

INCREASED RENEWABLE ENERGY AND ENERGY EFFICIENCY BY INTEGRATING, COMBINING URBAN WASTEWATER AND WASTE MANAGEMENT SYSTEM

TAKING
COOPERATION
FORWARD



ECOMONDO Rimini 05/10/2019



REEF 2W Tool and its possible applications



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WHAT IS THE REEF 2W TOOL?

REEF 2W



It is a standalone software thought to help local policy and decision maker to do a first assessment of the possible energetic interaction between the urban area and the local treatment plant for a reciprocal advantage

Start



HOW THE TOOL WORKS

- It was developed in one of the most common electronic sheet using a VBA language.
- It is not necessary to have an internet access (during the use)
- All the information provided by the user and received remain in the computer of the user.
- At the moment developed in English, but already implemented to dialog in German, Croatian, Czech, Italian, possible add any other language
- It works providing an assessment of the status quo situation and one or more possible future scenarios



INTRODUCTIVE PAGE

Tool progress status:

Status quo

Status quo

Report

Future situation

Future situation

Future situation

Report



Information about WWTP and Plant type



Energetic Assessment



Spatial Assessment



Environmental Assessment



Economic Assessment

Reset



INTRODUCTIVE PAGE

Treatment Plant Description

Plant type Wastewater Treatment Plant

Solid waste Treatment

Name of User

Date

(yyyy/mm/dd)

Country

Treatment capacity

PE (*)

Connected population

PE (*)

Wastewater flow (**)

m³/d

COD inflow concentration (***)

mg/l

TN in influent (****)

kgTN/m³

(*) PE Equivalent Population

(**) Daily average

(***) COD Chemical Oxygen Demand

(****) TN Total Nitrogen

Ok

Cancel

?



ENERGETIC ASSESSMENT

Substrates Database



Substrate to select		Tons (t a.r. /year)	Total Solid (%)	Volatile Matter (%)
Primary Sludge	<input checked="" type="checkbox"/>	21401	7,5	67,58
Secondary Sludge	<input checked="" type="checkbox"/>	21547	7,5	67,58
External Sewage Sludge	<input type="checkbox"/>			
Other substrates				
Organic Fraction of Municipal Solid Waste	<input type="checkbox"/>			
<input type="text" value="up to 4 substrates"/>			30	90

a.r. As Received (Raw substrate, before anyway treatment)

Ok

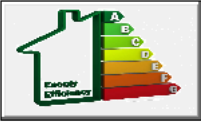
Cancel


?



ENERGETIC ASSESSMENT

Energy assessment

Energy efficiency 

Renewable energy 

Ok Cancel ?

Electric energy consumption

Inflow pumping station and mechanical pre-treatment

Pumping stations kWh/d

Screen kWh/d

Sand trap and primary clarifier kWh/d

Mechanical - biological treatment

Aeration kWh/d

Stirrers kWh/d

Return sludge pumps kWh/d

Miscellaneous (sec. clarifier) kWh/d

Sludge treatment

Thickening kWh/d

Digestion kWh/d

Dewatering kWh/d

Infrastructure

Heating kWh/d

Misc. infrastructure kWh/d

Ok Cancel ?

