

# Closing the Loop between Waste-to-Energy Technologies: A Holistic Assessment Based on Multiple Criteria

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## SUPPLEMENTARY MATERIAL

### S1) QUESTIONNAIRE TO THE PUBLIC.

Age: 1)  $\leq 24$

2) 25-39

3) 40-64

4)  $\geq 64$

Education level:

1) Primary school degree

2) High school degree

3) University degree

4) Master's or PhD title.

What is your opinion on energy production from waste?

1) It is absolutely necessary

2) I'm positive

3) I'm neutral

4) I'm negative

5) I totally disagree

**Incineration** is a waste-to-energy method in which thermal and electric energy is produced from the burning of waste. Flue gases are then cleaned with proper technology. How informed are you in relation to this method?

1) I have a clear understanding of the method

2) I've heard of it, but I don't have a clear understanding

3) I've never heard of it

In an **anaerobic digestion** unit, organic material (manure, food, etc.) decomposes with the help

of microorganisms in special tanks. The biogas that is produced is utilized in the production of thermal and electric energy, as a fuel. How informed are you in relation to this method?

- 1) I have a clear understanding of the method
- 2) I've heard of it, but I don't have a clear understanding
- 3) I've never heard of it

**Gasification** is a novel method in which waste is not burned, but converted to gaseous fuel, in high temperatures and small amounts of air, inside special chambers. The fuel then is cleaned from pollutants and is utilized to produce thermal and electrical energy. How informed are you in relation to this method?

- 1) I have a clear understanding of the method
- 2) I've heard of it, but I don't have a clear understanding
- 3) I've never heard of it

**Pyrolysis** is a novel method in which the waste is converted into gaseous and liquid fuel, in high temperatures, inside special chambers. The procedure is done in absence of air, and the products, after they are cleaned from pollutants, are utilized in the production of thermal and electric energy. How informed are you in relation to this method?

- 1) I have a clear understanding of the method
- 2) I've heard of it, but I don't have a clear understanding
- 3) I've never heard of it

According to your opinion, what are the most important benefits from the operation of a waste-to-energy unit, near your area of residence? (Up to 2 answers)

- 1) Independence from fossil fuels (oil, lignite, etc.)
- 2) New job opportunities
- 3) Reduction of environmental pollution and climate change
- 4) Reduction in heating costs, through the use of district heating
- 5) Reduction of the amount of waste that is landfilled
- 6) There is no benefit
- 7) Not applicable

According to your opinion, what are the most important downsides from the operation of a waste-to-energy unit, near your area of residence? (Up to 2 answers)

- 1) Negative impact on public health (through air and ground pollution)
- 2) Aesthetic degradation of the landscape
- 3) The land would lose a part of its value
- 4) It would reduce public participation in recycling
- 5) It would cause traffic congestion due to frequent passage of garbage trucks
- 6) There is no downside

7) Not applicable

How do you assess the operation of an incineration plant near your area, given that all the necessary anti-pollution measures are followed?

- 1) Definitely positive
- 2) Probably positive
- 3) I'm neutral
- 4) Probably negative
- 5) Definitely negative

How do you assess the operation of an anaerobic digestion plant near your area, given that all the necessary anti-pollution measures are followed?

- 1) Definitely positive
- 2) Probably positive
- 3) I'm neutral
- 4) Probably negative
- 5) Definitely negative

How do you assess the operation of a gasification plant near your area, given that all the necessary anti-pollution measures are followed?

- 1) Definitely positive
- 2) Probably positive
- 3) I'm neutral
- 4) Probably negative
- 5) Definitely negative

How do you assess the operation of a pyrolysis plant near your area, given that all the necessary anti-pollution measures are followed?

- 1) Definitely positive
- 2) Probably positive
- 3) I'm neutral
- 4) Probably negative
- 5) Definitely negative

How much do you trust the compliance in respect to audit procedures of operating rules and environmental standards, of a waste-to-energy unit, for our country?

- 1) Absolutely
- 2) Very much
- 3) Much
- 4) I'm neutral

- 5) Little
- 6) Very little
- 7) Not at all.

## S2) QUESTIONNAIRE TO THE EXPERTS

Name:

- 1) Short answer text

Sector/field of expertise:

- 1) Short answer text

Which, in your opinion, is the ranking of the 4 waste-to-energy technologies, from the least to the most expensive, considering plants of the same capacity?

Option 1: Incineration

Option 2: Gasificaton

Option 3: Anaerobic digestion

Option 4: Pyrolysis

Which, in your opinion, is the ranking of the 4 waste-to-energy technologies, in terms of environmental impact, from the least to the most environmentally friendly, for units of same capacity and anti-pollution technologies?

Option 1: Incineration

Option 2: Gasificaton

Option 3: Anaerobic digestion

Option 4: Pyrolysis

To what extent do you think that the above four technologies can be realistically applied, in large scale (and not as a pilot projects) in Greece?

**Table S1.** Question format for the large-scale application of technologies

Incineration	Widely
Gasification	To a great extent
Anaerobic digestion	To a moderate extent
Pyrolysis	To a lesser extent
	Not at all

What do you consider to be the most important reasons that the operation of units with these technologies in Greece, is not progressing at a fast pace (up to 3 answers)?

- 1) Public's belief of significant environmental burden
- 2) Lack of public information of these technologies
- 3) Lack of public confidence in environmental control procedures
- 4) Legislative framework
- 5) Reduced financial viability of investment
- 6) Technological hysteresis
- 7) Aesthetic factor