Sustainability assessment: Ukrainian Case Study

Marco Colangeli

Programme Adviser

Food and Agriculture Organization of the United Nations

Tuesday, 27 November 2018

FAO Headquarters

Rome, Italy

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

FORBIO

FULL RESULTS AVAILABLE: HTTPS://FORBIO-PROJECT.EU/DOCUMENTS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

AIR QUALITY (GHG + NON-GHG Emissions)

In the baseline scenario the reference fuel used is petrol. The emission intensity of European petrol is 83.3 gCO2eq/MJ (Biograce, 2014).

The PROESA technology foresees the use of by- and co-products of the ethanol value chain and thus an allocation among the various products was performed (energy content).

The 16,720 ha available in the *target area* would be enough to produce some 33,440 tons of lignocellulosic ethanol and generate 87 GWh of electricity in excess to what is used in the processing stages.

Ethanol: 74 percent
Surplus electricity: 26 percent

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

AIR QUALITY (GHG + NON-GHG Emissions)

Information related to processing stage are based on the model biorefinery of Crescentino, Italy.

This plant relies on off-site production of enzymes and yeast.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

AIR QUALITY (GHG + NON-GHG Emissions)

Baseline: petrol

Emission intensity of petrol: 83.3 gCO_2eq/MJ (Source: BioGrace, 2014).

Target: lignocellulosic ethanol from willow

Emission intensity of lignocellulosic ethanol (allocated results): 36.10 gCO_2eq/MJ

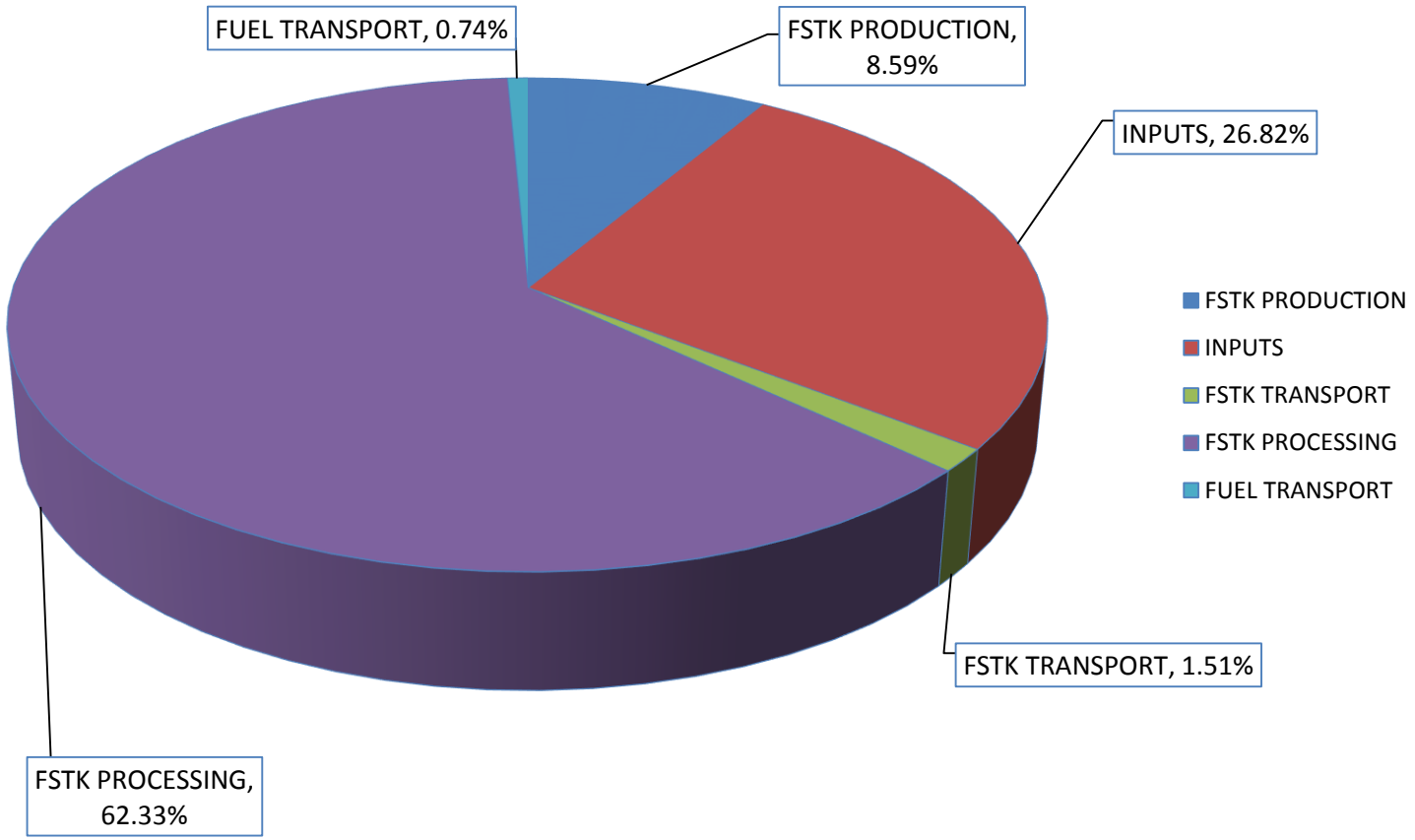
Emission reduction compared to baseline: 56.67%

