BIKE

BIOFUELS PRODUCTION
AT LOW - ILUC RISK
FOR EUROPEAN SUSTAINABLE
BIOECONOMY

D 6.4

Main findings of the Open Labs

Dissemination level: PU

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Executive summary

This document reports the activities carried out for the BIKE open labs which had to been occurred in the 2nd half of the project. In total four open labs had to been organised (one per case study) to disseminate them. Each open lab had to include half day of presentation of the case study indoors and half day with its presentation on site (outdoors). Each open lab had to incude representatives from agriculture, energy, policy, industry, etc. Each open had a facilitator that had to help the participants to better understand the case study and to discuss it in small groups. The Open Labs had to been organished from M20 to M34: Open Lab 1 for CS 1, Open Lab 2 for CS 2, Open Lab 3 for CS 3, Open Lab 4 for CS 4. Due to COVID-19 crisis the starting month of the open labs was M25 and the concluding one was M34. In the figure below the BIKE value chains are presented; two of them (value type 1) are referring to energy crops cultivation on unused, abandoned or severly degreated lands, while the other two (value chain 2) referring to energy crops cultivated in rotation with conventional crops that increase the yields per land unit through the improved agricultural practices [improved crop management (sowing, soil preparation, fertilisation, etc.); soil carbon increase with biochar, crop rotation; catch crops, improvements in harvest; precision farming techniques, etc].

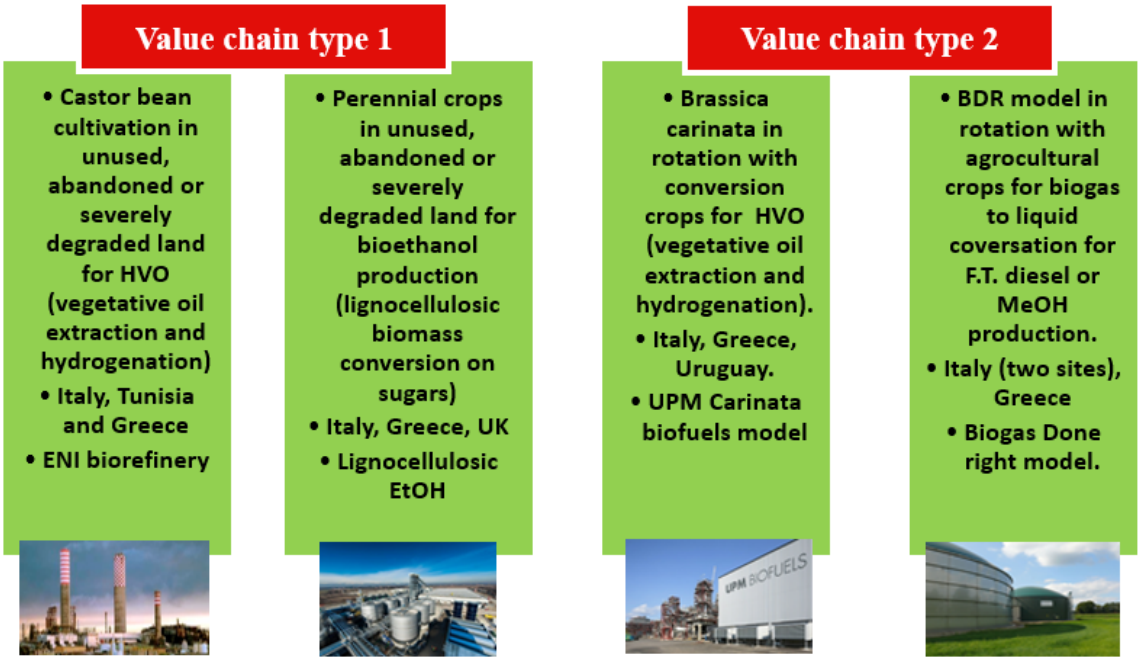

Figure 1: BIKE project identified value chains

This deliverable outline the main activities of each open lab, supported by photo evidence is provided for each of the five Open labs. These took place in the following locations and periods:

- Arborea (Italy) in September 2022 (M25)
- Aliarthos (Greece) in September 2022 (M25)

- Nea Gonia (Greece) in March 2023 (M31)
- Candidoni (Italy) in May 2023 (M33)
- Nagylók and Szabadegyháza (Hungary) in June 2023 (M34)

Open lab n.1 – Arborea (Italy)

On the 6th of September 2022, the BIKE consortium partners gathered in Arborea (Italy) to visit the pilot site of Marrubiu, operated by Eni and Bonifiche Ferraresi Group (BF) through Agri-Energy. Agry Energy is a joint venture between Eni and Bonifiche Ferraresi Group (BF). BF manages in Sardinia a farm of over 1,000 hectares, situated in the province of Oristano. 14 hectares are allocated to test the performances of low-iluc crops for biofuel production, including Castor (7 varieties tested), safflower (3 varieties), camelina (3 varieties), sunflower (2 varieties) and brassica spp. (11 varieties). Improved seeds have been supplied from Brazil (Kaiima) and India (AGF).

