of the GHG emissions and other pollutants in the EU's transport sector. Therefore, alternative fuels and propulsion systems are needed that can replace fossil fuels and internal combustion engines. However, vehicles with alternative propulsion technologies such as battery, gas or fuel cell technology usually require also high investment and the set up of an entire charging infrastructure.

Therefore, in short term, in particular the public transport companies are also looking for viable, less costly solutions to reduce their GHG emissions and other pollutants. The utilisation of used cooking oil (UCO) is one alternative to quickly reduce emissions. Biodiesel produced from UCO is considered of having economic and environmental benefits over conventional fuels. In the EU, there exist infrastructure for production and utilisation of biodiesel from waste cooking oil.

2. The Renewable Energy Directive 2009/28/EC and its recast 2018/2001/EU (REDII)

The original Renewable Energy Directive (2009/28/EC) established an overall policy for the production and promotion of energy from renewable sources in the EU. Based on individual national targets, the RED requires the EU to cover at least 20% of its total energy needs with renewables by 2020.

The RED specifies national renewable energy targets for 2020 for each country, taking into account its starting point and overall potential for renewables. The EU Member States planned how to meet these 2020 targets and the general course of their renewable energy policy in their national renewable energy action plans. Furthermore, all EU Member States have to ensure that at least 10% of their transport fuels come from renewable sources by 2020. In November 2016, as part of its "Clean Energy for all Europeans" initiative, the European Commission also adopted a legislative proposal for a recast of the RED. In December 2018, the revised REDII Directive 2018/2001/EU entered into force. The directive aims at helping the EU to meet its emissions reduction commitments under the Paris Agreement, by establishing a new binding renewable energy target for the EU for 2030 of at least 32%. The REDII also contains a clause for a possible upwards revision by 2023.

In RED II, the overall EU target for Renewable Energy Sources consumption by 2030 has been raised to 32%. The REDII also includes a transport sub-target, which requires the EU Member States and the fuel suppliers to supply a minimum of 14% of the energy consumed in road and rail transport by 2030 as renewable energy.

Biofuels used in transport must comply with the REDII's sustainability and GHG emission criteria in order to be counted towards the overall 14% renewable energy target and to be eligible for financial support by public authorities. While some of these criteria are the same as in the original

RED, the REDII introduces new sustainability criteria for forestry feedstocks as well as GHG criteria for solid and gaseous biomass fuels. The REDII sets limits on high indirect land use change (ILUC)-risk biofuels, bio liquids and biomass fuels with a significant expansion in land with high carbon stock. These limits will affect the amount of the fuels that Member States can count towards their national targets when calculating the overall national share of renewables and the share of renewables in transport. EU Member States will still be able to use (and import) fuels covered by these limits, but they will not be able to include the volumes above the set limits when calculating the extent to which they have fulfilled their renewable targets.

Regarding the treatment of UCO in the REDII directive, UCO is not considered waste. It rather is considered as "feedstocks for the production of biofuels and biogas for transport, the contribution of which towards the minimum share established in the first subparagraph of Article 25(1) shall be limited and may be considered to be twice their energy content".

While UCO-based biodiesel save almost its entire equivalent in fossil fuel, the EU's REDII limits the amount of biodiesel made from UCO that can be counted towards renewable energy targets after 2020 in response to concerns of fraud and the environmental impacts. UCO has fraud potential, because there seems to exist a link to palm oil. The UK and the Netherlands have recently launched official investigations into companies, which have allegedly been selling unsustainable biodiesel containing palm oil. Critics suggest that there is a hidden link between UCO and palm oil, as palm oil is often masquerading as UCO through international adulteration. In order to pay tribute to this problem, the REDII does not distinguish between different types of used cooking oils, and does not consider UCO as waste. It rather is considered as feedstocks for the production of biofuels and biogas for transport. According to REDII, Article 27, "Calculation rules with regard to the minimum shares of renewable energy in the transport sector", " … the share of biofuels and biogas produced from the feedstock listed in Part B of Annex IX shall, except for in Cyprus and Malta, be limited to 1,7% of the energy content of transport fuels supplied for consumption or use on the market." Therefore, the RED II directive provides a 1.7% cap on UCO, which applies to the amount of biofuel that can be counted towards the renewable energy targets. However, it does not affect the amounts of such fuels consumed in an individual Member State. Also the 1.7% limit itself is not too concerning as it is expressed in energy content, therefore UCO can amount to 3.4% in the allowed application of double counting in the EU Member States. Member States may also, where justified, modify that limit, taking into account the availability of feedstock.

