SWIM and Horizon 2020 Support Mechanism

Working for a Sustainable Mediterranean, Caring for our Future

SWIM-H2020 SM EFH-IL-2
Waste to Energy Exploitation of Olive Mills Waste Streams

Presented by:

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SWIM and Horizon 2020 SM EFH-IL-2

07/11/2017, Tel-Aviv, Israel

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Presentation Structure

1. European Acquis: Waste Management, Promotion of Energy Production with the use of Renewable Energy

2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

3. Pilot station for OMSW pelleting

4. Israel - Cyprus - Greece Energy Relations: Collaboration Perspectives for the Future

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1. European Acquis: Waste Management, Promotion of Energy Production with the use of Renewable Energy

European Directive 2009/28 on the promotion of the use of energy from renewable sources

- The **EU's Renewable energy directive** sets a binding target of **20% final energy consumption from renewable sources by 2020**. To achieve this, EU countries have committed to reaching **their own national renewables targets** ranging from 10% in Malta to 49% in Sweden. They are also each required to have at least 10% of their transport fuels come from renewable sources by 2020.

- All EU countries have adopted **national renewable energy action plans** showing what actions they intend to take to meet their renewables targets. These plans include sectorial targets for electricity, heating and cooling, and transport; planned policy measures; the different mix of renewables technologies they expect to employ; and the planned use of cooperation mechanisms.

1. European Acquis: Waste Management, Promotion of Energy Production with the use of Renewable Energy

European Directive 2009/28 on the promotion of the use of energy from renewable sources – National Action Plans

Secure | https://ec.europa.eu/energy/en/topics/renewable-energy/national-action-plans

Energy

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National action plans

Individual EU countries have different available resources and their own unique energy markets. This means that they will have to follow distinctive paths when it comes to meeting their obligations under the Renewable Energy Directive, including their legally binding 2020 targets. In their national action plans, they explain how they intend to do this. The plans cover:

- individual renewable energy targets for the electricity, heating and cooling, and transport sectors
- the planned mix of different renewables technologies
- policy measures to achieve national targets including cooperation between local, regional, and national authorities
- any planned statistical transfers and/or joint projects with other countries
- national policies to develop biomass resources
- measures to ensure that biofuels used to meet renewable energy targets are in compliance with the EU's sustainability criteria

LATEST

High-level Conference on Clean Energy Financing
31 October 2017

Agreement on statistical transfers of renewable energy amounts between Lithuani and Luxembourg
26 October 2017

Focus on Luxembourg: the Energy Union tour
23 October 2017

Focus on France: the Energy Union tour
4 October 2017

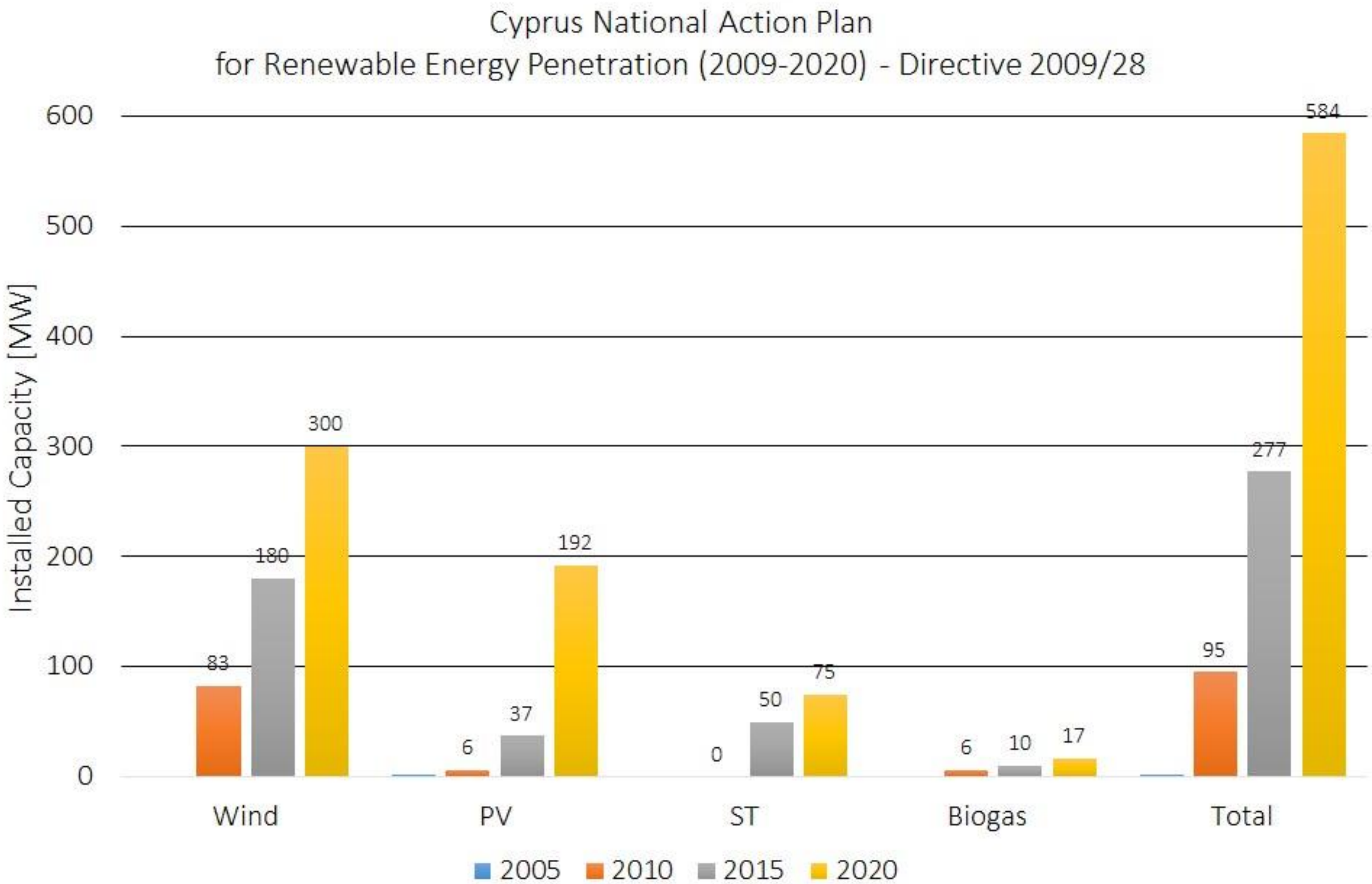
EU energy statistics – latest data now available!
4 October 2017

View all latest

Link

1. European Acquis: Waste Management, Promotion of Energy Production with the use of Renewable Energy

European Directive 2009/28 on the promotion of the use of energy from renewable sources – Cyprus National Action Plan



1. European Acquis: Waste Management, Promotion of Energy Production with the use of Renewable Energy

Renewable Energy Technology Units connected to the Grid – Cyprus September 2017

	Wind	PV	ST	Biogas	Total
Units	6	1931	0	14	1951
Capacity [MW]	157.5	70.6	0	9.7	237.8
Production [MWh]	1353121	413301	0	304045	2070467

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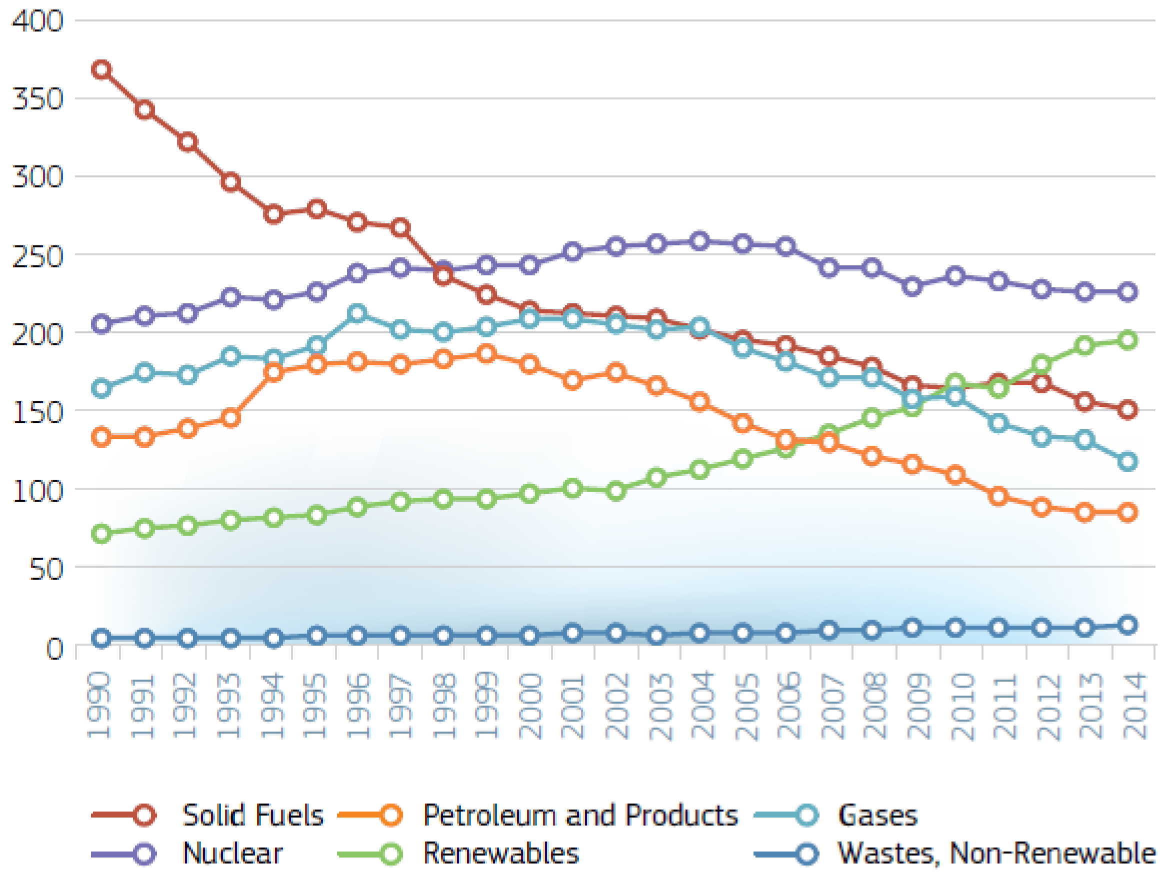
1. European Acquis: Waste Management, Promotion of Energy Production with the use of Renewable Energy

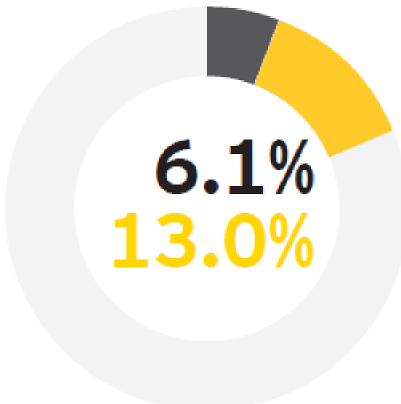
European Directive 2009/28 on the promotion of the use of energy from renewable sources – EU Production by Fuel 1990-2014