Eni identified this target area to develop a field case study to optimize agronomic practices aimed at optimizing the cultivation of drought-resistant crops, such as castor as low-ILUC risk feedstock. Apart from BIKE partners, additional participants had been invited to join this open lab on growing energy crops on abandoned and severely degraded lands. Half of the day was focused on the presentation of the project indoors and the other half on visiting the fields (outdoors).

Here, the cultivation of oil crops is undergoing over 29 fields divided in two parts. The land area considered was not cultivated before and is considered “degraded”. The goal now is to assess the crop performances under irrigation and with just rainfed.

The pilot study contributes to creating know-how on castor bean cultivation on degraded lands. It also promotes sustainable practices for agri-feedstock production and land use. Moreover, it contributes to the territorial regeneration of marginal areas, creating new opportunities for farmers.

Castor oil coming from the castor beans cultivated in this way can be used for the production of Hydrotreated Vegetable Oil, falling in the definition of low-ILUC risk biofuel. These kinds of biofuels are considered by many to be the best available solution to decarbonize aviation and maritime shipping in the short-medium run.

Following the on-site visit to the fields, BIKE partners have gathered to discuss the latest project results and present a general update on the latest activities.

During the open lab a part of castor field was harvested mechanically using a new header that had been developed in Italy for castor bean.

Follow-up

The first cargo of vegetable oil produced by Eni in Kenya departed from the port of Mombasa at the beginning of October 2022, bound for the biorefinery in Gela (Sicily). This marks the start of the transport and logistic system that will support the value chain in the country, starting with a production of 2,500 tons and the involvement of 40000 farmers by the end of 2022. After the

successful startup of the first Agrihub in Makueni (oil production capacity of 15000ton/year), only one year after the signature of the MoU with the Government of Kenya, Eni has started up a second Agrihub in Mombasa in August 2023 (oil production capacity of 55000 ton/year). The Project will reach the full development by involving 200'000 farmers and a production target of 200'000 tonnes by 2030.

The vegetable oil in kenya is currently produced by castor, croton and cotton seeds, food processing residues, as well as from the collection of used cooking oil and animal fats. These are agri-feedstocks, which are not in competition with the food production, cultivated in degraded areas, harvested from spontaneous trees, or resulting from the valorization of agricultural by-products. This activity offers new income opportunities and market access to thousands of farmers. In addition, the agri-hub produces feed and bio-fertilizers, derived from the protein component of the seeds, thus benefitting livestock production and contributing to food security.

This supply chain and all its related agri-feedstocks are certified according to the ISCC-EU (International Sustainability and Carbon Certification) sustainability scheme, one of the main voluntary standards recognized by the European Commission for the certification of biofuels (RED II). Eni was the first company in the world to certify castor and croton and to allow an African cotton mill to reach these certification standards, offering new market opportunities to local farmers.

In June 2022, ISCC conducted an audit round in Kenya to guarantee the full compliance with the low-ILUC risk certification scheme, the one developed within the BIKE project.

The development of renewable energy, bioenergy and biofuels play a key role in the energy transition path. To achieve carbon neutrality by 2050 - the goal of Eni's strategy - it is necessary to develop increasingly sustainable products including biofuels, and to increase the use of technologies that produce cleaner energy.

In this context, Eni has developed a unique model of vertical integration of agribusiness into the biofuel value chain, to secure volumes of high quality vegetable oils for the biorefineries to produce lower emission biofuels at a competitive cost.