3. Promoting the utilisation of UCO

Between May 2012 and May 2015, the utilisation of recycled used cooking oil for sustainable biodiesel was also promoted in the EU-supported so-called RecOil project. The budget of the RECOIL project was set at 1.5 Million EUR, out of which the EU contributed 75%. It was estimated that biodiesel produced from UCO could replace 1,5% of the EU27 diesel consumption. RecOil was aimed at increasing the production of sustainable biodiesel production and its local market intake by enhancing the household used cooking oil (UCO) collection and transformation. RecOil assessed the "UCO to biodiesel" chain best practices through a household survey, the industry expertise and local authorities cooperation, to develop an on-line decision-making guide.

Regarding the project's results, the main achievement was the development of an on-line guide for UCO collection, transformation and commercialisation that can be used as a main reference for this sector. This guide includes an implementation methodology and a decision-making support tool for the replication of good practices

throughout Europe. One other major output was the development of pilot projects in promotion, collection, transformation and commercialisation of UCO/Biodiesel. These pilot projects validate the information related to the best practices found and act as living labs for the theoretical concepts collected. They have a strong demonstration effect on local communities and for all stakeholders. Most of these pilots become permanent; it means around of 500 UCO collection points and thousands of UCO litters collected from householders monthly.

Finally, with this project, the biodiesel market is promoted by improving public awareness of the importance of recycling UCO. In some regions the UCO collection increased by more than 120% based on the promotional campaigns developed. The engagement and discussion with stakeholders here referred by them as an opportunity to discuss the sector and share experiences. Regarding the results and lessons learned, UCO collection points should be as numerous as possible, located in busy places or places with high visibility. Facilities in which containers with oil inside can be thrown into are preferred. Furthermore, communication aspects need to be considered about WHAT, HOW and WHERE to deliver UCO. Environmental reasons for recycling shall be made explicit and preferably relating to individual behaviour. It is important for people to know exactly the destination of the UCO. However, UCO collection and processing are affected by uncertainties in the EU and National Energy and Environment policy. The lack of clarity regarding the waste classification and the certification process limits the creation of value chains. Policy makers and the general public are not aware of the problems that occur due to improper disposal of UCO.

4. Lisbon's "Powered by Biodiesel" project

The "Powered by Biodiesel" (Movido a Biodiesel) project is a joint initiative of Lisbon's Public Transport Company CARRIS and PRIO, a leading advanced fuels and biofuels operator in Portugal. CARRIS has joined forces with the PRIO in this project, in order to boost sustainable mobility in Portugal's capital through the use of 100% UCO. In July 2019, the project's first phase was launched with three buses operating between Serafina and the Marquis of Pombal on the 702-bus route in Lisbon. The buses are supplied with a new fuel, especially produced by PRIO from waste cooking oils. The busses run on B100, which is a 100% biodiesel made from UCO. The project's second phase started in December 2019, with all six buses on the route being now in operation with 100% biodiesel from UCO. Thereby, one of Lisbon's main bus routes is now 100% fuelled with PRIO's UCO derived B100 biodiesel. Regarding the consumption cost for UCO derived biodiesel, the CARRIS Company stated that compared to conventional biodiesel, there is only a slight increase in consumption and fuel costs. According to the CARRIS Chairman of the Board of Directors Tiago Farias, the public transport company is making a major effort to renew its fleet, but since this renewal takes some time, transition solutions need to be found. Therefore, CARRIS intends to use this project to achieve two objectives. It intends to explore one more way to reduce the climate impacts of the operation of public transport busses and to use the high visibility of the company in the city of Lisbon to raise awareness of the importance of recycling. Regarding the collection and processing of UCO, the PRIO Company is responsible for collecting the UCO from 600 recycling bins across the country. These bins are cleaner and have larger storage capacity than traditional ones, according to the company. According to PRIO's executive director Emanuel Proença, the company collects UCO from Portugal, but also from other countries in Europe and abroad. The more than 80,000,000 litres of UCO per year is then processed in a factory in the port of Aveiro, in the centre-north of Portugal. According to Proença, this project will make it possible to reduce the majority of CO2 emissions of 83% compared to the traditional fossil fuelled buses without the need to make any changes to vehicle engines. At the same time, by using the UCO derived biodiesel, it is also a way to