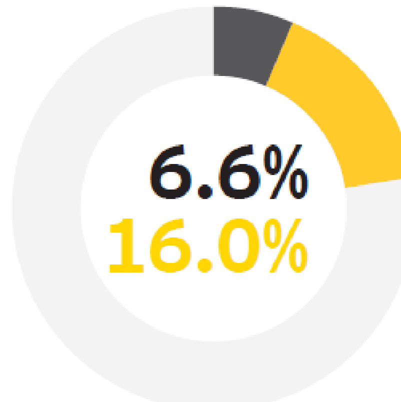


1. European Acquis: Waste Management, Promotion of Energy Production with the use of Renewable Energy

Energy Dynamics in Cyprus

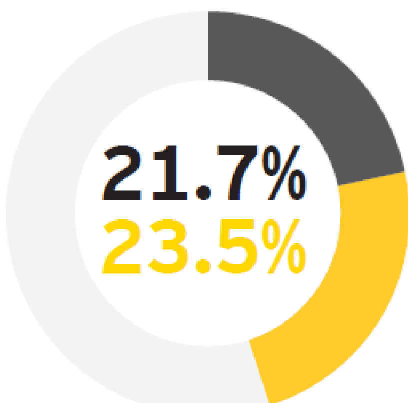
Final energy from renewables

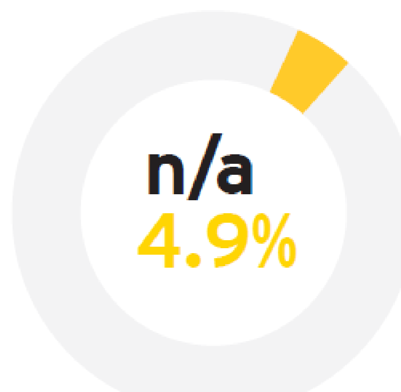




Electricity generation from renewables

Share of heating and cooling from modern renewable technologies





Share of transport final energy demand

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Definition of Renewable Energy

- ‘Energy from renewable sources’ means energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, **biomass, landfill gas, sewage treatment plant gas and biogases**;
- ‘Biomass’ means the biodegradable fraction of products, waste and residues from biological origin **from agriculture (including vegetal and animal substances)**, forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste;

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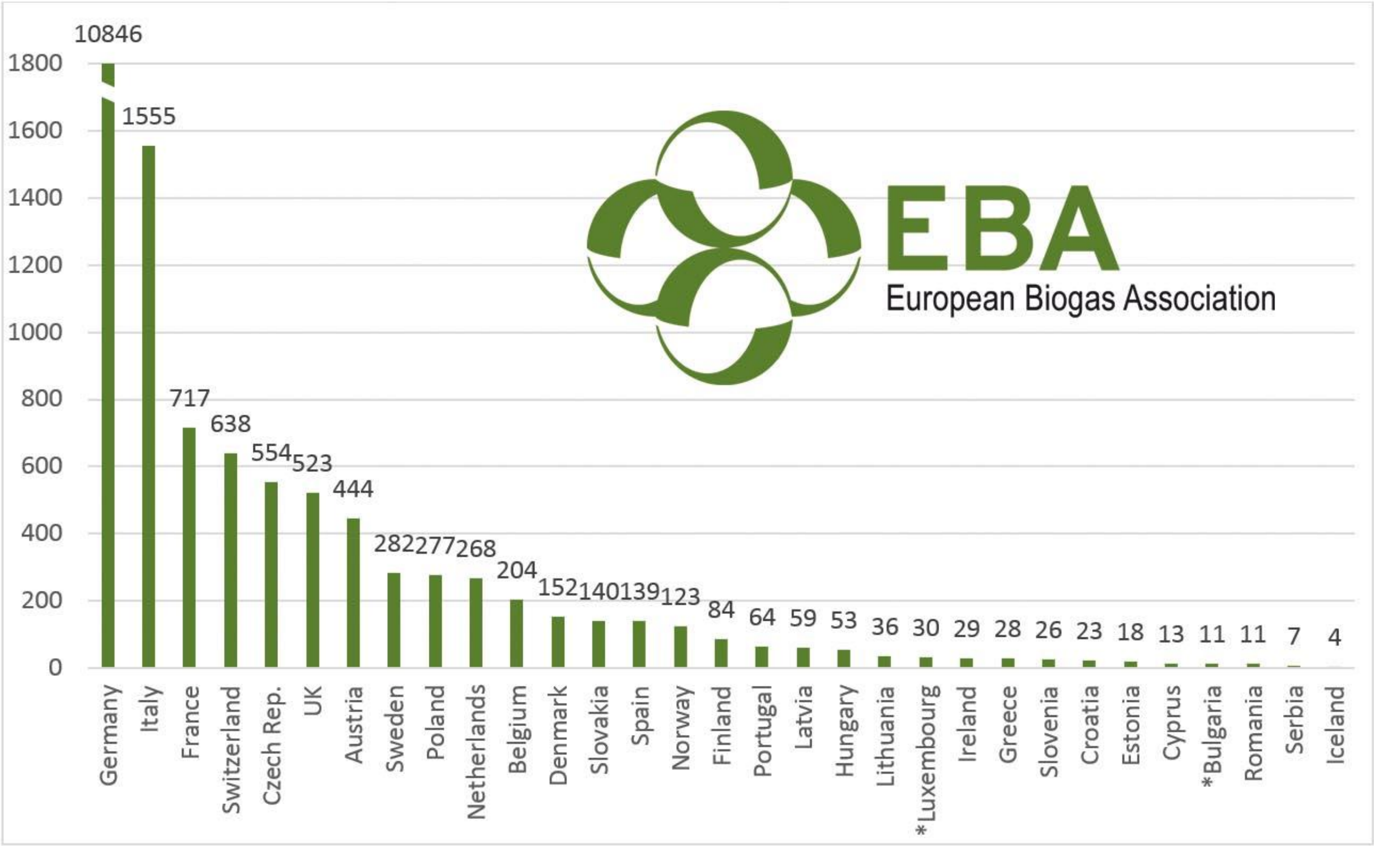
1. European Acquis: Waste Management, Promotion of Energy Production with the use of Renewable Energy

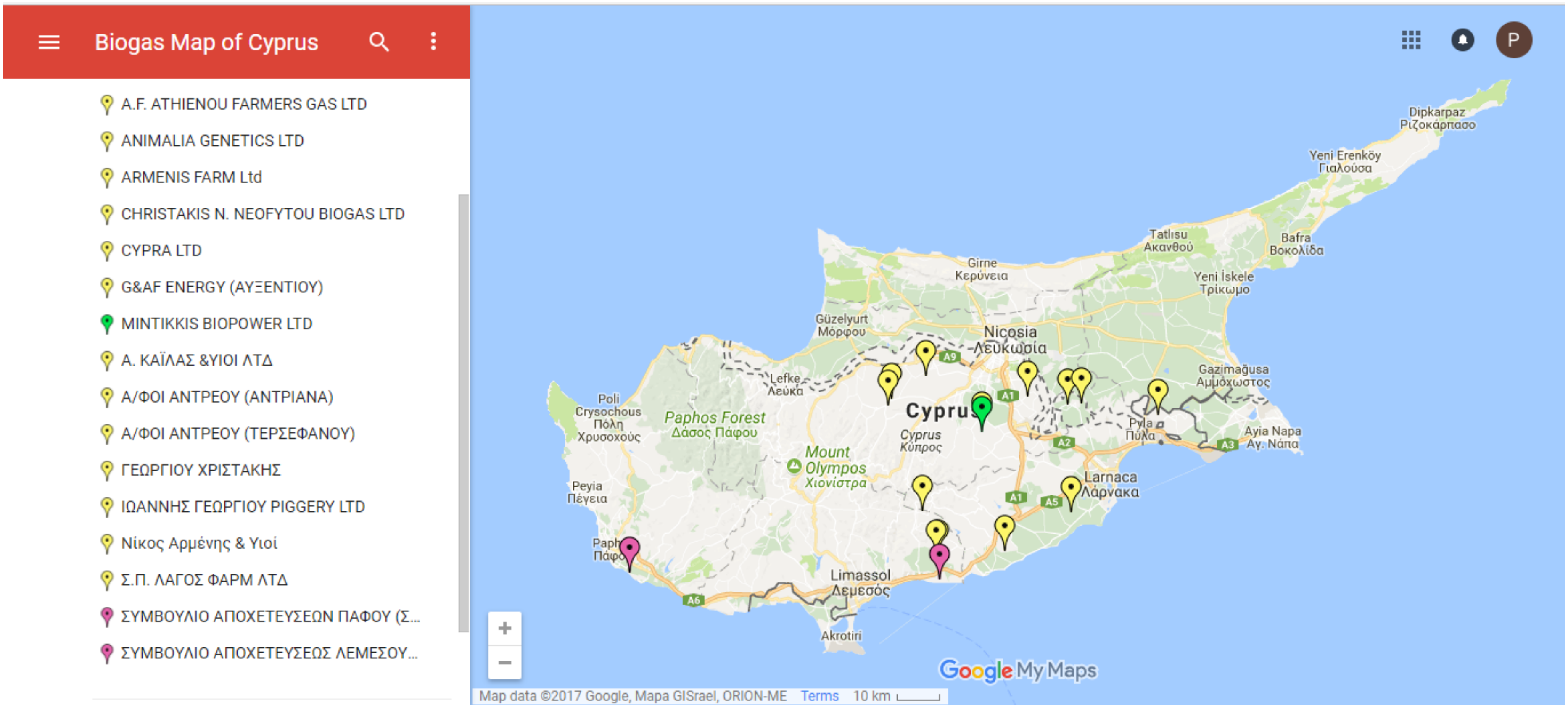
Biogas Plants in Europe (2015)



17,358 biogas plants in Europe (31/12/2015)
Total installed capacity of 8,728

1. European Acquis: Waste Management, Promotion of Energy Production with the use of Renewable Energy

Biogas Map of Cyprus



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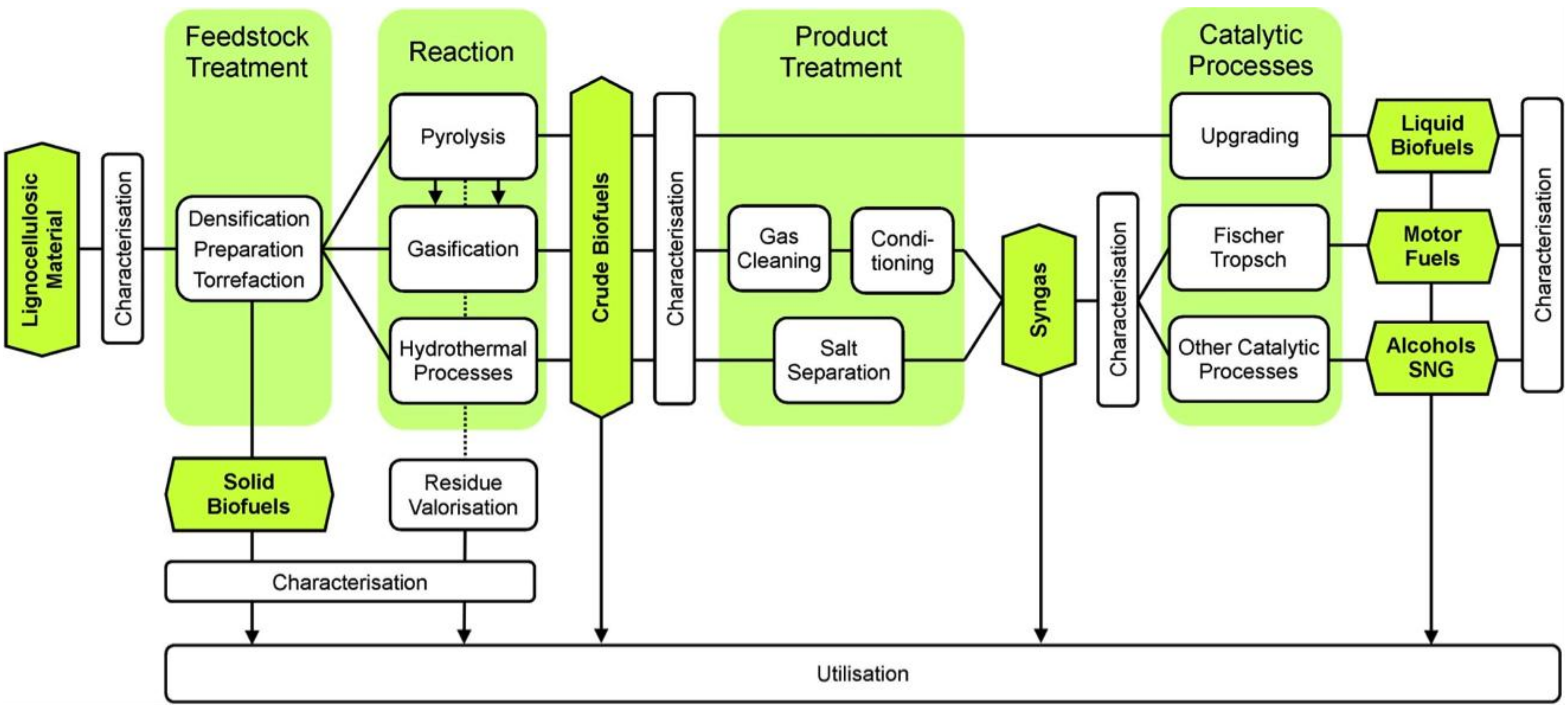
2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