Pictures of the Open lab #1


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BIKE
Open Lab - Sardinia
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Open lab n.2 – Aliartos (Greece)

On 29th of September 2022, the 2nd open lab was organished in one of sites of CRES field trials. This open lab followed the BIKE technical meeting that took place on 28th of September 2022 in Athens. The open lab participants visited CRES fields in Aliartos/Greece (130 km north of Athens). The field site considered as marginal and three perennial grasses had been compared for more than a decade as well as annual lignocellulosic crops like hemp, sunn hemp, kenaf and oilseeds like castor bean, camelina and crambe. The fields of the perennial grasses had been established in the view of OPTIMA project (2011-15) focuses on growing perennial grasses (miscanthus, switchgrass, giant reed) on marginal lands. For these crops different cultural practices had been compared; irrigation and fertilization rates, plant densities, sowing dates, establishment methods, harvesting dates, tillage and reduced tillage cultivation options. Giant reed and miscanthus had been established by rhizomes (0.3 ha each), while switchgrass had been established by seeds (two lowland varieties; Kanlow and Alamo, 0.5 ha). Among the three grasses compared the most productive was giant reed (mean yields of 20 t/ha dry matter), while switchgrass and miscanthus gave quite similar yields (mean yields of 14 to 16 t/ha dry matter). It was found that giant reed and miscanthus are dependent to irrigation, while switchgrass could develop well with even 50% less irrigation. The trials are still on-going.

In the same area the participants had the opportunity to visit a castor bean trial, where four high yielding hybrids were compared (imported from KAIIMA company). At the time of the visit the majority of the racemes were mature and the field was ready for the final harvest that took place the day after the open lab. The hybrids tested are short ones, producing high number of racemes per plant and having high seed yields (<3 t/ha). The plantation was not sprayed with herbicide to stop the crop grow and it was left to mature physically. Thus, at the end of September some racemes per crop were still green.

Nearby two fields of annual fibre crops had been carried out; one for industrial hemp and the second for kenaf. In both trials two high yielding varieties had been compared under four irrigation rates (0, 25, 50 & 100% of PET) and three nitrogen fertilization rates (0, 60 and 120 kg N/ha). It was found that the plots that didn't irrigated were empty of plants and the biomass yields was increased when the irrigation and fertilization rates were also increased. Between the two factor (irrigation and fertilization) it was found that irrigation was the one that affected more the growth and yields. The biomass yields of hemp in this site was 15t/ha, while for kenaf was 22 t/ha.

Finally, the participants were able to visit a field trial where sunn hemp was grown after a winter cereal as double cropping. Sun hemp is a promising biomass crop that should be sown in spring and harvested in autumn. In the case of this trial sunn hemp was sown after the harvesting of durum wheat that harvested in mid-June 2022. Due to late sowing (2nd part of June) irrigation was necessary for the good establishment of the crop. The final harvest of sunn hemp had been scheduled for late October 2022 and the yields of durum wheat was 6 t/ha seeds (plus 5 t/ha straw) and for sunn was 13 t/ha dry matter yields.

Pictures of the Open lab #2

Open lab n.3 – Thessaloniki (Greece)

On the 31st of March 2023, the third Open lab of the BIKE project took place, in the proximity of the Greek city of Thessaloniki. This open lab followed a workshop on low ILUC feedstock that took place in Thessaloniki. In this workshop several EU projects had been invited to join (GOLD, CERESIS, PHY2CLIMATE, MAGIC, MIDAS, MARGIN UP, FORTE, BIO4A, etc.).

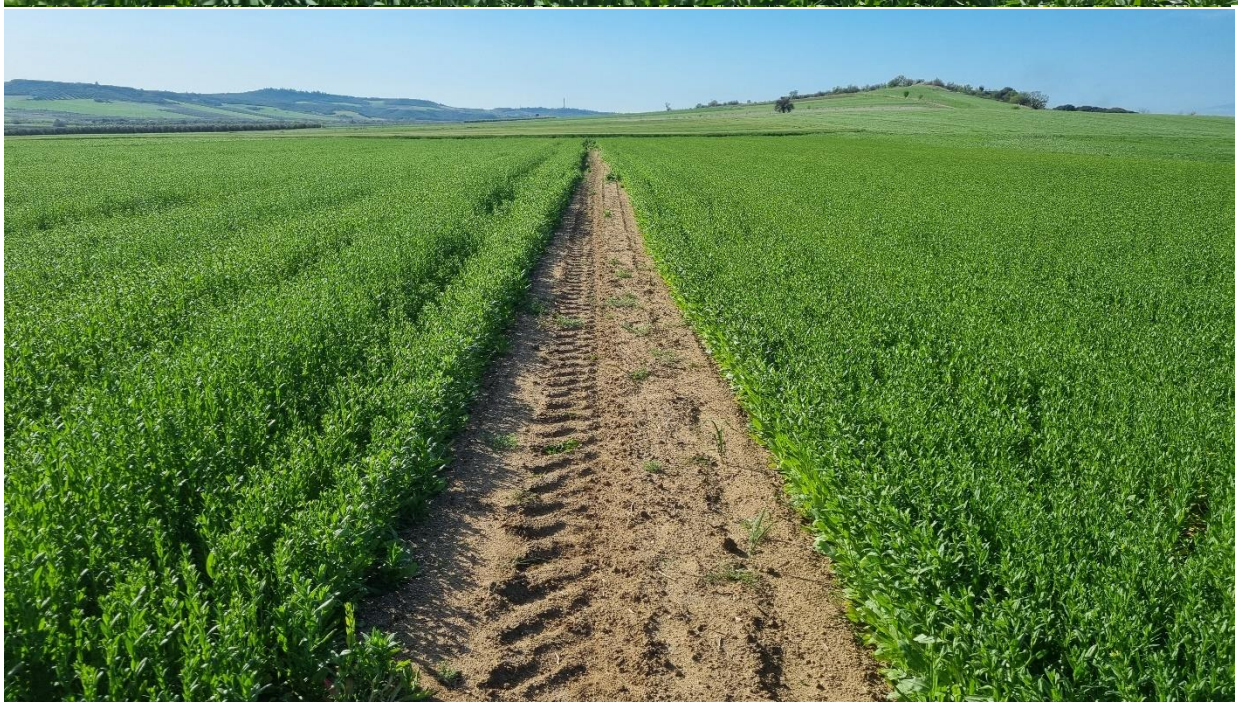
Here, project partners and other external guests who participated in the workshop "Production of Low-ILUC risk biomass feedstock", visited to distinct fields in the countryside north-east of Thessaloniki.