Avoided emissions: 42,319 tons CO_2eq per year

On-site enzymes production would diminish of a further 22.4 gCO_2eq/MJ the carbon intensity of the bioethanol, resulting in a reduction of about 83% when compared to baseline.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

AIR QUALITY (GHG + NON-GHG Emissions)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

SOIL QUALITY

In baseline conditions, the area is covered by grasslands and these systems in low productivity, marginal areas tend to be in equilibrium in terms of SOC.

The target scenario foresees the cultivation of willow, a perennial deciduous tree crop which is harvested in winter, when the plants have shed their leaves.

In this scenario no organic fertilization (e.g. manure) is performed and thus the SOC balance is only affected by the natural removal and the inputs from the debris represented by the above and below ground biomass.

It was estimated that willow cultivation returns about 5,600 kg of biomass (mostly leaves and chips from the harvesting operation) per ha are left in the field at every harvest, which equals to some 1,867 kg per year. In total, the system has the potential to accumulate up to 314 kg of SOM per ha each year.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

LAND TENURE

Sustainability risks exist for this indicator in the case of Ukraine. The land tenure structure of the *target area* is rather complex and still under development.

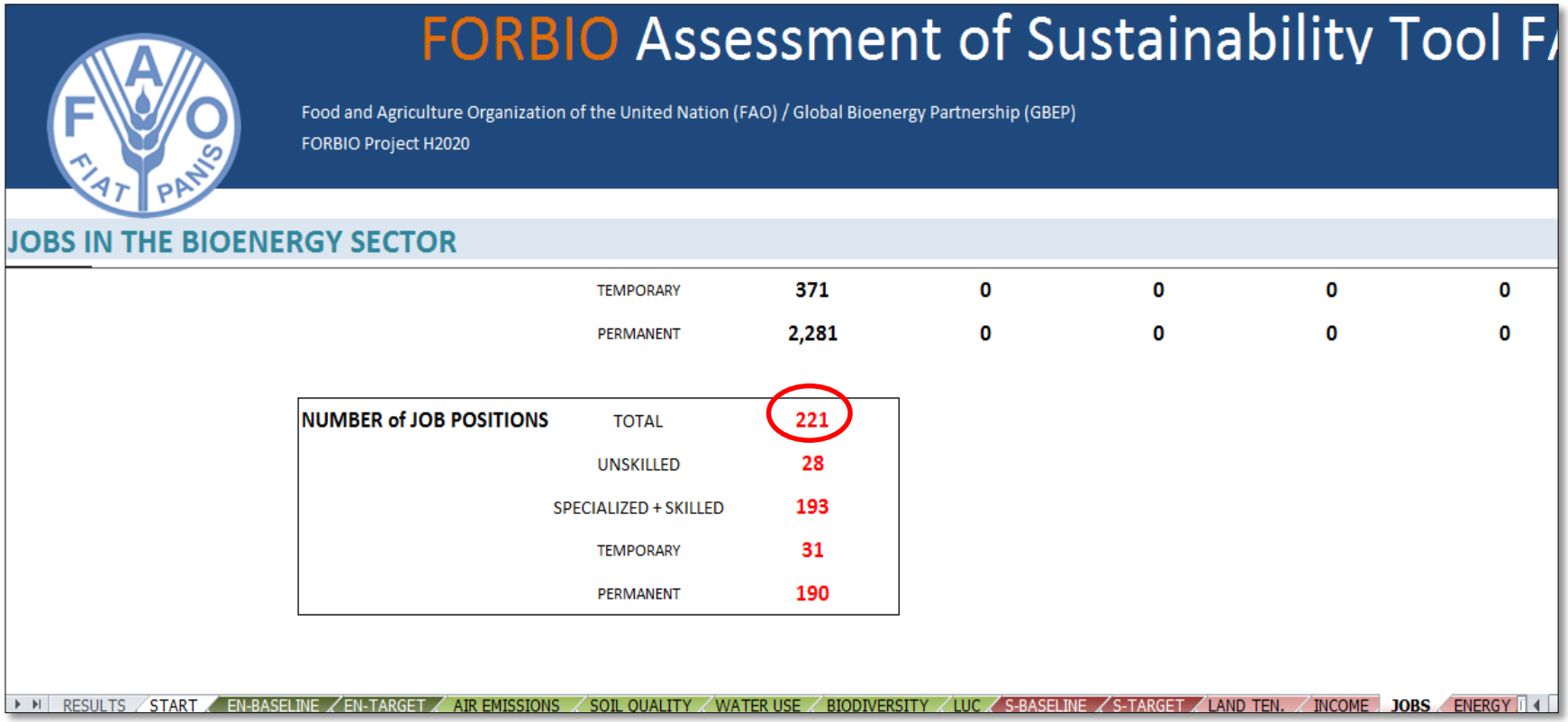
After the collapse of the former USSR, agriculture in Ukraine has been dominated by large extension of land owned by private entities, mainly agri-holdings.