Waste to Energy Technologies



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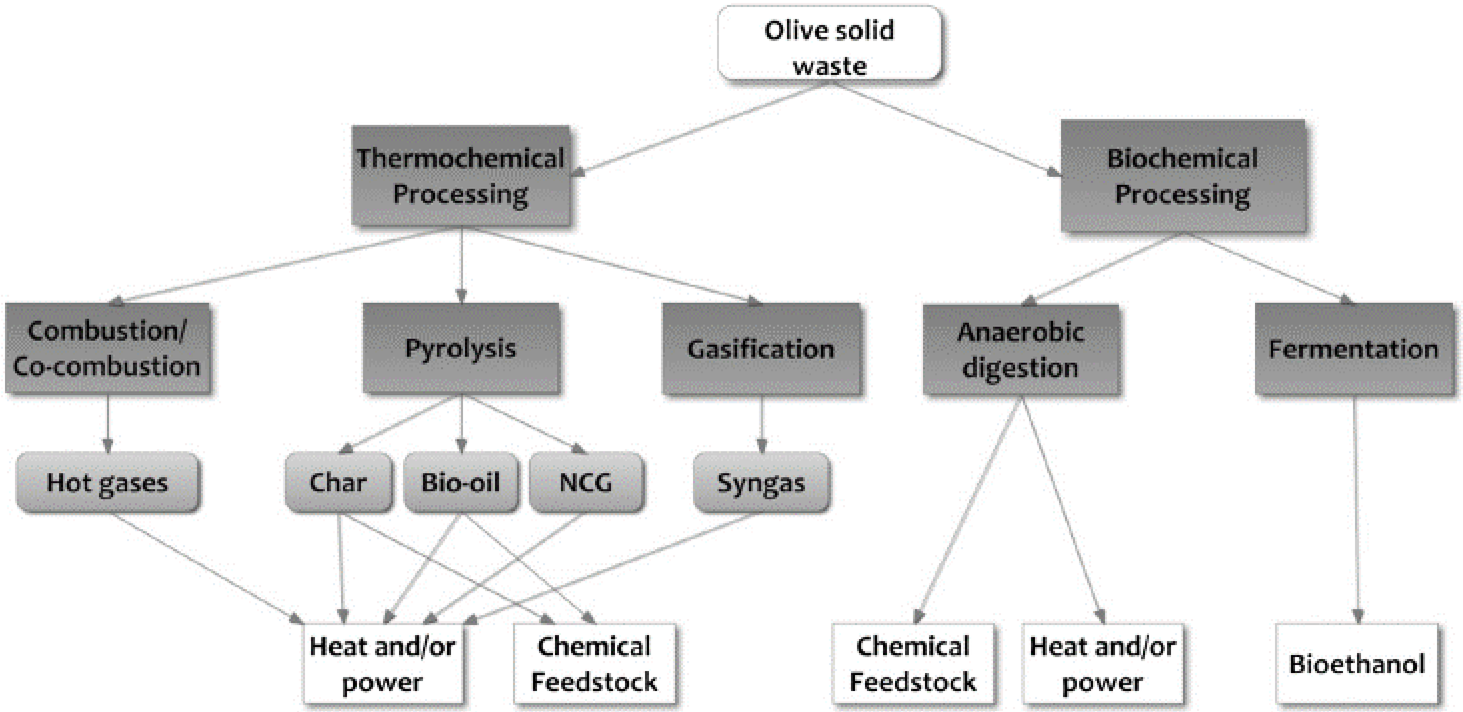
2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

Waste to Energy Technologies - OMSW



E. Christoforou, P.A. Fokaides / Waste Management 49 (2016) 346–363

2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

Olive Mill Solid Waste

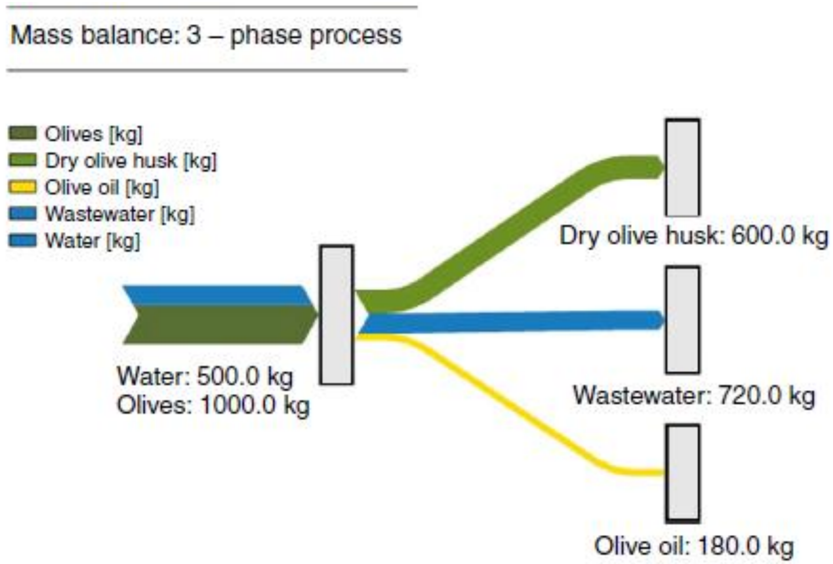


Fig. 1 Sankey diagram—three-phase olive oil extraction process

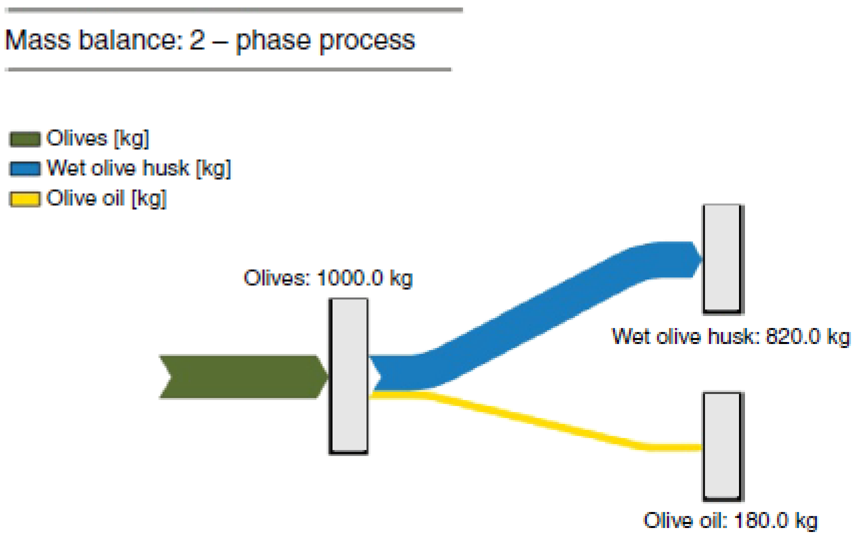
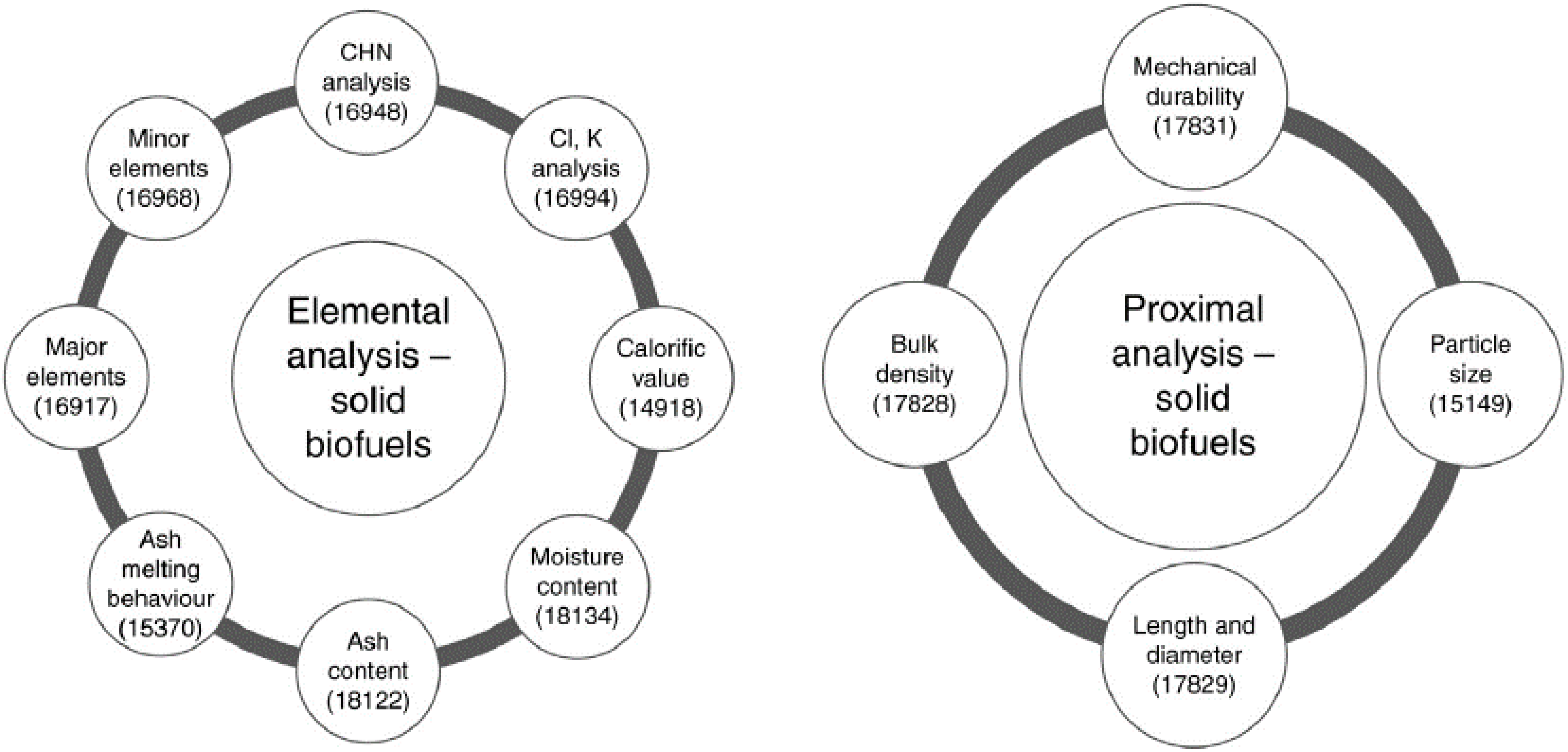


Fig. 2 Sankey diagram—two-phase olive oil extraction process

J Therm Anal Calorim (2014) 118:1789–1796

2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

Elemental and Proximal Analysis Standardized Methods for Solid Biofuels



Fokaides, P.A. (2017). Energy recovery alternatives for the sustainable management of olive oil industry. In Olive Mill Waste, Recent Advances for Sustainable Management (pp 79–96). Academic Press.

