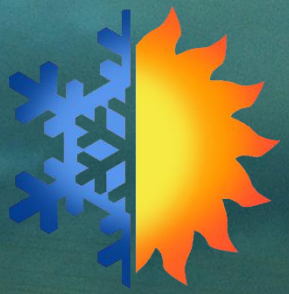
Bioenergy Simulator

7th IRENA Assembly
January 13th, 2017

Global Atlas FOR RENEWABLE ENERGY

IRENA
International Renewable Energy Agency



GBEP
Global Bioenergy Partnership

Data sources

GAEZ
Global Agro-Ecological Zones

WORLD RESOURCES INSTITUTE

OAK RIDGE
National Laboratory

OpenStreetMap
The Free Wiki World Map

protectedplanet.net

Implementation partner

Masdar INSTITUTE

ValBiom
valorisation de la biomasse asbl

Technical and financial support

Background

- **4 potential sources**
  - **Crops** – highlighting 14 common bioenergy crops
  - **Agricultural residues** – encompassing 30 different residues
  - **Livestock waste** – covering 9 specific waste types
  - **Forest plantations** – including 52 tree species

- **25 production processes**
  - 6 types of biofuels among liquid, solid and gaseous fuels
  - 19 different bioenergy conversion technologies

- **3 energy uses** - transport, heating, electricity

Starting the simultation

In partnership with:
Masdar INSTITUTE

Area selection

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International Renewable Energy Agency

Define the Area 1 | Define the Process 2 | See Results 3

Global Atlas
FOR RENEWABLE ENERGY

PREVIOUS NEXT

Start | Crops | Agricultural Residues | Livestock Waste | Forest Plantations

Source selection

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Define the Area 1 | Define the Process 2 | See Results 3

Global Atlas
FOR RENEWABLE ENERGY

AGRICULTURAL RESIDUES DATA

Selected Area (ha)

23

Crop

Sunflower

Average crop yield (t/ha)

Select a value: Default - Rain-fed condition

☐	High inputs	2.8
☑	Intermediat...	1.2
☐	Low inputs	0.4

Residue

Stover

Moisture content (%)

Default: ☑ 0

Residue to product ratio

Default: ☑ 2

Utilization of agricultural residues for bioenergy uses (%)

Default: ☐ 70

Warning

The selected area contains

- **Areas that are protected.**
  (World database of Protected Areas - UNEP-WCMC)

Information

The selected area contains

- **Maximum value of population density of 392 people per km²**
  (LandScan 2014 Global Population Database - Oak Ridge National Laboratory)

TECHNOLOGY

Bioenergy end-use

PREVIOUS NEXT

Start | Crops | Agricultural Residues | Livestock Waste | Forest Plantations

End-use and technology selection

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Define the Area 1 | Define the Process 2 | See Results 3

Global Atlas FOR RENEWABLE ENERGY

TECHNOLOGY

Bioenergy end-use

Heat & power

Bioenergy conversion technology

Biomethane chp - gas turbine

Overall energy efficiency of the selected technology

Overall electrical efficiency

Default: ☑ 0.35

Overall thermal efficiency

Default: ☑ 0.45

TECHNOLOGY INFORMATION

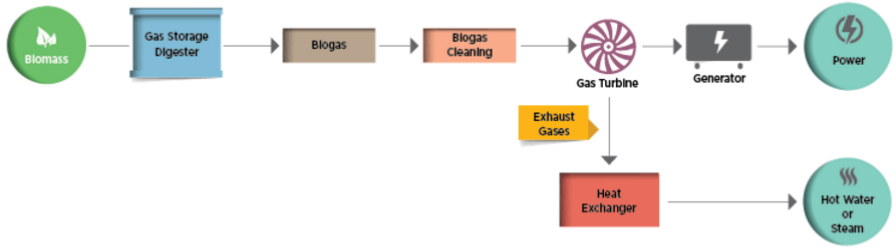
Biofuel used

Biogas is a mixture of primarily biomethane (CH4) and carbon dioxide (CO2). It is produced by bacteria through anaerobic digestion of organic wastes (e.g. sewage, manure, food wastes, landfill). The remaining non-digestible solids are collected as sludge which can be valuable as fertiliser in agriculture. The biogas can be treated and purified to become natural gas or biomethane.

Bioenergy conversion technology

Anaerobic digestion is a process which takes place in almost any biological material that is decomposing and is favoured by warm, wet and airless conditions. The resulting gas consists mainly of methane and carbon dioxide and is referred to as biogas. The biogas can be used, after clean-up, in internal combustion engines, micro-turbines, gas turbines, fuel cells and stirling engines or it can be upgraded to biomethane for distribution. Combined heat and power (CHP) or cogeneration is a technology used to improve energy efficiency through the generation of heat and power in the same plant, using a gas turbine with heat recovery.

PROCESS SCHEME



PREVIOUS NEXT

Start | Crops | Agricultural Residues | Livestock Waste | Forest Plantations

Final results

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Define the Area 1 | Define the Process 2 | See Results 3

Global Atlas
FOR RENEWABLE ENERGY

SUMMARY OF THE SELECTED BIOENERGY SUPPLY CHAIN

Type of crop: Sunflower
Biomass feedstock: Sunflower Stover
Biofuel produced: Biomethane
Bioenergy conversion technology: Biomethane chp - gas turbine
Bioenergy end-use: Heat & power

RESULTS

Land area: 23 ha
Crop average yield: 1.2 t/ha
Total crop production: 27.6 t
Total agricultural residues for bioenergy: 38.64 t
Biomethane yield: 235.2 m^3/ha
Biomethane total production: 5,409.6 m^3
Bioenergy yield: 8.42 GJ/ha
Total bioenergy production: 193.664 GJ
Gross electricity production: 18.979 MWh
Gross heat production: 24.402 MWh

POSSIBLE APPLICATION OF THE POTENTIAL BIOENERGY PRODUCTION

Considering that the average annual electricity consumption in France is 7.3 MWh per capita (The World Bank, 2010 - 2013), the estimated electricity production could supply n. 3 person(s)/year.