recycle and value a residue like UCO that has no alternative use. The recycling saves the ground water from this pollutant.

5. Conclusion

The main advantage of the utilisation of the UCO for replacing the fossil fuels like in case of Lisbon's 702-bus route operation is that fossil fuels can be immediately replaced by UCO biodiesel fuel at no extra capital cost. The buses are the same like those using conventional diesel and do not need any adaptations. An overall assessment of the pilot project will determine whether CARRIS will launch a tender for an acquisition of this type of fuel, turning this operation from an innovation "pilot" project into one of "regular" operations. Meanwhile, CARRIS has also signed a contract for the acquisition of 165 new buses, including the purchase of 125 gas coaches and 30 electric buses by 2021, among others. Since decarbonising transport is an enormous challenge, all available sustainable options should be considered including both, biofuels and electro mobility. The "Powered by Biodiesel" (Movido a Biodiesel) project is also timely, considering that Lisbon has been named Europe's Green Capital for 2020.

References

Carris will acquire 165 new buses. In: https://caetanobus.pt/en/carris-assina-contratos-para-aquisicao-de-165-novos-autocarros/, retrieved 14 January 2020

https://bioplasticsnews.com/2019/08/25/one-third-of-used-cooking-oil-in-europe-is-fraudulent-and-eu-will-limit-usage/, retrieved 10 January 2020

https://bioplasticsnews.com/2019/08/25/one-third-of-used-cooking-oil-in-europe-is-fraudulent-and-eu-will-limit-usage/, retrieved 10 January 2020

Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (Text with EEA relevance.) PE/48/2018/REV/1. In: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC, retrieved 13 January 2020

Directive (EU) 2018/2001 of the European Parliament and of the Council. In: http://www.legislation.gov.uk/eudr/2018/2001/article/27/adoptedv, retrieved 13 January 2020

Michalopoulos, Sarantis: Lisbon bus project uses 100% used cooking oil as fuel. In: https://www.euractiv.com/section/agriculture-food/news/lisbon-bus-project-uses-100-used-cooking-oil-as-fuel/, 10 Jan 2020, retrieved 13 January 2020

Primeira carreira de autocarros movidos a biodiesel avançado já circula em Lisboa In: http://www.carris.pt/pt/noticias/2019/primeira-carreira-de-autocarros-movidos-a-biodiesel-avancado-ja-circula-em-lisboa/, 12.12.2019, retrieved 13 January 2020

Promotion of used cooking oil recycling for sustainable biodiesel production (RECOIL). In: https://ec.europa.eu/energy/intelligent/projects/en/projects/recoil

Renewable energy directive. In: https://ec.europa.eu/energy/en/topics/renewable-energy/renewable-energy-directive/overview, retrieved 13 January 2020

Renewable Energy - Recast to 2030 (RED II). In: https://ec.europa.eu/jrc/en/jec/renewable-energy-recast-2030-red-ii, retrieved 14 January 2020

Q&A: RED II offers flexibility to EU member states. In: https://www.argusmedia.com/en/news/1807212-qa-red-ii-offers-flexibility-to-eu-member-states, 07 December 2018, retrieved 14 January 2020

Sapp, Meghan: Lisbon launches B100 bus routes. In: https://www.biofuelsdigest.com/bdigest/2019/12/12/lisbon-launches-b100-bus-routes/, December 12, 2019, retrieved 14 January 2020