Production costs of biogas (methane) and electricity in Greek anaerobic digestion facilities

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Introduction

Design

- Farm type and size
- Pre-treatment
- AD technology
- Biogas processing and valorisation

Construction of infrastructure

- Buildings
- Tanks

Acquisition and installation of equipment

- mechanical, safety, generator, etc

Operation by trained personnel

- Waste collection and transportation
- Energy crops

Annual maintenance

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Objectives of the study

- Present current situation of anaerobic digestion facilities in Greece
- Capital and operational expenses of anaerobic digestion facilities with CHP 500 to 2000 kW
- Costs of biogas (methane) and electricity production

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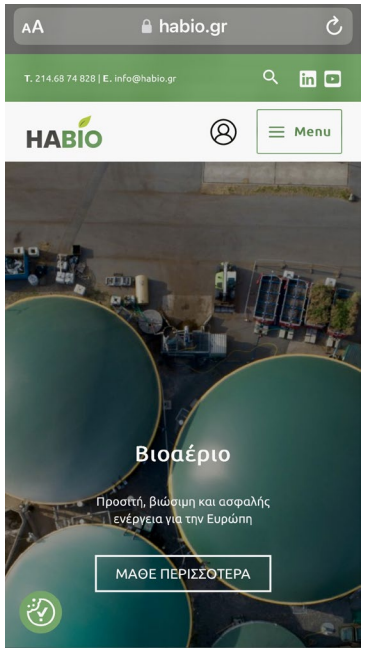
Materials and methods

- HABIO database
- Inventory of full-scale facilities (interviews with plant owners – operators)



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Materials and methods

CAPEX → **Annual eq. CAPEX**
(15 years, 6% interest)

OPEX

- Energy crops
- Waste transportation costs
- Electricity consumption
- Labor
- Maintenance
- Chemicals
- Consulting services

→ **Annual OPEX**

Total Annual COST

Cost / m^3 CH_4
Cost / kWh-el

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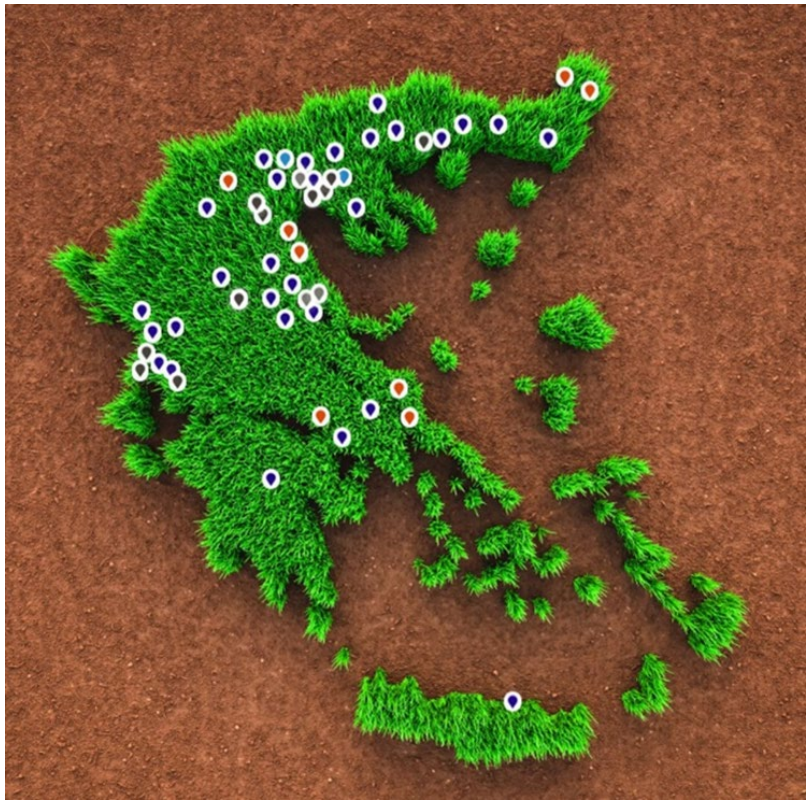
Results

- **Distribution of anaerobic digestion facilities in Greece**



- **Take home message:** Large amount of energy from wastes remain untapped especially in South Greece