Large surfaces of less productive and wanted land remained property of the central government and are normally given under concession through a system of permits. The structure of tenure rights is not dynamic and permits are issued by the government with a special procedure.

The aforementioned complexity highlighted the risk in Ukraine that marginal lands of interest for the production of biomass may remain underutilized because of the difficulties for small farmers to i. obtain a permit; or ii. to be identified as the land owner.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

JOBS IN THE BIOENERGY SECTOR



FORBIO Assessment of Sustainability Tool F

Food and Agriculture Organization of the United Nation (FAO) / Global Bioenergy Partnership (GBEP)

FORBIO Project H2020

JOBS IN THE BIOENERGY SECTOR

TEMPORARY	371	0	0	0	0
PERMANENT	2,281	0	0	0	0

NUMBER of JOB POSITIONS		
	TOTAL	221
	UNSKILLED	28
	SPECIALIZED + SKILLED	193
	TEMPORARY	31
	PERMANENT	190

RESULTS | START | EN-BASELINE | EN-TARGET | AIR EMISSIONS | SOIL QUALITY | WATER USE | BIODIVERSITY | LUC | S-BASELINE | S-TARGET | LAND TEN. | INCOME | JOBS | ENERGY

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

INCOME

According to the Deliverable 2.6 (techno-economic assessment), production cost of willow SRC in the case study location is EUR 28.7 per ton of biomass delivered at the biorefinery gate. Biomass transport costs represent a contribution of EUR 3.5/t. Considering an average yield of 10 t ha-1 yr-1, the landowner fee was calculated at EUR 1.3/t or EUR 13/ha.

Assuming that all field operations are carried out by third party actors, the income for an average farm (90 ha) owner in the Ivankiev Region would be EUR 1,170/year.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

PRODUCTIVITY

This indicator includes several aspects: biomass yield, fuel yield, production cost.

The estimate of production cost was performed through a number of calculations and data obtained both from direct communication with Biochemtex and information found in the specialized literature.

CAPEX:

EUR 125,000,000 for a 33,440 t/year biorefinery (Crescentino, Italy)

OPEX

Feedstock expenditure: EUR 4,681,000 per year

Enzymes, yeast, catalysts, other inputs: EUR EUR 10,790,000 per year (E4tech, 2017)

Salaries: EUR 2,952,000 per year

Miscellaneous: EUR 1,200,000 per year

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

PRODUCTIVITY

In total the production cost of lignocellulosic ethanol was calculated to be EUR 720 per ton.

This value calculated in the real case scenario of FORBIO was compared to values found in literature. According to E4TECH (2017), lignocellulosic ethanol production costs in Europe range between EUR 940 and 1,010 per ton.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

GROSS VALUE ADDED

At current market prices, sales of ethanol would generate some 17,835,600 EUR/year.

At the current price of electricity for large scale biomass-fueled power plants of EUR 123.9/MWh as per Article 20 of Law "On Heat Energy Supply", (2018) revenues for the generation of 87 GWh of renewable electricity would account to EUR 10,779,300 per year for the next 20 years.

The generation of heat to serve 28,030 households in the country would deliver additional EUR 4,905,252/year

Total revenues for a 33,400 t/year biorefinery at current market conditions would then be EUR 33,520,000 per year.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

GROSS VALUE ADDED

Being, the total production cost of lignocellulosic ethanol in Ukraine would be 720 EUR/t or 24,048,000 EUR/year

Thus, given the current market conditions, the Gross Value Added of a second generation biorefinery would be positive by some EUR 9,457,000 per year

Ethanol price volatility though is a key parameter but in this case the favourable market and incentive conditions for electricity and heat generated make the GVA of this advanced biofuel value chain sustainable.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

Thank you

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.