2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

Solid biofuels – Fuel specifications and classes (ISO 17225-1:2014)

3.2 By-products and residues from food and fruit processing industry	3.2.1 Chemically untreated fruit residues	3.2.1.1 Berries 3.2.1.2 Stone/kernel fruits/fruit fibre 3.2.1.3 Nuts and acorns 3.2.1.4 Crude olive cake 3.2.1.5 Blends and mixtures
	3.2.2 Chemically treated fruit residues	3.2.2.1 Berries 3.2.2.2 Stone/kernel fruits 3.2.2.3 Nuts and acorns 3.2.2.4 Exhausted olive cake 3.2.2.5 Blends and mixtures

2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

Solid biofuels – Fuel specifications and classes (ISO 17225-1:2014)

Table B.9 — Typical values for olive and grape cake

Parameter	Unit	Olive cake			Grape cake	
		Crude olive cake 3.2.1.4	Exhausted olive cake 3.2.2.4	Olive kernels 3.2.1.2	Crude grape cake 3.2.1.1	Exhausted grape cake 3.2.1.1, 3.2.2.1
Ash	w-% d	10	3,4 to 11,3	1,2 to 4,4	4,5 to 11,2	6 to 13
Gross calorific value $q_{V,gr,d}$	MJ/kg d	19,4 to 21,4	18,1 to 21,6	18,6 to 20,8	19,3 to 22,0	
Net calorific value $q_{p,net,d}$	MJ/kg d	18,1 to 20,7	13,9 to 19,2	17,3 to 19,3	16,7	19,0
Carbon, C	w-% d	50	48 to 52	45,7 to 52,3	54	46,0 to 54,4
Hydrogen, H	w-% d	6,9	4,6 to 6,3	6,1 to 6,8	6,8	5,8 to 7,5
Oxygen, O	w-% d	30	33	38,5 to 42,1	not specified	not specified

2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Moisture Content and Elemental Analysis

Table 2 Moisture content (as received) determination, M_{ar}

A/A	Sub-sample	M_{ar}/%	Technology
1	NI 04_A	40.68	3-phase
2	NI 04_B	40.62	
3	NI 11_A	48.28	3-phase
4	NI 11_B	47.73	
5	PA 01_A	20.73	3-phase
6	PA 01_B	21.36	
7	PA 02_A	37.99	3-phase
8	PA 02_B	38.30	
9	FAM 01_A	44.60	3-phase
10	FAM 01_B	44.45	
11	FAM 02_A	48.77	3-phase
12	FAM 02_B	49.08	
13	LA 02_A	42.55	3-phase
14	LA 02_B	42.68	
15	LIM 02_A	39.94	3-phase
16	LIM 02_B	39.82	
17	LIM 04_A	58.29	2-phase
18	LIM 04_B	58.59	

Table 3 Elemental analysis results

A/A	Sub-sample	C/%	H/%	N/%
1	NI 04_A	47.69	5.93	0.42
2	NI 04_B	48.38	5.84	0.28
3	NI 11_A	49.11	6.68	0.48
4	NI 11_B	49.82	6.61	0.57
5	PA 01_A	49.31	5.95	0.25
6	PA01_B	49.12	5.91	0.24
7	PA 02_A	52.58	6.82	0.40
8	PA02_B	52.87	6.82	0.34
9	FAM 01_A	49.74	6.03	0.32
10	FAM 01_B	48.12	5.89	0.24
11	FAM 02_A	52.96	6.8	0.58
12	FAM 02_B	52.99	6.82	0.39
13	LA 02_A	53.74	6.67	0.40
14	LA 02_B	53.46	6.61	0.33
15	LIM 02_A	51.16	6.58	0.50
16	LIM 02_B	51.72	6.63	0.39
17	LIM 04_A	50.32	6.24	0.29
18	LIM 04_B	48.88	5.99	0.32

J Therm Anal Calorim (2014) 118:1789–1796

2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Elemental Analysis and Calorific Value

Table 4 Comparison of mean values of C, H, and N content

C/%	H/%	N/%	Source
50.67	6.38	0.37	This study
52.80	6.69	0.45	Phyllis2 [40]
48.81	6.23	0.36	Phyllis2 [40]
47.07	5.95	2.40	Phyllis2 [40]
49.59	6.09	0.95	Phyllis2 [40]
51.38	6.32	0.45	BIOBIB [41]

Table 6 Comparison of olive husk calorific values

Calorific value/MJ kg^{-1}	Source
21.645	This study
21.61	Phyllis2 [40]
21.39	Phyllis2 [40]
18.70	Phyllis2 [40]
22.09	Phyllis2 [40]
21.60	BIOBIB [41]

J Therm Anal Calorim (2014) 118:1789–1796

2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Collection and Processing – Life Cycle Assessment

$$min\left[\sum_{i=1}^{n} m_i{*}g{*}\left|\sqrt{|x_i-x|^2+|y_i-y|^2}\right| + \sum_{j=1}^{k} m_j{*}g{*}\left|\sqrt{|x_j-x|^2+|y_j-y|^2}\right|\right]$$

m_i Average annual quantity of olive husk for transportation to the MC, kg
m_j Average annual quantity of pellet for transportation from the MC, kg
x Cartesian coordinates of MC along x-axis, m (Annex, Table A3)
x_i Cartesian coordinates of olive mills along x-axis, m (Annex, Table A1)
x_j Cartesian coordinates of industrial zones along x-axis, m (Annex, Table A2)
y Cartesian coordinates of MC along y-axis, m (Annex, Table A3)
y_i Cartesian coordinates of olive mills along y-axis, m (Annex, Table A1)
y_j Cartesian coordinates of industrial zones along y-axis, m (Annex, Table A2)
g Gravity acceleration, 9.81 m s^{-2}

A. Kylili et al. / Biomass and Bioenergy 84 (2016) 107-117

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2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Collection and Processing – Life Cycle Assessment

Coordinates of olive mills in Cyprus

Province	Olive oil mill	Latitude	x_i (Easting-UTM, m)	Longitude	y_i (Northing-UTM, m)
Ammochostos	1	35°02′31.20″N	578969.87	33°51′57.02″E	3878043.34
	2	35°01′22.04″N	571596.22	33°47′05.32″E	3875851.69
Larnaca	3	34°51′48.28″N	544374.58	33°29′07.73″E	3858003.51
	4	34°51′23.12″N	542453.14	33°27′51.91″E	3857219.24
	5	34°51′15.16″N	541942.31	33°27′31.75″E	3856971.80
	6	34°47′15.58″N	531351.56	33°20′33.68″E	3849549.39
	7	34°48′45.25″N	529508.36	33°19′21.50″E	3852305.48
	8	34°51′42.92″N	517472.19	33°11′28.15″E	3857747.6
Nicosia	9	34°57′08.22″N	527510.16	33°18′04.68″E	3867792.80
	10	34°59′06.50″N	532842.92	33°21′35.46″E	3871454.16
	11	35°04′10.85″N	489950.82	32°53′23.21″E	3880775.97
	12	35°04′05.09″N	489864.77	32°53′19.82″E	3880598.63
	13	35°02′16.12″N	490523.31	32°53′45.96″E	3877241.12
	14	35°08′01.46″N	511119.12	33° 7′19.38″E	3887881.18
	15	35°08′51.07″N	521562.22	33°14′12.19″E	3889428.25
	16	35°05′42.04″N	525402.42	33°16′43.32″E	3883615.03
	17	35°02′08.88″N	515226.06	33°10′00.95″E	3877025.89
	18	35°02′43.87″N	523202.6	33°15′15.88″E	3878120.60
	19	35°00′44.89″N	526771.46	33°17′36.33″E	3874465.21
	20	35°02′50.40″N	490604.4	32°53′49.12″E	3878296.97
	21	35°07′07.18″N	508490.59	33° 5′35.45″E	3886206.23
Paphos	22	35°00′03.42″N	449317.37	32°26′40.49″E	3873289.32
	23	34°59′28.79″N	449826.06	32°27′00.79″E	3872219.70
	24	34°55′23.54″N	460818.64	32°34′15.69″E	3864610.91
	25	34°44′39.55″N	454131.81	32°29′56.04″E	3844803.97
	26	34°44′44.98″N	455547.84	32°30′51.69″E	3845025.83
Limassol	27	34°40′46.02″N	476483.67	32°44′35.84″E	3837526.20
	28	34°45′24.73″N	478004.37	32°45′34.80″E	3846107.51
	29	34°40′51.81″N	493600.46	32°55′48.50″E	3837676.78
	30	34°50′48.48″N	515298.36	33°10′02.42″E	3856066.75
	31	34°43′37.38″N	495268.46	32°56′53.95″E	3842775.84

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2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Collection and Processing – Life Cycle Assessment

1. *Scenario 1*: Centralised management centre
2. *Scenario 2*: Decentralised management centres
3. *Scenario 3*: Centralised management centre incorporating Renewable Energy Sources (RES)
4. *Scenario 4*: Decentralised management centre incorporating Renewable Energy Sources (RES)

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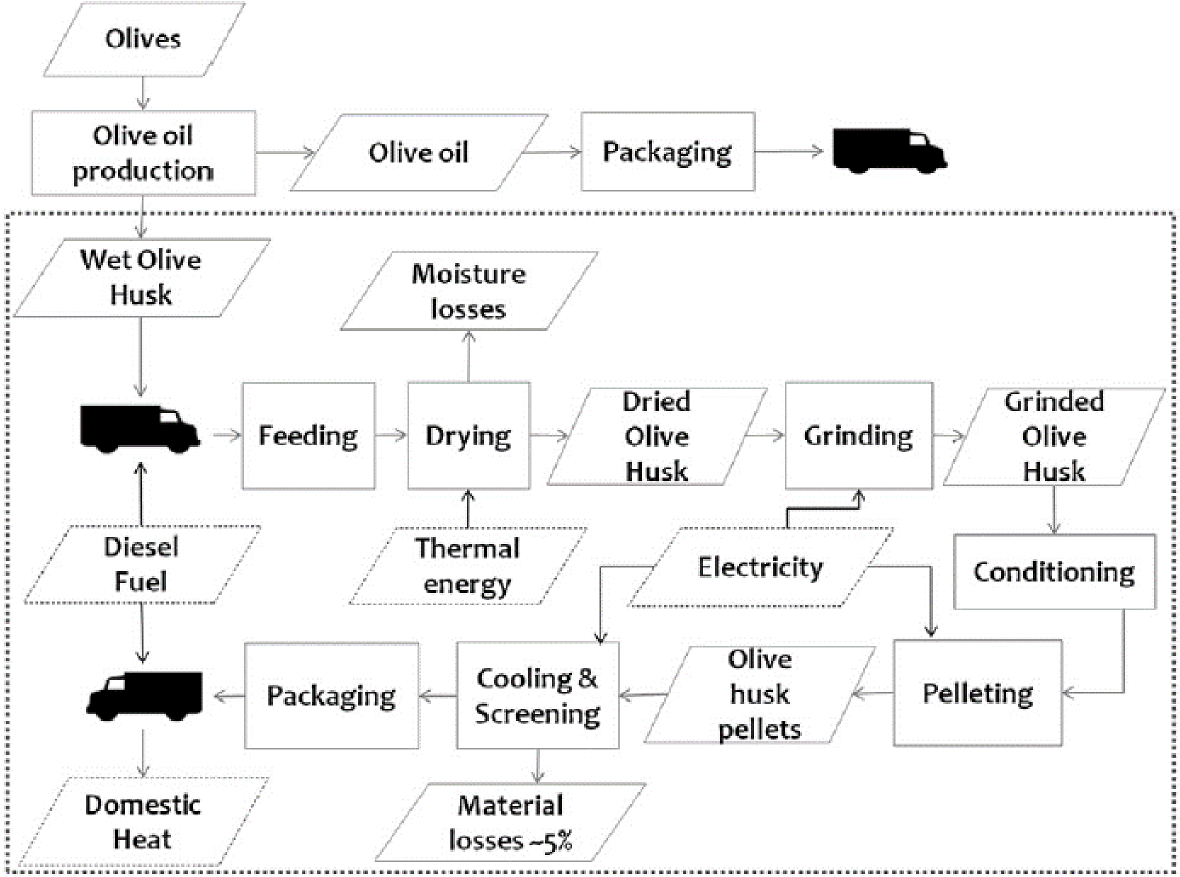
2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Collection and Processing – Life Cycle Assessment