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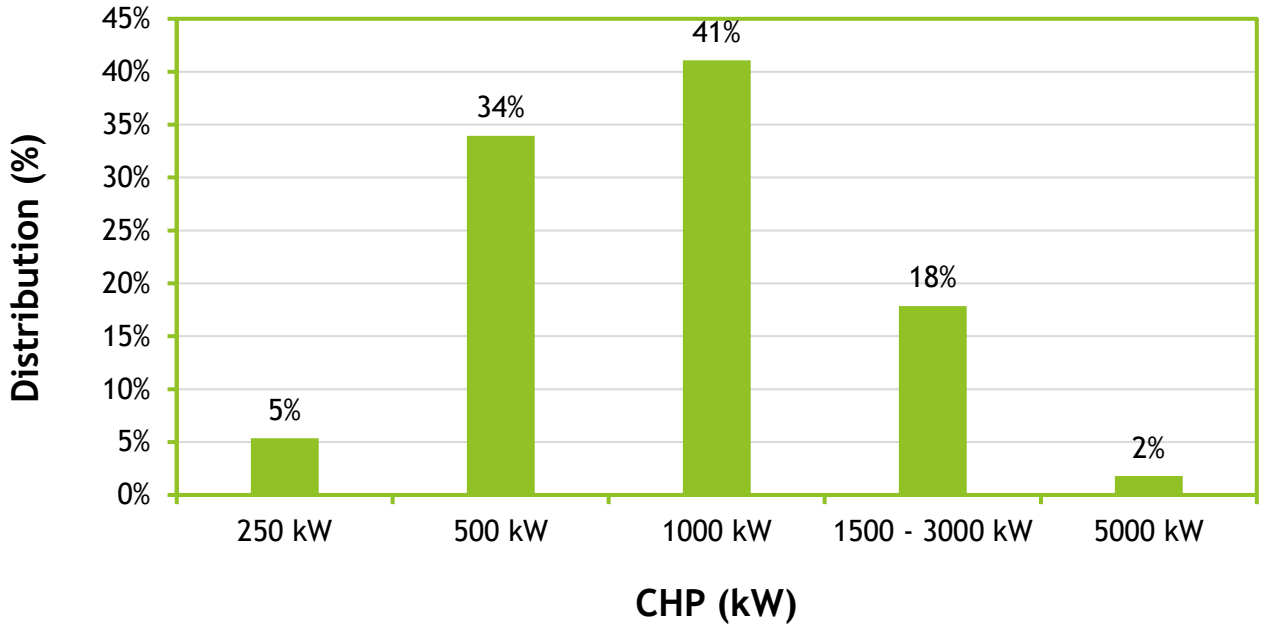
Results

- **Distribution of anaerobic digestion facilities per CHP installed electric power**



- **Take home message:** Greece is dominated (75%) by 500 and 1000 kW anaerobic digestion facilities