Thermal energy consumption

Sludge heating kWh/d

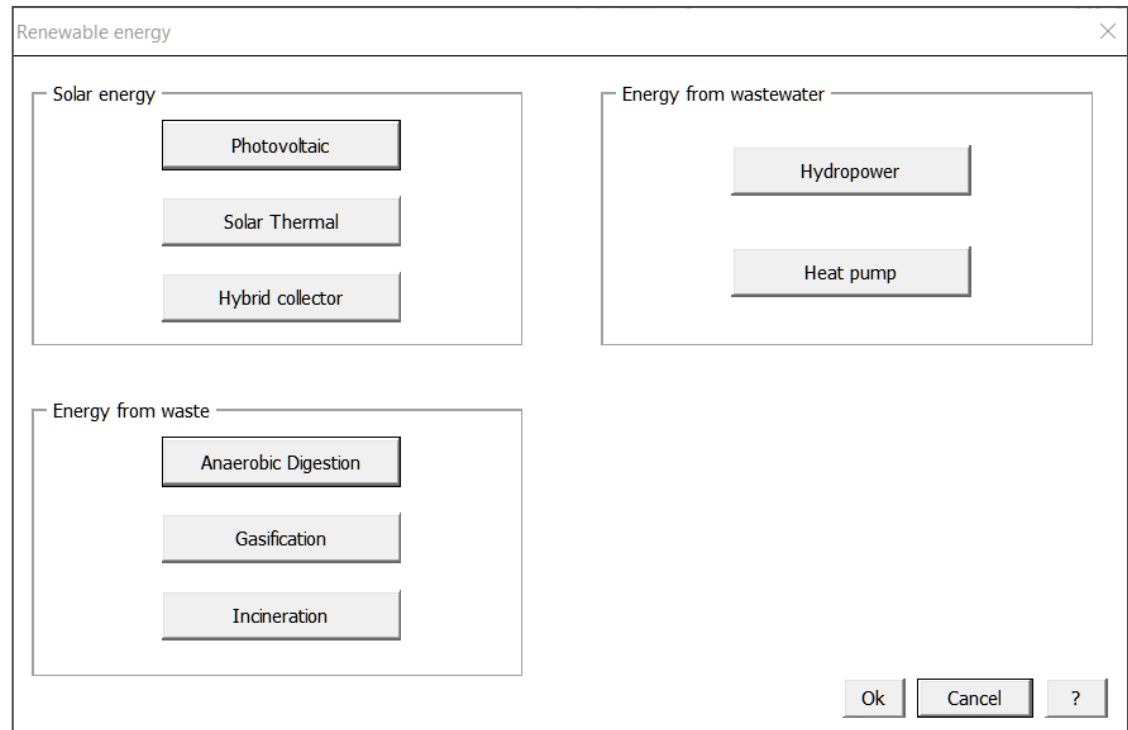
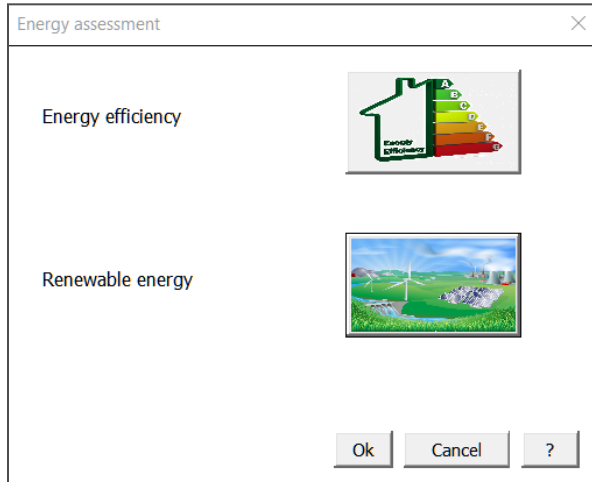
Transmission loss, digester tower heating kWh/d

Heated area kWh/d

Ok Cancel ?



ENERGETIC ASSESSMENT



ENERGETIC ASSESSMENT

Digester parameters ×

Digester volume m³

Digester height m

Digester temperature °C

HRT d

Organic load (*) kg VSS/d

HRT Hydraulic Retention Time
VSS Volatile Suspended Solids
(*) Organic loading rate

Biogas production ×

Total biogas production m³/y

Technologies for the Hydrolysis process ×

Thermo-Chemical (65°C)

Thermo-Pressure (165°C)



ENERGETIC ASSESSMENT

Biogas utilization

100% biogas to CHP Engine CHP engine + Gas heat pump

100% biogas to Biogas Upgrading Biogas Upgrading + Gas heat pump

100% biogas to Gas heat pump

Ok Cancel ?

Upgrading technology

PSA - Pressure Swing Adsorption Info

PWA - Pressure Water Adsorption Info

Membrane Info

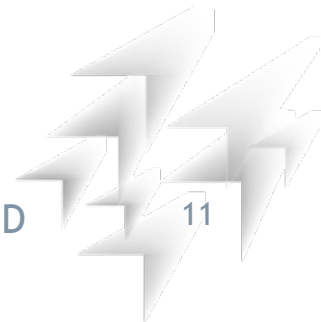
Cryogenic Info

Ok Cancel ?

Methane production from PtG

Total methane production from PtG m3/y

Ok Cancel Calculate ?



INTEGRATED SUSTAINABILITY ASSESSMENT (ISA)

Spatial assessment



Spatial Assessment

- Evaluate the existing energetic requirements of the considered urban area for the different urbanized areas considered (centre, peri-urban, industrial, rural)
- Evaluate the potential development that the urban area will have
- Suggest possible energetic interaction between the treatment platform and the urban area

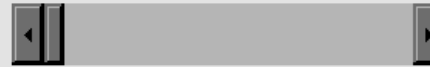


SPATIAL ASSESSMENT

Medium sized town centre



From 800 To 4000



Value changed 800

Legend

- > 2 MWh/(m y)
- 0,5 - 2 MWh/(m y)
- < 0,5 MWh/(m y)

Connection density

0 MWh/(m y)

Available thermal excess energy from the WWTP or the solid waste treatment

436.059.498.43 MWh/y

Total heat demand in the surrounding area of the WWTP or the solid waste treatment

0,00 MWh/y

Remaining thermal excess energy from the WWTP or the solid waste treatment

436.059.498.43 MWh/y

Gross development area

Specific heat demand

Degree of connected heat consumers (*)

Settlement specific grid length (inter.)