Here, the BIKE partner CRES (Centre for Renewable Energy Sources and Saving) is testing the cultivation of Camelina as a sequential crop, in rotation with sunflower, on lands considered to be Both marginal and typical agricultural lands. In total three sites had been established; the first site was devoted to camelina (where two plant densities had been compared and two swing dates), the second on camelina and carinata on a slope marginal site and the 3rd on camelina, carinata, sunflower. The sowing in the 1st site was done in winter 2022-23, while in the other two was done in the beginning of March 2023. The final harvest of the 1st site was done at the end of May 2023 and thereafter sunflower was sown using a a no-till sowing technique

This will help to retain a certain amount of soil moisture and will help to increase the soil organic matter in the field.

When the 2nd the 3rd site had been visited the crops were quite small. Despite the late sowing in these sites the plants developed quite well and the final harvest of them had been carried out in mid-June 2023 (camelina and carinata). The seed yields of camelina were 1.5 t/ha, while for carinata was > 2t/ha. It should be pointed out that several pests and diseases had been recorded in carinata fields and where similar to the ones recorded in the typical rapeseed fields, while the camelina fields were totally free of pest and diseases.

Pictures of the Open lab #3



Open lab n.4 – Candidoni (Italy)

On the 11th of May 2023, BIKE partners visited a farm in southern Italy, during the last Open Lab of the Project. The visited farm was "Fattoria Della Piana", an interesting and promising example of Biogas Done Right model, based on the implementation of circular and sustainable agricultural practices, producing sustainable, low ILUC biogas, that should guide the green transition.
Fattoria della Piana is the biggest farm in Reggio Calabria (in Candidoni city) and one of the biggest in the south of Italy and still growing. A growth that is obtained respecting the environment and turning waste into resources.

The farm has a biogas plant of 998 kW/h fed with agricultural by-products, manure and sequential crops following the principle of the BDR and Farming for Future models.
The organic fertilizer (digestate) gives back to the land all the nutritional elements that are needed to grow high quality fodder. They produce more energy than they consume, reducing their environmental impact thanks also to photovoltaic power plants installed over the stable roofs.

The farm acquired 103 hectares of abandoned land in 2012. The soil type is clay and the surface had low organic content and had suffered from progressive desertification. It had been abandoned due to low productivity of mixed hay cultivation. Thanks to the use of digestate over the last 9 years it has had progressively higher organic matter in the soil and as a result, higher productivity. Indeed, now they are able to cultivate Corn as primary crop and grain as secondary crops in those lands.

Their main barn has 900 cows, and they collect sheep and cow milk from 90 smaller stables. Every year the farm transforms 3 million litres of sheep milk and 3 million litres of cow milk.
Fattoria della Piana is member of CIB, the Italian Biogas Consortium, and it was selected as a case study for the purposes of the BIKE project. Here a virtuous system is effectively in place, where an abandoned land has been rendered fertile again, making it available for cultivating new crops, without causing no land displacement.

