

IdeaLab Co-Adapt + UA Modeling of biomass use as a circular resource in residential areas

> Co-Adapt **Communities For Climate Change Action**

# User manual for the software «ORGANIC WASTE ENERGY PRODUCTION SYSTEM»

Welcome to the user manual for the Organic Waste Energy Production System software. This program allows you to predict the functional, economic and environmental performance of bioenergy production systems from organic waste. The manual will help you to use the software effectively.

## Navigate through the pages

## 1. Welcome

On the Welcome page, you will see three buttons:

- Start: Start working with the program.
- Close: Close the program.
- Info: View more information about the program.

Welcome	Welcome to the Organic Waste Energy Braduction System
Initial Data	
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Functional Metrics	
Cost Metrics	
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• To get started, click on the "Start" button.

# 2. Initial Data

The Initial Data page allows you to enter the initial data for calculations. This page contains the following elements:

Fields and sliders for entering data:

• Characteristics of the residential area:



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- Settlement Type: select the type of settlement (city, village, township).
- Income level of the population: select the income level of the population (low, medium, high).
- Residential Area, m<sup>2</sup>: the area of the residential zone in square meters.
- Number of households, units: number of households.
- Number of inhabitants, persons: number of inhabitants.
- Select Organic Waste Source:
- Select Organic Waste Source: food waste (FW), yard waste (YW), mixed food and yard waste (FYW), mixed organic waste (MOW).
- Average daily volumes of organic waste per inhabitant, kg/person: average daily volumes of organic waste per person (slider from 0.10 to 0.60 kg/person).

Buttons:

- Save data: Save the entered data.
- Clear data: Clear all data entry fields.
- Go to forecasting process: Go to the forecasting process.

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Welcome	Welcome Initial Data Organic Waste Forecast Functional Metrics Cost Metrics												
	Characteristics of the residential area:												
Initial Data	In the blab big organic Wate Forecast Functional Metrics Cost Metrics          Characteristics of the residential area:         Settlement Type:         city village township         Income level of the population:         low       medium       high         Residential         Area, m*:       950       households, 20       Number of inhabitants, 62         Plants in the Area       Select Organic Waste Source:         * food waste (FW)       r yard waste (YW)       r mixed food and yard waste (FYW)       mixed organic waste (MOW)         Average daily volumes of organic waste per inhabitant, kg/person:       0.20       0.20       0.25       0.30       0.35       0.40       0.45       0.50       0.55       0.60         Save data       Clear data       Go to forecasting process												
Organic Waste Forecast	city village township												
Functional Metrics	Income level of the population:												
Cost Metrics	Residential and Number of Number of Number of												
	Area, m <sup>a</sup> : 930 nousenoids, 20 innabitants, 62 nunits: persons:												
	₽ Plants in the Area												
	Select Organic Waste Source:												
	IF food waste (FW) □ yard waste (YW) □ mixed food and yard waste (FYW) □ mixed organic waste (MOW)												
	Average daily volumes of organic waste per inhabitant, kg/person:												
	0.10 0.15 0.20 0.25 0.30 0.35 0.40 0.45 0.50 0.55 0.60												
	Save data Clear data Go to forecasting process												

After entering the initial data into the individual fields and sliders, click the "Save data" button to save them. If necessary, you can clear all the fields by clicking on the "Clear data" button, or go to the next page by clicking on the "Go to forecasting process" button.

#### **3. Organic Waste Forecast**

On the Organic Waste Forecast page, you can forecast the generation of organic waste. Here you will find the following elements:

Buttons:

- Calculate Forecast: Calculate the forecast.
- Graphs: View forecast graphs.
- Clear forecast: Clear forecast results.
- Go to proceed to Function: Go to proceed to functional metrics.

Table with forecast results:

- Month: Month of the forecast.
- Volume of organic waste generation, kg/person: volume of waste per person.



- Total organic waste generation in the residential area, kg/month: the total amount of waste in the residential area.
- Volume of organic waste generation, t<sup>3</sup>/month: the volume of waste generated.
- Volume of solid organic matter, TS, kg/month: volume of solid matter.
- Volume of volatile organic substances, TVS, kg/month: volume of volatile substances.

To forecast the volume of organic waste generation, click on the "Calculate Forecast" button. After that, a table with the results of the forecasting of the following indicators will be filled in.

Welcome Initial Data			Forecasting the fo	rmation of orga	anic waste		
Organic Waste Forecast	Calculate Forecast		Graphs	Clea	ır forecast	Go to proceed to Function	
Functional Metrics							
Cost Metrics	Month	Volume of organic waste generation, kg/person	Total organic waste generation in the residential area, kg/month	Volume of organic waste generation, m <sup>3</sup> /month	Volume of solid organic substances, TS, kg/month	Volume of volatile organic substances, TVS, kg/month	
	1	0.14	260.4	0.453	113.25	103.114	
	2	0.16	297.6	0.518	129.5	117.91	
	3	0.18	334.8	0.582	145.5	132.478	
	4	0.2	372.0	0.647	161.75	147.273	
	5	0.24	446.4	0.776	194.0	176.637	
	6	0.256	476.16	0.828	207.0	188.473	
	7	0.264	491.04	0.854	213.5	194.392	
	8	0.266	494.76	0.86	215.0	195.757	
	9	0.256	476.16	0.828	207.0	188.473	
	10	0.22	409.2	0.712	178.0	162.069	
	11	0.18	334.8	0.582	145.5	132.478	
	12	0.16	297.6	0.518	129.5	117.91	

To visualize the trends in the change of the forecasted indicators, click on the "Graphs" button. After that, graphs of changes in the volume of solid organic matter, TS, kg/month and volatile organic matter, TVS, kg/month will appear in separate windows.