Grid length (exter.)

ha

MWh/(ha y)

%

m/ha

m

(*) If not all potential heat consumers connect to the district heating grid (degree of connected heat consumers < 100 %) the length of the settlement specific internal grid might be affected

Ok Cancel ?

INTEGRATED SUSTAINABILITY ASSESSMENT (ISA)

Environmental assessment



Environment Assessment

- Environmental evaluation is based on the reduction of carbon dioxide emissions
- Existing and future situation are considered and compared. The effect on the greenhouse gases emission are analysed and reported.



SPATIAL ASSESSMENT

REEF 2W Model

Environment Assessment

Type of thermal energy supply

- Natural gas
- District heating

Thermal Energy excess

Do you export the thermal energy excess?

- Yes
- No

Sludge use

- Mono-Incineration
- Co-Incineration
- Anaerobic digestion+HTC (*)
- Anaerobic digestion+Composting
- Agricultural Use
- Landfilling

(*) HTC Hydrothermal Carbonization

Ok Cancel ?

Energetic Assessment

Spatial Assessment

Environmental Assessment

Economic Assessment

Reset

INTEGRATED SUSTAINABILITY ASSESSMENT (ISA)

Economic assessment



Economic Assessment

- Operational cost have been considered for the evaluation of the economic advantage that the recovery of energy from wastes can determine, considering also incomes from new wastes disposal, and subsidies for the production or energies
- Investment costs are considered to provide a rough idea about.




ECONOMIC ASSESSMENT

Economic Assessment


Country	<input type="text" value="Czech Republic"/>	
Price of electricity	<input type="text"/>	EUR/kWh
CNG price for cars (*)	<input type="text"/>	EUR/m3
Selling price of electricity	<input type="text"/>	EUR/kWh
Selling price for biomethane	<input type="text"/>	EUR/m3
Selling price for heat	<input type="text"/>	EUR/GJ
Subsidy for electricity	<input type="text"/>	EUR/kWh
Subsidy for biomethane	<input type="text"/>	EUR/kWh
Subsidy for heat	<input type="text"/>	EUR/kWh
Disposal price sludge landfilling	<input type="text"/>	EUR/t
Disposal price sludge Mono-incineration	<input type="text"/>	EUR/t
Disposal price sludge Co-incineration	<input type="text"/>	EUR/t
Disposal price sludge composting	<input type="text"/>	EUR/t

(*) CNG Compressed Natural Gas


Ok Cancel Default ?




Energetic Assessment




Spatial Assessment




Environmental Assessment




Economic Assessment



REEF 2W



Report



Data

Information about WWTP and Plant type


WWTP Description	
Plant type	Wastewater Treatment Plant
Name of Line	h2h
Date	h2h
Country	h2h
Treatment capacity	h2h
Connected population	h2h
Daily average of wastewater flow	h2h
BOD effluent concentration	h2h

Substrate

Substrate			
	Time (h)	TSS load (kg)	Volume (m ³)
Primary Sludge	h2h	h2h	h2h
Secondary Sludge	h2h	h2h	h2h
Industrial Sludge Sludge	h2h	h2h	h2h
Organic Fraction of Municipal Solid Waste	h2h	h2h	h2h
h2h	h2h	h2h	h2h
h2h	h2h	h2h	h2h
h2h	h2h	h2h	h2h
h2h	h2h	h2h	h2h