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2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Collection and Processing – Life Cycle Assessment

Process & inputs	Value				Units	Description	Data source
	SC 1	SC 2	SC 3	SC 4			
Transport from olive mills to management centre							
Mass transported	1503.7	1503.7	1503.7	1503.7	kg	kg of waste olive husk	For the production of 1 t of EN ISO 17225-6:2014 compliant non- woody pellets for non- industrial use
Diesel	173.6	46.3	173.6	46.3	MJ	Calculated considering the cargo weight and real distance	GaBi6 database
Transportation distance	1817.6	605.9	1817.6	605.9	km	Considering the location of management centre(s)	Google maps
Feeding							
Mass	1503.7	1503.7	1503.7	1503.7	kg	kg of waste olive husk entering the system	For the production of 1 t of EN ISO 17225-6:2014 compliant non- woody pellets for non- industrial use
Drying							
Mass loss	30	30	30	30	%	Moisture content reduction from 45% wt to 15% wt	Technical data: Model: Phaethon 1 [49]
Grid electricity	324.8	252.6	–	–	MJ	For SC 1&3: Input: 9 kW; Output: 150 kg h^{-1} For SC 2&4: Input: 7 kW; Output: 150 kg h^{-1}	
Solar energy	–	–	324.8	252.6		For SC 3&4: Thermal energy provided by solar thermal collectors	GaBi 6 database
Grinding							
Grid electricity	189.5	139.0	–	–	MJ	For SC 1&3: Input: 7.5 kW; Output: 150 kg h^{-1} For SC 2&4: Input: 5.5 kW; Output: 150 kg h^{-1}	Technical data: Model: RS 650 [50]
Solar energy	–	–	189.5	139.0		For SC 3&4: Electricity provided by solar photovoltaics	
Pelleting							
Grid electricity	339.2	235.6	–	–	MJ	For SC 1&3: Input: 22 kW; Output: 250 kg h^{-1} For SC 1&3: Input: 7.5 kW; Output: 120 kg h^{-1}	Technical data: Model: AMP360c [51] Type: Rotating roller
Solar energy	–	–	339.2	235.6		For SC 3&4: Electricity provided by solar photovoltaics	

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2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Collection and Processing – Life Cycle Assessment

Cooling and screening							
Mass loss	5	5	5	5	%	Loose material loss	Empirical data [56],
Grid electricity	8.7	9.4	–	–	MJ	Input: 0.75 kW Output: 325 kg h^{-1}	Technical data: Model: ACC300 [51]
Solar energy	–	–	8.7	9.4		For SC 3&4: Electricity provided by solar photovoltaics	
Transport from management centre to sale points							
Mass transported	1000	1000	1000	10,000	Kg	Functional unit	For the production of 1t of EN ISO 17225-6:2014 compliant non- woody pellets for non- industrial use
Diesel	159.1	62.3	159.1	62.3	MJ	Calculated considering the cargo weight and distance	GaBi 6 database
Transportation distance	356.6	49.3	356.6	49.3	Km		Google maps

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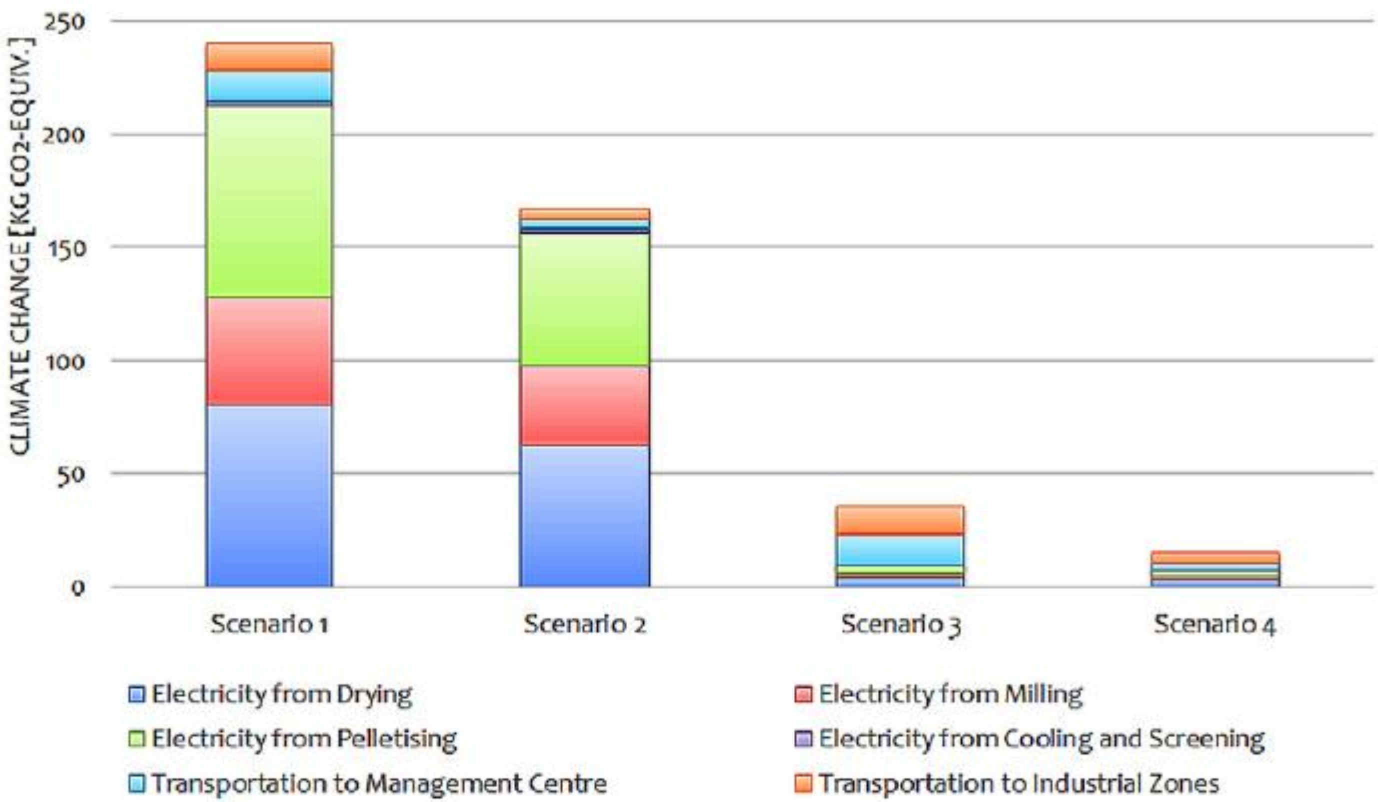
2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Collection and Processing – Life Cycle Assessment



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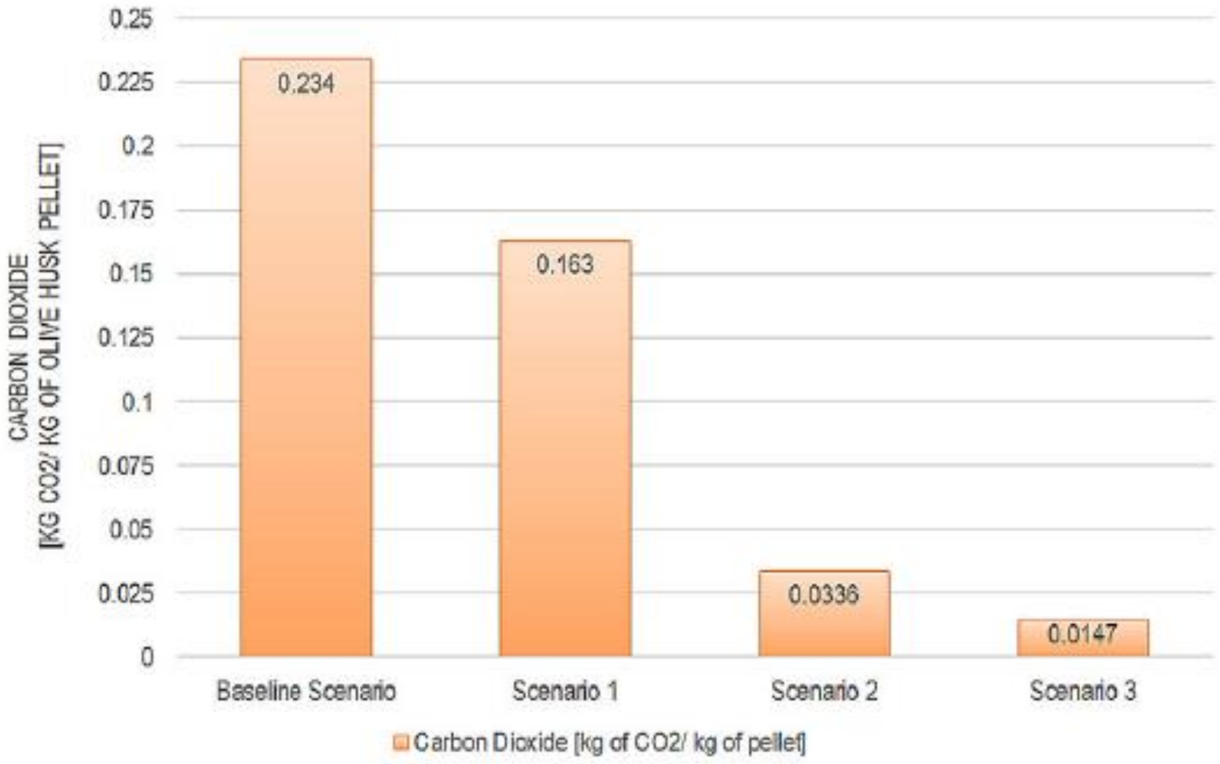
OMSW Collection and Processing – Life Cycle Assessment



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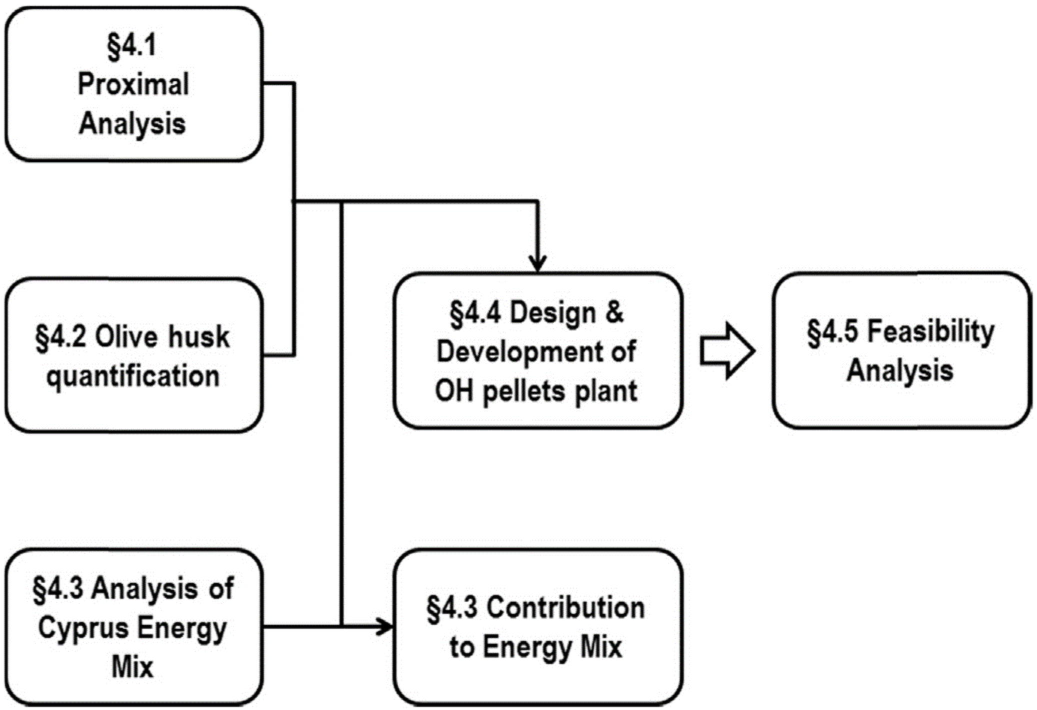
2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Collection and Processing – Feasibility Assessment