If necessary, you can clear all the fields by clicking the "Clear forecast" button, or proceed to the next page by clicking the "Go to proceed to Function" button.

#### 4. Forecast Functional Metrics

The Forecast Functional Metrics page displays the results of determining functional metrics. Elements of this page:

Buttons:

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- Calculate Metrics: Calculate functional metrics.
- Graphs: View metrics graphs.
- Clear Metrics: Clear metrics results.
- Go to Cost Metrics: Go to cost metrics.

Table with the results of functional indicators:

- Month: Month of the forecast.
- Biogas volume, m<sup>3</sup>/month: volume of biogas produced.
- Methane volume, m<sup>3</sup>/month: methane volume.
- Electricity production, kWh/month: volume of electricity produced.
- Heat production, kWh/month: amount of heat produced.
- Fertilizer production, kg/month: the volume of fertilizers produced.

To forecast functional indicators, click on the "Calculate Metrics" button. After that, a table with the results of the metrics forecasting will be filled in.

Welcome	-									
Initial Data										
Organic Waste Forecast	10 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30									
Functional Metrics	onal Metrics Calculate Metrics		Grap	hs	Clear Metrics	Go to Cost Metrics				
Cost Metrics	Month	Biogas volume, m³/month	Methane volume, m³/month	Electricity production volume, kWh/month	Production volume of heat energy, kWh/month	Production volume of fertilizer, kg/month				
	1	35.222	19.886	187.127	218.939	91.318				
	2	40.276	22.74	213.983	250.361	104.424				
	3	45.252	25.549	240.416	281.287	117.323				
	4	50.306	28.403	267.272	312.709	130.429				
	5	60.336	34.066	320.561	375.056	156.434				
	6	64.379	36.348	342.035	400.181	166.913				
	7	66.401	37.49	352.781	412.754	172.157				
	8	66.867	37,753	355-256	415.649	173.365				
	9	64.379	36.348	342.035	400.181	166.913				
	10	55.36	31.256	294.119	344.119	143.53				
	11	45.252	25.549	240.416	281.287	117.323				
	12	40.276	22.74	213.983	250.361	104.424				

To visualize trends in functional indicators, click on the "Graphs" button. After that, two graphs will appear in separate windows. The first one shows the trends in the volume of biogas and methane m<sup>3</sup>/month.



The second graph shows the trends in electricity production, kWh/month, heat production, kWh/month, and fertilizer production, kg/month.



If necessary, you can clear all the fields by clicking the "Clear Metrics" button, or go to the next page by clicking the "Go to Cost Metrics" button.

## 5. Cost Metrics

On the Cost Metrics page, you can define cost metrics. Elements of this page: Fields:

- ✓ Choose a currency: Select a currency (EUR).
- $\checkmark$  Time Period (years): Select the period in years (from 1 to 20).

Buttons:

- ✓ Calculate Cost Metrics: Calculate cost metrics.
- ✓ Graphs: View cost metrics graphs.
- ✓ Clear Metrics: Clear metrics results.
- ✓ Save Results: Save results.

Table with the results of the cost indicators:

- Metric: Name of the metric.
- Annual volume: volume for the year.
- Annual cost, EUR: cost per year in euros.
- Disposal of organic waste, kg: volume of disposed waste.
- CO<sub>2</sub> reduction, kg: volume of CO<sub>2</sub> reduction.
- Methane output, m<sup>3</sup>: volume of methane produced.
- Electricity production, kWh: amount of electricity produced.
- Heat production, kWh: the amount of heat produced.
- Production of solid fraction (biofertilizer), kg: the volume of solid fraction produced.

To forecast cost indicators, you should select a currency (for example, EUR) and set the life cycle period of the bioenergy system in years (from 1 to 20) on the slider. After that, by clicking on the "Calculate Metrics" button, a table with the results of the cost forecasting will be filled in.

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Welcome	Welcome Initial Data Organic Waste Forecast Function	al Metrics Cost M	etrics Sults of determin	ation of va	lue indicato	s			
Initial Data	Choose a currency:								
Organic Waste Forecast	EUR								
Functional Metrics	Time Period (years) 7								
Cost Metrics	1	2 3 4	5 6 7 8 9	10 11 12 1	3 14 15 16	17 18 19 20	þ		
	Calculate Cost Metrics		Graphs	s Clear Metrics		s	Save Results	\$	
	Indicator	Disposal of organic waste, kg	Reduction of CO2 volumes, kg	Methane output, m <sup>3</sup>	Electricity production, kWh	Production of heat energy, kWh	Production τof solid fraction (biofertilizer), kg		
	Annual volume	4690.92	2110.91	358.13	3369.98	3942.88	1644.55		
	Annual cost, EUR	79.75	527.73	107.44	741.4	276.0	82.23		

To visualize trends in value indicators, click on the "Graphs" button. After that, a graph with trends in value indicators will appear in a separate window.



The results show that the payback period of a modular bioenergy plant for a residential area will be about 2 years, which is economically beneficial for the residents of this residential area.

If necessary, you can clear all fields by clicking on the "Clear Metrics" button. To save the results to a file, click on the "Save Results" button.

Thank you for using the "Organic Waste Energy Production System". We hope this manual will help you in working with the software. If you have any questions or need additional information, please contact the support service.