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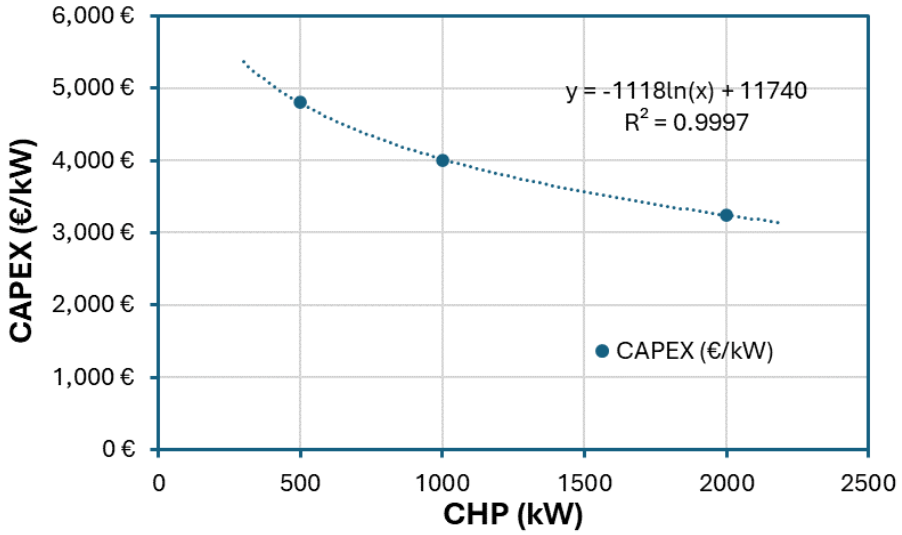
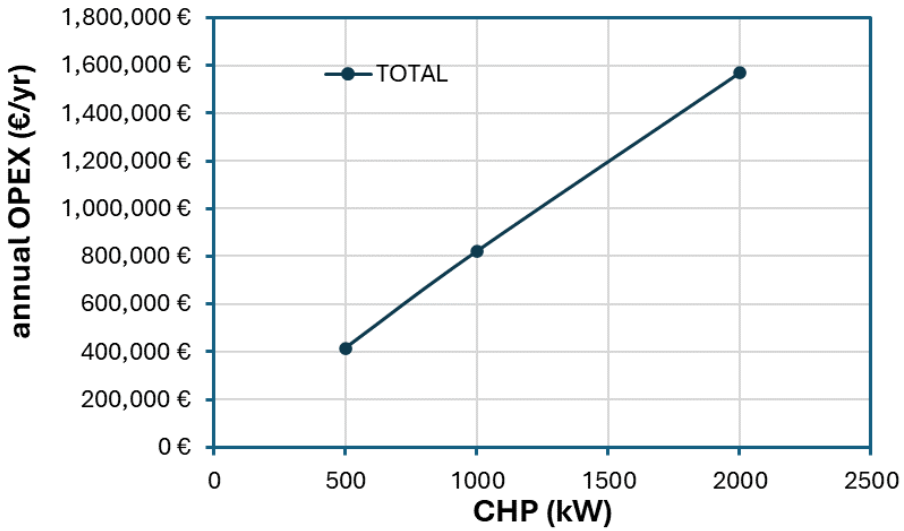
Results

- **CAPEX and annual OPEX for different size anaerobic digestion facilities in Greece**





- **Take home message:** OPEX is the most **important expenditure** in anaerobic digestion facilities

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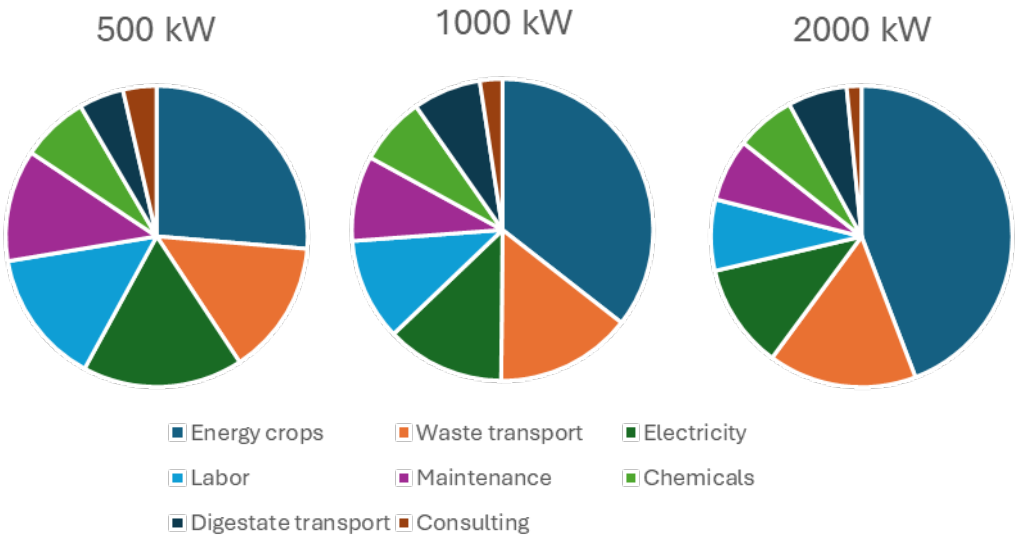
Results

- **Distribution of OPEX for different size anaerobic digestion facilities**



Take home message:
Energy crops and waste transportation expenditures (47-62%), followed by electricity (11-18%), labour (8-15%) and maintenance (7-12%)