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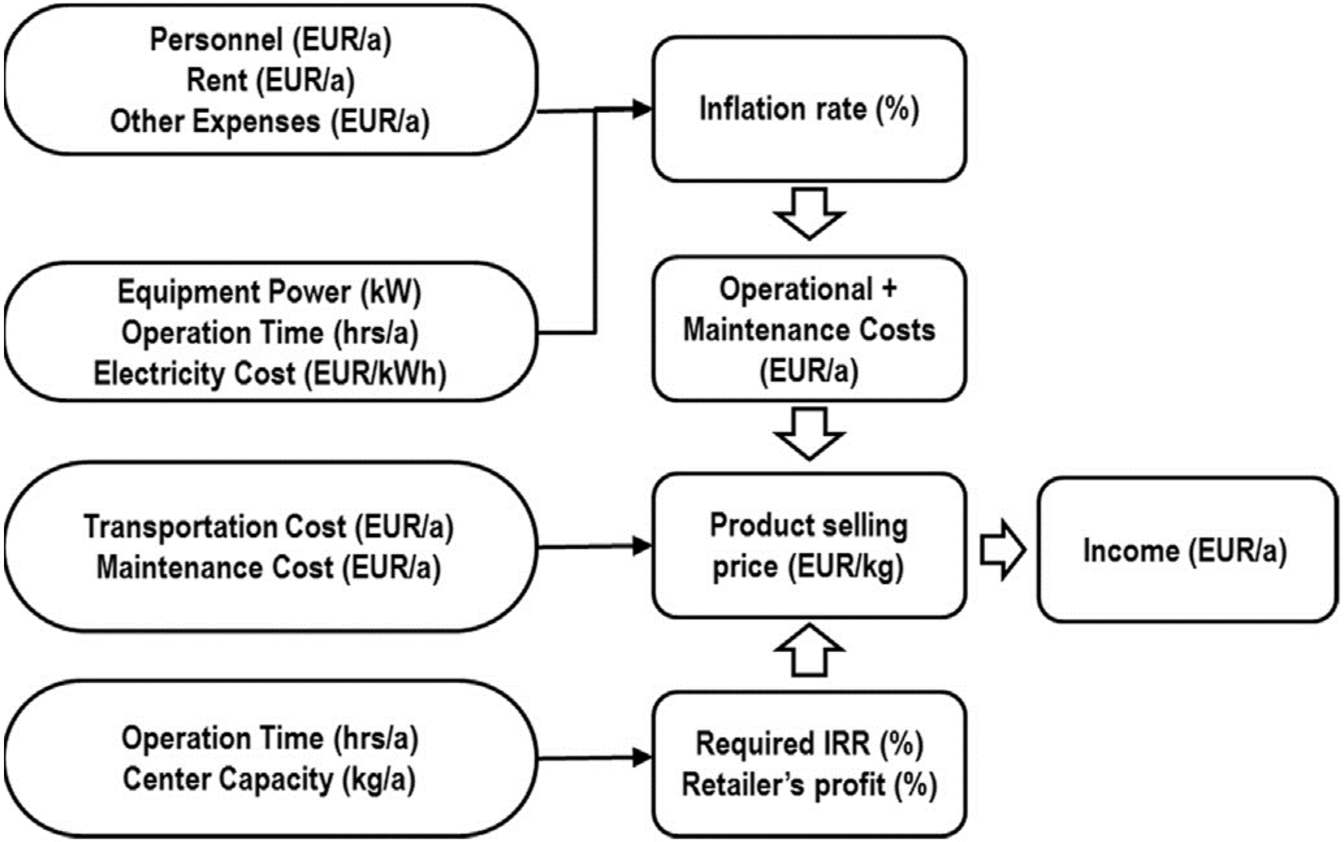

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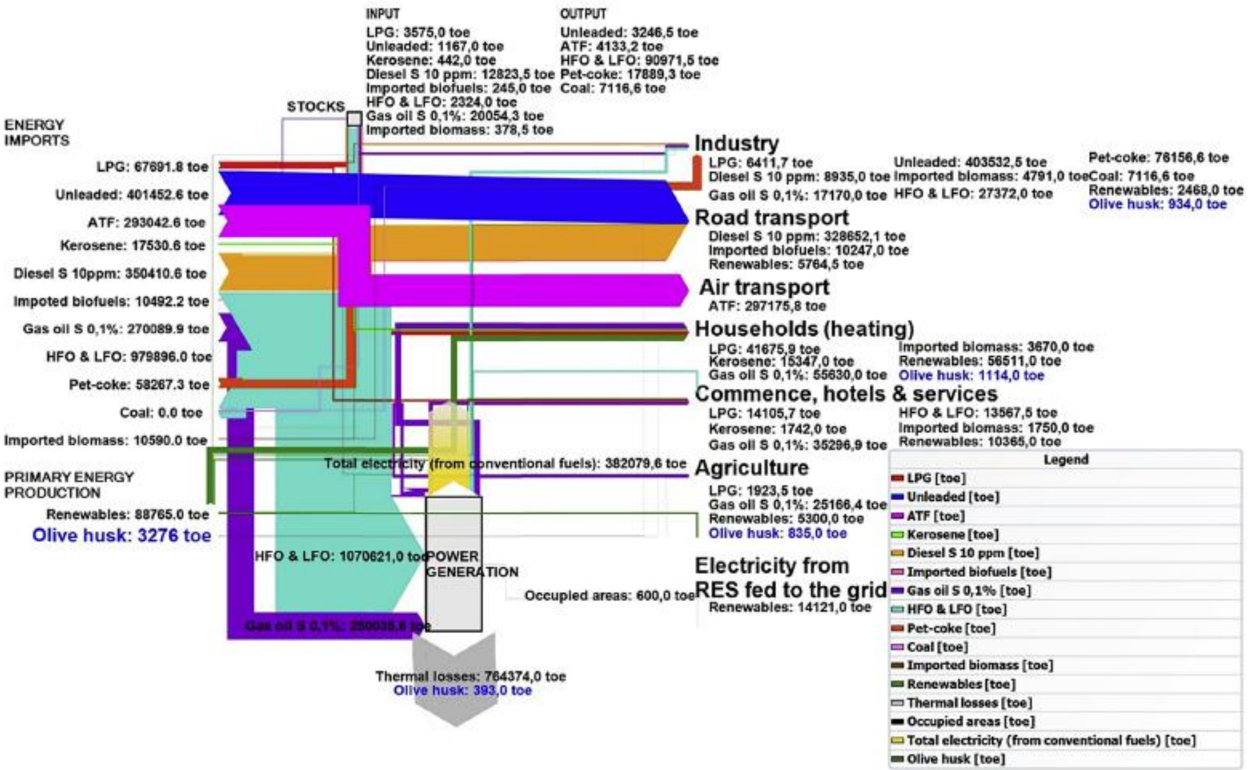
2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Collection and Processing – Feasibility Assessment



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2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Collection and Processing – Feasibility Assessment

Technical data of olive mills solid waste pellet plant equipment.

Equipment/property	Unit
Dryer	
Manufacturer	Litsakis Pantelis & Antonios O.E. (GR)
Model	Phaethon 1
Power	3 kW
Capacity	max 250 kg h^{-1}
Milling machine	
Manufacturer	KOVO NOVÁK (CZ)
Model	RS 650
Power	7.5 kW
Number of blades	18
Capacity	100–500 kg h^{-1}
Sieves size	4 mm
Cyclone power	2.5 kW
Pellet Mill	
Manufacturer	Laizhou Chengda Machinery Co., Ltd. (CN)
Model	AMP360c
Type	Rotating roller (3 rollers)
Power	22 kW
Capacity	220–500 kg h^{-1}
Pellet diameter	6 mm
Weighing and packaging assembly	
Manufacturer	Metrotech (GR)
Model	TEDEA 1263
Class	C3
Capacity	50–635 kg

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2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Collection and Processing – Feasibility Assessment

Assumptions taken into consideration for the feasibility analysis of the olive mills solid waste pellet production plant – Baseline case study.

Assumption	Value	Unit
Operation		
Investment	60,000	€
Instalments	326	€ $month^{-1}$
Inflation	3	%
Depreciation	20	years
Personnel[a,b]	2030	€ $month^{-1}$
Other cost	500	€ $month^{-1}$
Rent	250	€ $month^{-1}$
Power	50	kW
Electricity	0.2	€ kWh^{-1}
rowheadTransportation		
Average transportation distance	100	km
Truck capacity	20	tonnes
Diesel fuel cost	1.30	€ lt^{-1}
Fuel consumption (empty)[c]	23	lt 100 km^{-1}
Fuel consumption (full)[c]	32	lt 100 km^{-1}
Truck maintenance[d]	850	€
IRR	10%	%
NPV	4	%

[a] Two full-time employees.
[b] GDP [€] (nominal, 2013):26,389 [43].
[c] Data taken from Volvo Trucks webpage [44].
[d] Every 18,000 km.

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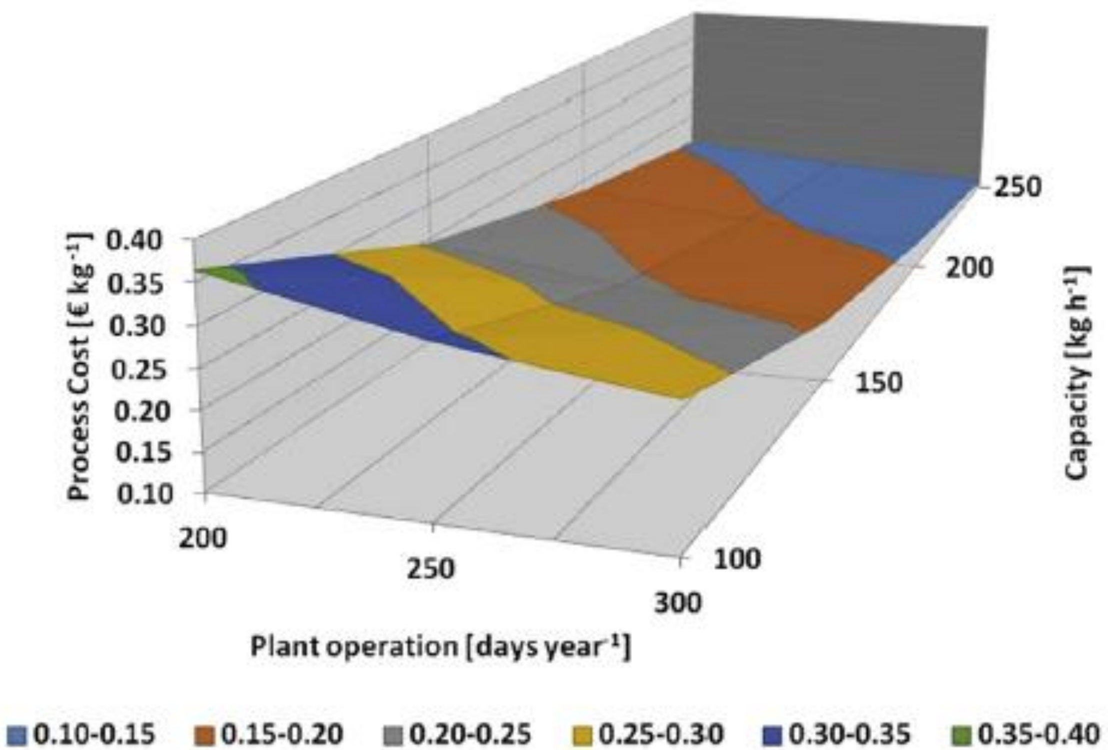
2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Collection and Processing – Feasibility Assessment