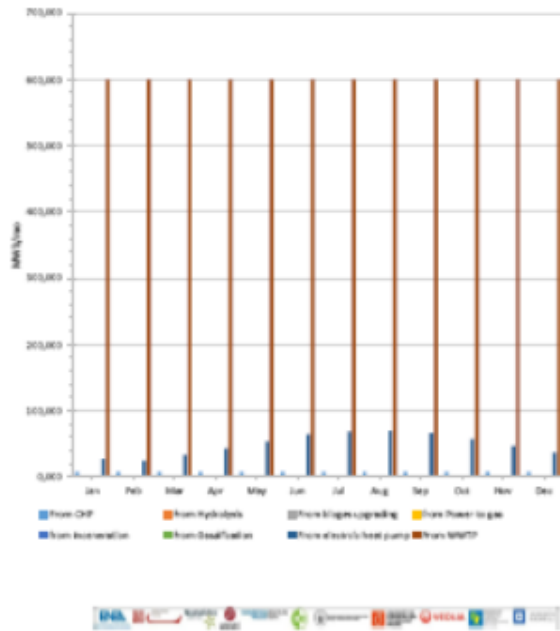
Energy efficiency

Electric energy consumption		
Pumping stations	h2h	h2h
Screen	h2h	h2h
Gravitation and primary clarifier	h2h	h2h
Aeration	h2h	h2h
Slimes	h2h	h2h
Substrate storage	h2h	h2h
Sludge dewatering (incl. dewatering)	h2h	h2h
Thickening	h2h	h2h
Digestion	h2h	h2h
Sludge drying	h2h	h2h
Heating	h2h	h2h
Other infrastructure	h2h	h2h
Tot. electric energy consumption	h2h	h2h

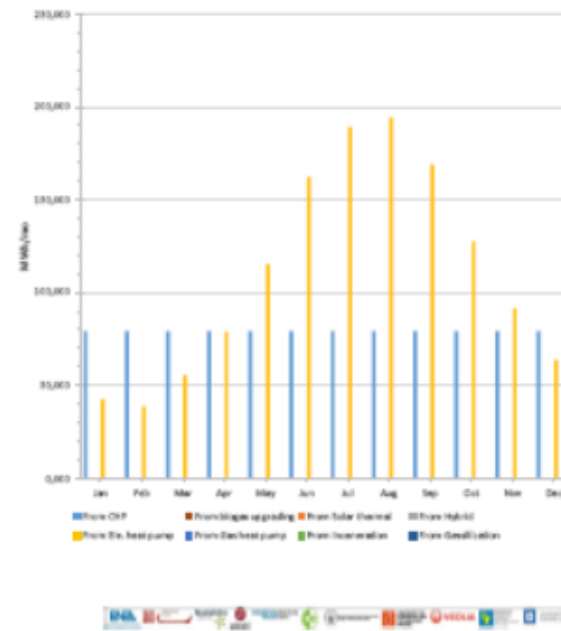




	Electric energy CONSUMPTION									
	Units									
	CHP	Hydro	Loggling	PE	Incineration	Gas/Coal	Electric heat pump	WWT		
MWh/year	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year
Jan	7,21	NA	NA	NA	NA	NA	16,65	200,00		
Feb	7,21	NA	NA	NA	NA	NA	14,68	200,00		
Mar	7,21	NA	NA	NA	NA	NA	12,80	200,00		
Apr	7,21	NA	NA	NA	NA	NA	10,47	200,00		
May	7,21	NA	NA	NA	NA	NA	7,98	200,00		
Jun	7,21	NA	NA	NA	NA	NA	5,67	200,00		
Jul	7,21	NA	NA	NA	NA	NA	3,70	200,00		
Aug	7,21	NA	NA	NA	NA	NA	1,98	200,00		
Sep	7,21	NA	NA	NA	NA	NA	0,70	200,00		
Oct	7,21	NA	NA	NA	NA	NA	0,24	200,00		
Nov	7,21	NA	NA	NA	NA	NA	0,04	200,00		
Dec	7,21	NA	NA	NA	NA	NA	0,01	200,00		
All (2016/17)	85,28	NA	NA	NA	NA	NA	200,00	71,05,23		
									100%	79%



	Thermal energy PRODUCTION									
	Units									
	CHP	Loggling	Solar thermal	Solar hybrid	Electric heat pump	Gas/Coal	Incineration	Gasification		
MWh/year	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year
Jan	71,05	NA	0,00	0,00	0,00	NA	NA	NA		
Feb	71,05	NA	0,00	0,00	0,00	NA	NA	NA		
Mar	71,05	NA	0,00	0,00	0,00	NA	NA	NA		
Apr	71,05	NA	0,00	0,00	0,00	NA	NA	NA		
May	71,05	NA	0,00	0,00	0,00	NA	NA	NA		
Jun	71,05	NA	0,00	0,00	0,00	NA	NA	NA		
Jul	71,05	NA	0,00	0,00	0,00	NA	NA	NA		
Aug	71,05	NA	0,00	0,00	0,00	NA	NA	NA		
Sep	71,05	NA	0,00	0,00	0,00	NA	NA	NA		
Oct	71,05	NA	0,00	0,00	0,00	NA	NA	NA		
Nov	71,05	NA	0,00	0,00	0,00	NA	NA	NA		
Dec	71,05	NA	0,00	0,00	0,00	NA	NA	NA		
All (2016/17)	850,23	NA	0,00	0,00	0,00,00	NA	NA	NA		
									100%	0%



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