INFORMATION

The results obtained from default values should be carefully interpreted and it is important to keep in mind the objective of the simulation is to understand the potential bioenergy production for a given area, biomass and associated technologies.

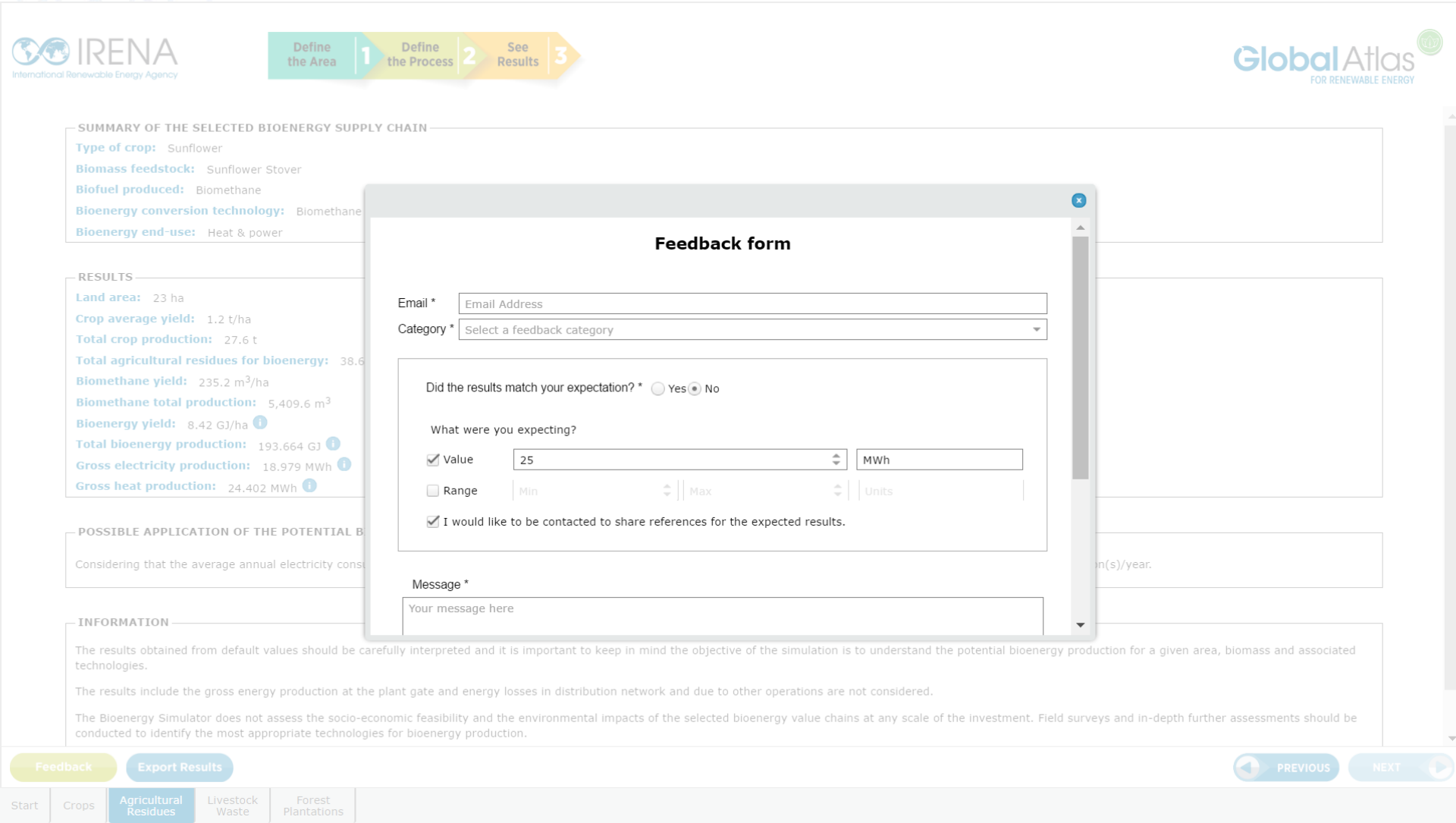
The results include the gross energy production at the plant gate and energy losses in distribution network and due to other operations are not considered.

The Bioenergy Simulator does not assess the socio-economic feasibility and the environmental impacts of the selected bioenergy value chains at any scale of the investment. Field surveys and in-depth further assessments should be conducted to identify the most appropriate technologies for bioenergy production.

Feedback | Export Results | PREVIOUS | NEXT

Start | Crops | Agricultural Residues | Livestock Waste | Forest Plantations

Feedback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Feedback
Export Results
PREVIOUS
NEXT
Start
Crops
Agricultural Residues
Livestock Waste
Forest Plantations
Feedback form
Email *
Email Address
Category *
Select a feedback category
Did the results match your expectation? * Yes No
What were you expecting?
Value
25
MWh
Range
Min
Max
Units
I would like to be contacted to share references for the expected results.
Message *
Your message here

Explore the bioenergy simulator

http://irena.masdar.ac.ae/bioenergy

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