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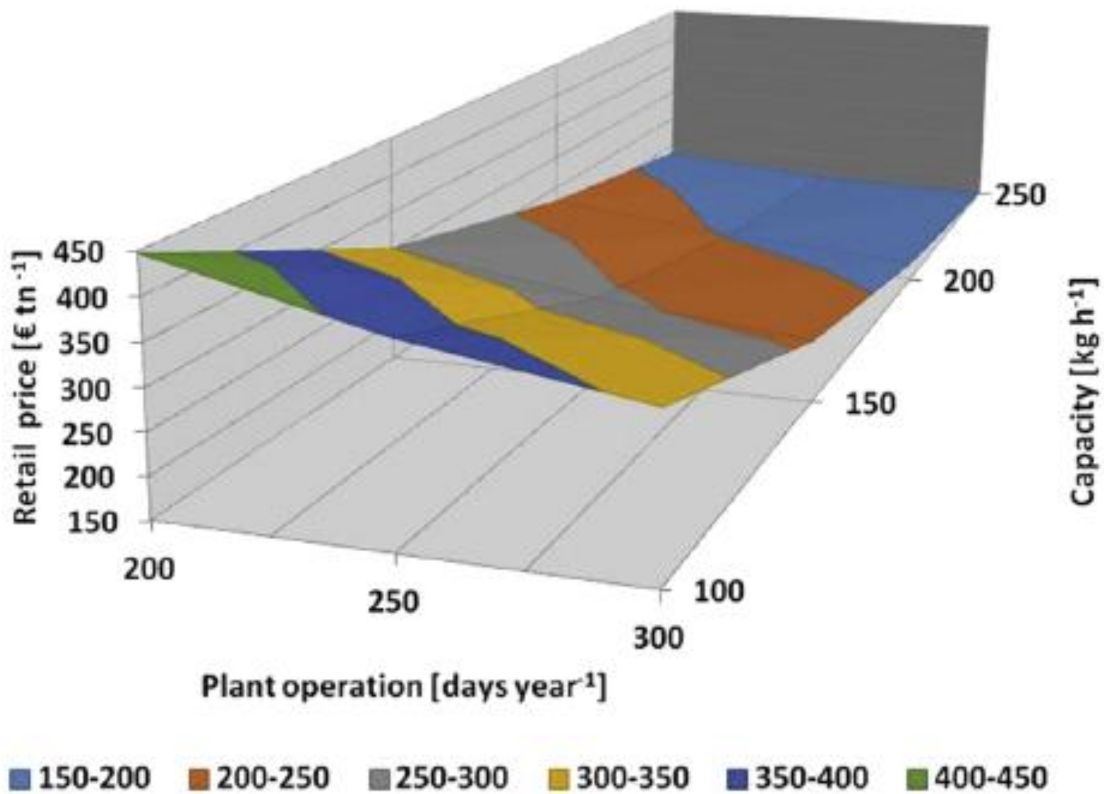

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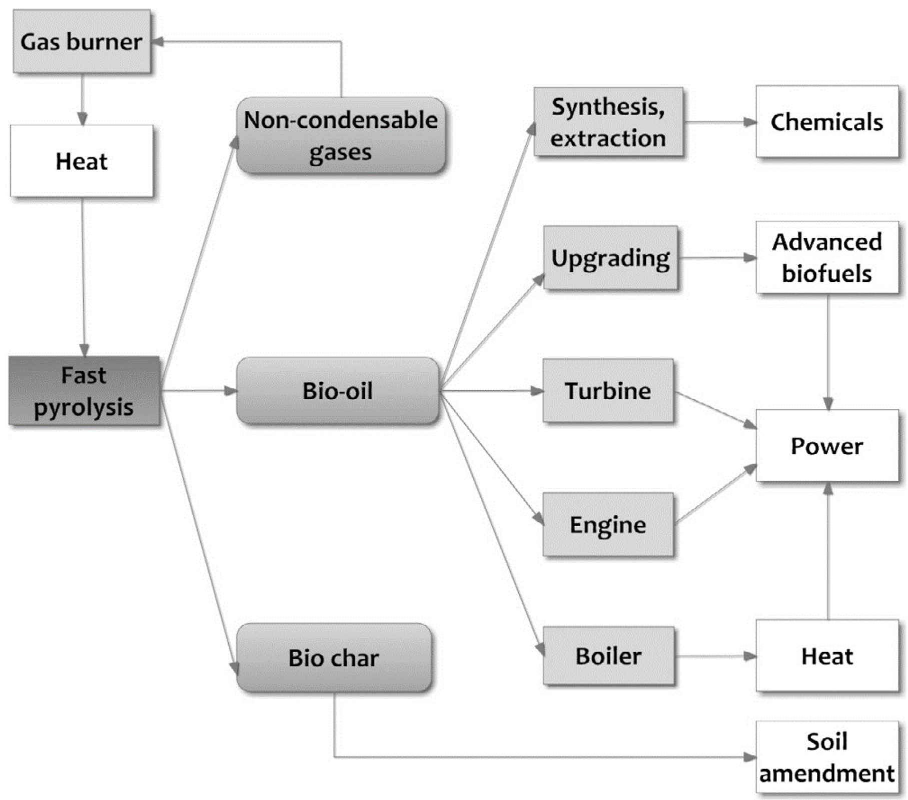
2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Fast Pyrolysis – Exploitation Options



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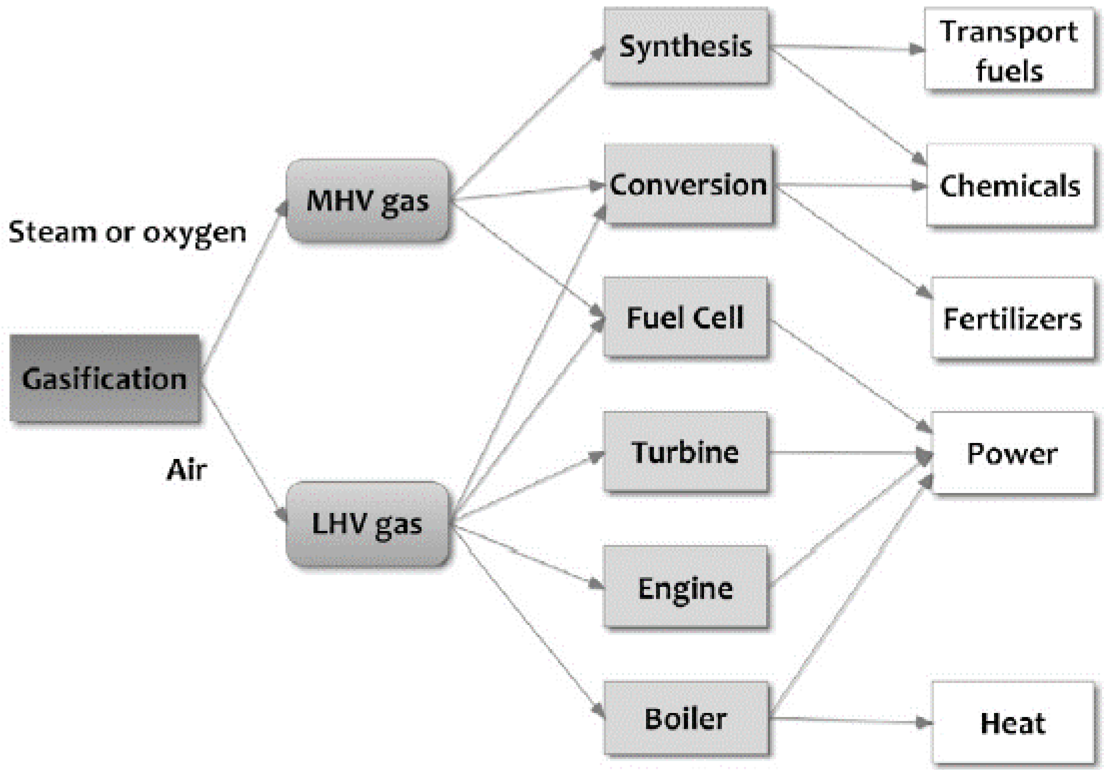
2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

OMSW Gasification – Exploitation Options



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2. Waste to Energy Technologies for Exploitation of Olive Mill Solid Waste (OMSW)

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- Christoforou, E. A., Fokaides, P. A., & Kyriakides, I. (2014). Monte Carlo parametric modeling for predicting biomass calorific value. **Journal of Thermal Analysis and Calorimetry**, 118(3), 1789-1796. link

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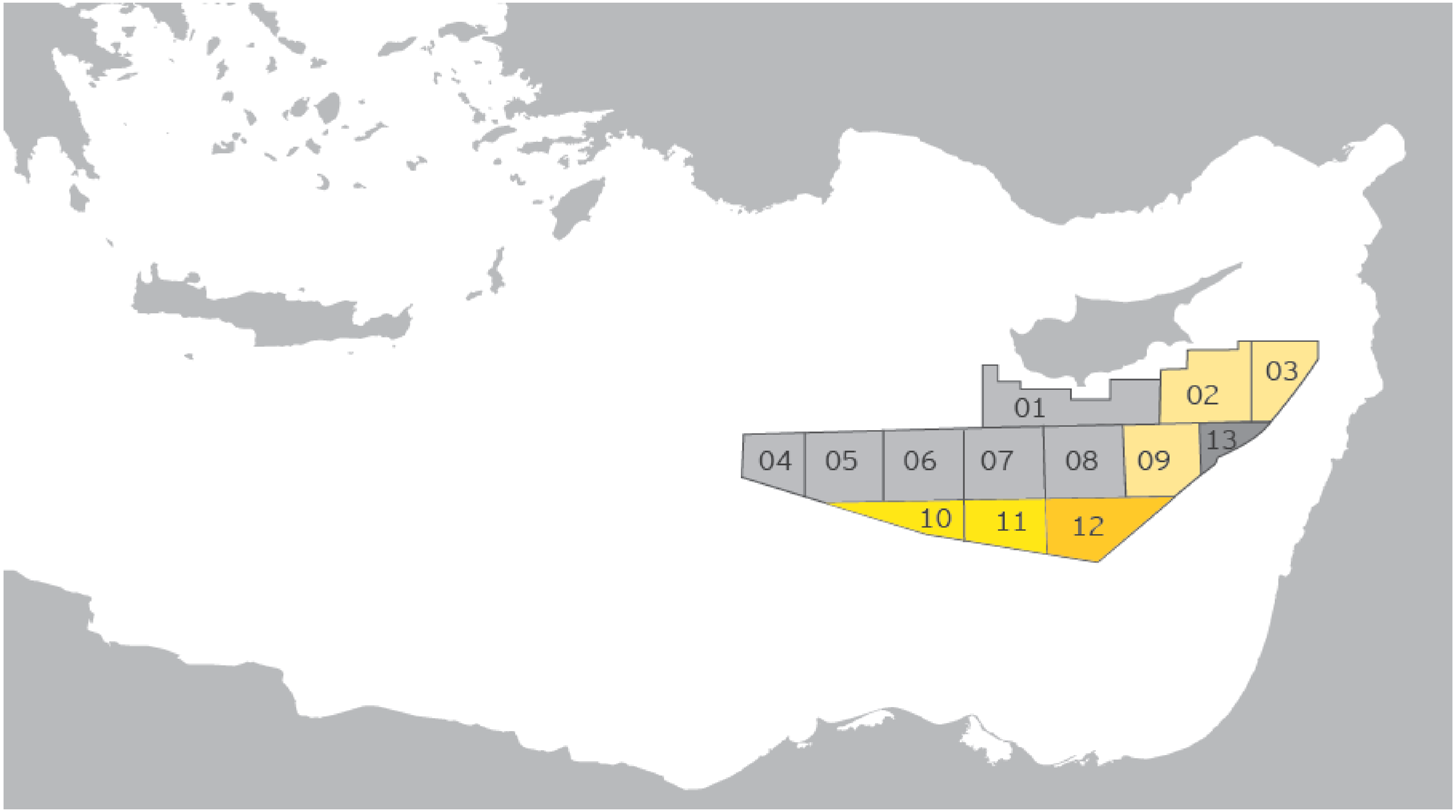
3. Pilot station for OMSW pelleting

Media Presentation

- https://www.youtube.com/watch?v=2QId0Qs1LEY&t=6s

4. Israel - Cyprus - Greece Energy Relations: Collaboration Perspectives for the Future

Cyprus Oil Exploitation Blocks



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Block 12

Estimated gross resources of natural gas revised to 4.5tcf (or 127 bcm) in 2014 from 4tcf (or 113bcm) initially estimated.