During the visit, stakeholders were trained by the farm owners and experts about the daily practices adopted by the farm. In fact, the main target of the farm is not the biofuels sector, but the production of food, in particular milk. Participants could better understand how a farmer, food producer, duly supported by the institutions and with a well-organized system, can integrate its business and become also a producer of sustainable, low Iluc risk biofuel.

Pictures of the Open lab #4


Fattoria
DELLA PIANA

Open lab n.5 – Nagylók and Szabadegyháza (Hungary)

On 13th June 2023, the Hungarian BIKE Partners (AKI Nonprofit Ltd. in partnership with Discovery Center Nonprofit Ltd.) organized a national BIKE Open Lab in Hungary (in Nagylók and Szabadegyháza). The theme of the Open Lab was to showcase "Opportunities and good practices for sustainable biomass production and processing". The event took place in two consecutive stations of the biofuel value chain with the first phase on a farm and the second phase in a bioethanol factory and attracted stakeholders from across the entire biofuel value chain (including farmers, policymakers, scientists, and other market players).

The programme was opened by Katalin Rácz, Research Director of AKI Nonprofit Ltd., who highlighted the importance of cooperation between the different value chain actors in research as well as the need for environmental, social and economic sustainability. The Hungarian BIKE team's first presentation was given by Csilla Óvári (AKI) on the "National targets and opportunities in biomass and renewable energy production" where she detailed the legislative requirements and environmental challenges producers are facing currently. Dr. Katalin Mozsgai (AKI) backed up her presentation next, by showcasing "Results of the BIKE project and its technical recommendations for sustainable biomass production".

In her presentation, she discussed the potential of new agricultural crop species identified in the project, the opportunities for obtaining low-ILUC risk (Indirect Land Use Change) certification, and the additionality measures that are required for obtaining the certification. To give practical examples of low-ILUC risk production methods, Péter Prescher (Feri Mezőgazdasági Bt.) together with Dr. Vince Láng (Discovery Ltd.) showcased the success of precision farming techniques and no-till farming as additionality measures. Besides increased yields, they also demonstrated how these measures had positive impacts on soil health.

Afterward, the participants visited the Hungrana Starch and Isosugar Manufacturing and Trading Ltd. (Hungrana Kft.) company site where Izabella Bakó, ISCC auditor (Bureau Veritas Magyarország Kft.) presented how ISCC certifies farmers under the International Sustainability and Carbon Certification Scheme (ISCC-EU) sustainability criteria – highlighting special information for farmers on the audit process. Finally, Dr. Szabolcs Magyar and Krisztián Juhász, technical and production directors of Hungrana Kft. presented the company's various production processes from corn as feedstock to native corn starch, sugar products, and bioethanol, a dehydrated alcohol specifically used in fuels.

Bioethanol produced by Hungrana Kft. has a GHG emission savings rate of well above the EU average, over 80% compared to motor gasoline, making it increasingly preferred on the European market. The event ended with a guided tour of the factory, where the participants were able to see the production facilities in operation as well as some of the products.

Pictures of the Open lab #5


HUNGRANA


HUNGRANA

Conclusions and findings

The organisation of the open labs was quite successfully and included all BIKE case studies. In total five open labs were organised (two in Italy, two in Greece and one in Hungary) instead of four initially planned. In total more than 100 participants joined the BIKE open lands. In all cases the open labs had indoors and outdoors sessions (half day each). In all labs, material was distributed to the participants and several questions had been raised during them.

All in all, the 1st Open Lab focused on growing oilseeds like castor bean on marginal lands, the 2nd on growing perennial grasses on marginal lands, the 3rd on growing selected oilseeds like carinata and camelina in rotation with conventional crops on typical agricultural lands following specific cultivation protocol to increase the biomass productivity per land unit, and the 4th on the biogas done right model. The 5th open lab, organized by AKI, in Hungary, addressed the application of low ILUC practices and the refinery process of bioethanol value chain.

The Open labs enabled invited stakeholders, and industrial partners, to understand the state of development, as well as the critical aspects of low ILUC risk case studies identified by BIKE project. Participants could observe the cultivation yield of castor and of perennial crops in degraded lands and have clear information about the potentials and the limits of mechanical harvesting systems. Moreover, stakeholders had the opportunity to better understand the risks and the benefits related to the cultivation of cover crops, such as Brassica Carinata, in Mediterranean areas. Finally, the visits to existing ongoing biofuels production facilities, such as the Biogas plant in Italy, and the Bioethanol facility in Hungary, put in evidence the technology readiness level and the industrial perspectives of Low ILUC risk biofuels in the European energy mix.