Estimated 9m barrels of condensate in 2014, up from 8.1m initially estimated.

In November 2015, BG International acquired a 35% interest in Block 12 for total cash consideration of $165m.

Noble and its partners postponed further drilling in Block 12 into 2016.

Noble Energy: 35%

BG International: 35%

Delek Drilling Partnership: 15%

Avner Oil Exploration Partnership: 15%

Blocks 2, 3, 9

Preliminary results from drilling showed inadequate quantities of exploitable natural gas at the Onasagoras and Amathusa fields (Block 9).

Eni: 80% participating interest

Kogas: 20% participating interest

Blocks 10 & 11

TOTAL relinquished its licence over block 10 without drilling any wells, while renewed its lease of Block 11 for 2 years until February 2018.

TOTAL

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4. Israel - Cyprus - Greece Energy Relations: Collaboration Perspectives for the Future

Projects of Common Interest (PCI)

- Regulation (EU) No 347/2013 of the European Council sets out a process to establish on a two-yearly basis Union-wide lists of **'Projects of Common Interest' (PCIs)** which will contribute towards the development of energy infrastructure networks in Europe.
- Projects labelled as PCIs will benefit from improved regulatory treatment and may be eligible for funding under the Connecting Europe Facility. They shall also benefit from **faster and more efficient permitting procedures**.
- Within this framework, **EIA for PCIs and for transboundary projects** come into discussion.

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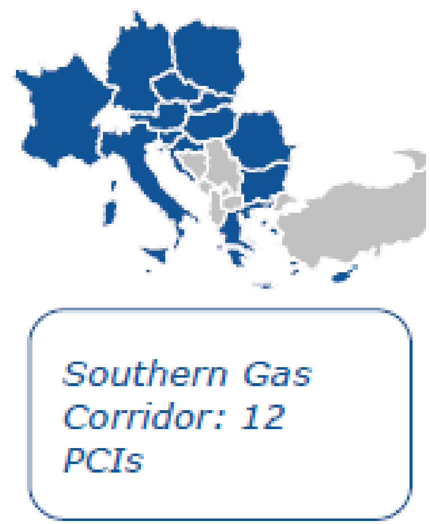
4. Israel - Cyprus - Greece Energy Relations: Collaboration Perspectives for the Future

Euro-Asia Interconnector

Following energy priority corridors involve Cyprus:

- North-South Interconnection East – Electricity
- North-South Interconnection East – Gas
- Southern Gas Corridor



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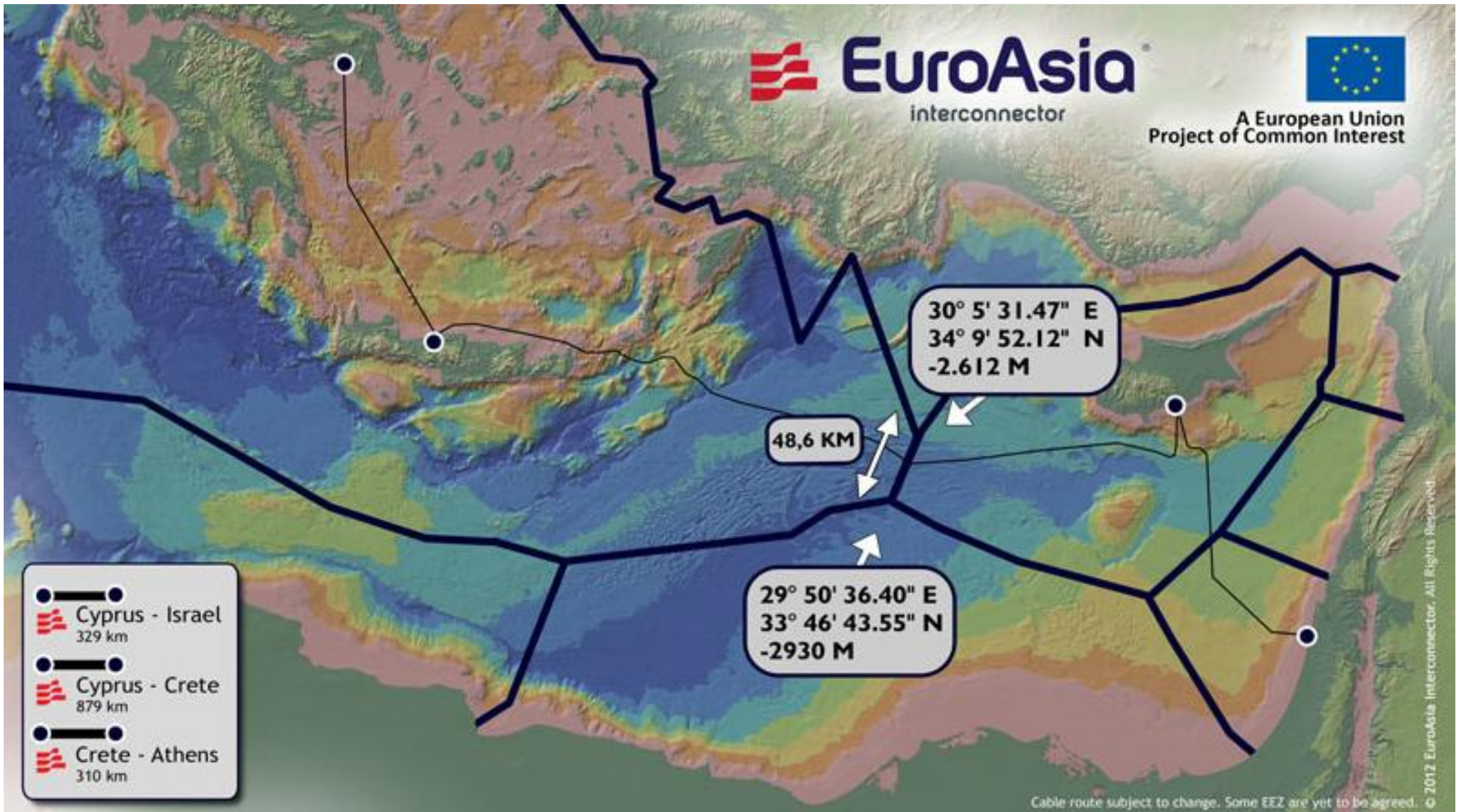
Euro-Asia Interconnector



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Euro-Asia Interconnector

- The EuroAsia Interconnector will link the **electrical systems of Israel, Cyprus and Greece (via Crete)** through sub-marine DC cables and HVDC onshore stations in each country/location, and will have a **capacity of 2000 MW**
- The project creates an **energy bridge between the two continents** with a total length of the **interconnector being approx. 1520 km**, and creates a reliable alternative corridor for transferring electricity to Europe

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Euro-Asia Interconnector

- The **287-kilometre (178 mi) cable will link Israel with Cyprus**.
- Cyprus will be connected with the Greek island of Crete. From Crete, an existing cable will be used for connection to Peloponnese in mainland Greece providing a connection to the pan-European electricity grid.
- The total length of the interconnector will be about 540 nautical miles (1,000 km; 620 mi) and it would be laid depths of up to 2,000 metres (6,600 ft) under sea level.
- It is expected to cost €1.5 billion, of which €500 million is the cost of the Israel–Cyprus link.

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Euro-Asia Interconnector – Benefits for Cyprus

- **Ends the energy isolation of Cyprus** as an EU member state
- Creates the electricity highway from Israel-Cyprus-Crete-Greece (Europe) through which **the European Union can securely be supplied with electricity produced by the gas reserves in Cyprus and Israel as well as from the available Renewable Energy Sources**
- Contributes to the target of the European Union for **10 % of electricity interconnection between Member States**
- Provides significant **socio-economic benefits at the range of 10 billion euros**. The expected cost of step one and step two of the project is 1.5 billion euros and will be undertaken in full by EuroAsia Interconnector

4. Israel - Cyprus - Greece Energy Relations: Collaboration Perspectives for the Future

East-Med Pipeline

4. Israel - Cyprus - Greece Energy Relations: Collaboration Perspectives for the Future

East-Med Pipeline

- The Eastern Mediterranean (EastMed) pipeline project relates to an **offshore/onshore natural gas pipeline, directly connecting East Mediterranean resources to Greece via Cyprus and Crete** that could:
  I. enhance Europe's gas security of supply via diversification of counterparts, routes and sources;
  II. develop EU indigenous resources such as the offshore gas reserves around Cyprus and Greece; and
  III. promote the development of a South Mediterranean Gas Hub.
- The project is being currently designed to transport up to **16 Bcm/y (billion cubic meters of gas per year) from the off-shore gas reserves in the Levantine Basin (Cyprus and Israel)** as well as from the potential gas reserves in Greece.
- The pipeline, in conjunction with the Poseidon and IGB pipelines, could supply gas to Italy and other South East European countries.

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East-Med Pipeline

- The EastMed project current design envisages **a 1.300 km offshore pipeline with various diameters (24÷32 inch) and a 600 km onshore pipeline (42 inch diameter)**. The pipeline, starts from the new natural gas discoveries in the East Mediterranean region and comprises the following sections:
  - **I. 200 km offshore pipeline stretching from Eastern Mediterranean sources to Cyprus;**
  - **II. 700 km offshore pipeline connecting Cyprus to Crete Island;**
  - **III. 400 km offshore pipeline from Crete to mainland Greece (Peloponnese);**
  - **IV. 600 km onshore pipeline crossing Peloponnese and West Greece.**
- The EastMed pipeline is preliminarily designed to have exit points in Cyprus, Crete, mainland Greece as well as the connection point with the Poseidon pipeline.

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East-Med Pipeline

- In 2015, with the support of the Cypriot, Greek and Italian Governments, the EastMed pipeline has been **confirmed as Project of Common Interest (PCI)**, being included by the EU Commission in the second PCI list among the Southern Gas Corridor projects.
- The EastMed project has also been included in the last Ten Years Development Plan (**TYNDP**), in line with the objective of the European Network Transportation System Operators of Gas (ENTSOG).
- The project has been awarded in 2015 with European grants of **2 million euro through the Connecting Europe Facility (CEF) program necessary for the co-finance of the Pre-FEED activities**.
- In January 2016, after a Trilateral Summit held in Nicosia, the Prime Ministries of Cyprus, Israel and Greece issued a joint Declaration in which they confirmed the strong support to the EastMed project for the export of Eastern Mediterranean gas to continental Europe.

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Projects of Common Interest (PCI) – European Directive 2011/92

- The European Directive 2011/92/EU on the assessment of the effects of public and private projects on the environment, known as the Environmental Impact Assessment (EIA) Directive, contains **specific provisions for cases where a project carried out in a Member State is likely to have significant effects on the environment of another Member State** (Article 7)
- The 1991 UNECE Convention on Environmental Impact Assessment in a Transboundary Context, known as the **Espoo Convention**, introduces specific rules for the conduct of EIA of activities in the territory of a Party designated as the Party of origin and is likely to cause significant adverse cross-border effects in another Contracting Party, defined as the affected party.

4. Israel - Cyprus - Greece Energy Relations: Collaboration Perspectives for the Future

Projects of Common Interest (PCI) – Espoo Convention

- The Espoo Convention (1991) sets the rules for conducting an environmental impact assessment in a cross-border context.
- The **EU has ratified the Espoo Convention**, which now forms an integral part of EU law and has priority over secondary legislation established under the Treaty on the Functioning of the European Union.
- This means that EU legal provisions should be interpreted in accordance with the Espoo Convention.

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