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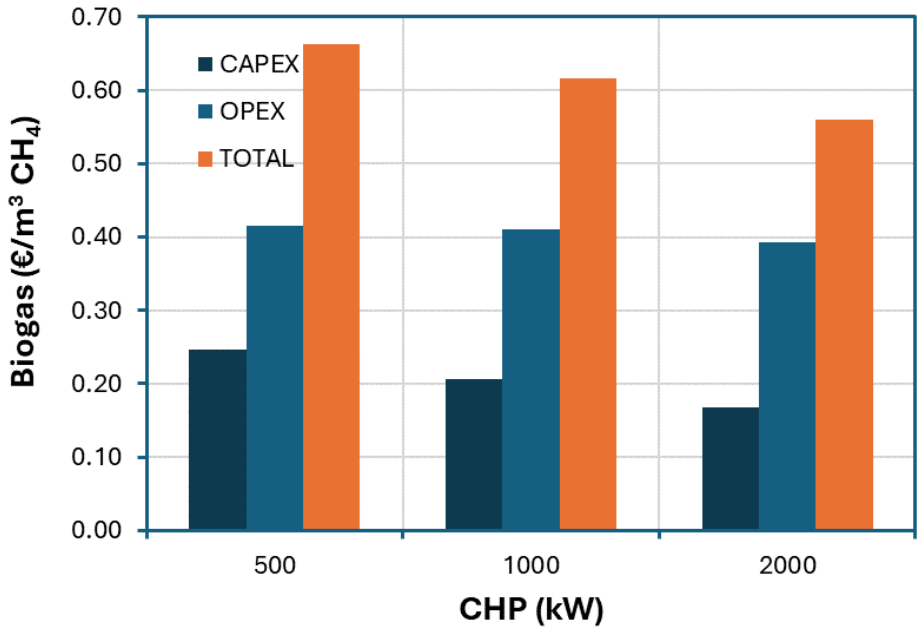
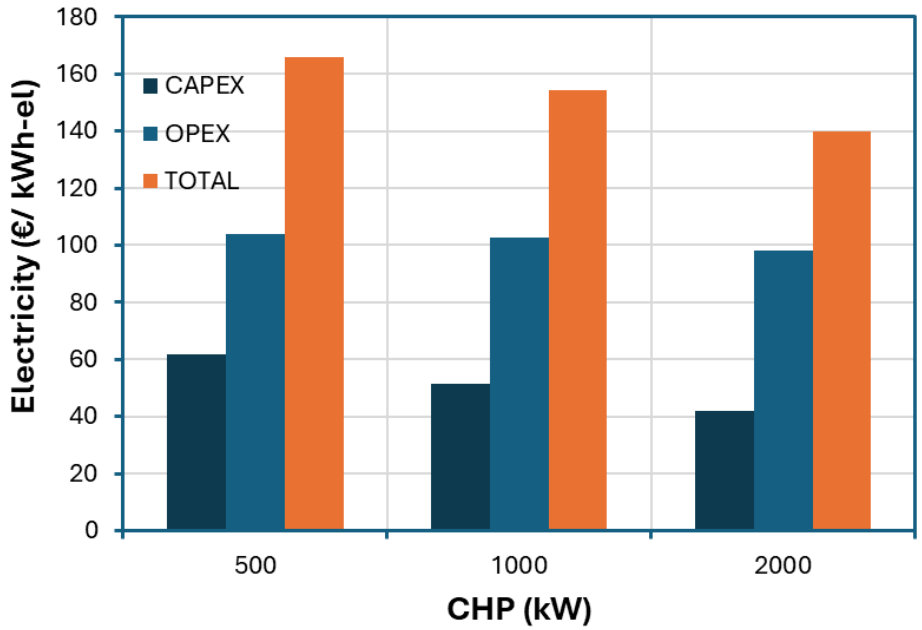
Results

- **Biogas (methane) and electricity production costs**





Take home message:

- Electricity costs 140-165 € / MWh considering 8000 h per year
- Biogas (CH_4) cost within the same range with natural gas, but with 30-50% CO_2

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Conclusions

- **What we need for the future to expand anaerobic digestion facilities in Greece:**
- Strict legislation
- Financial incentives
  - Subsidy investment for CAPEX
  - High electricity price
- Social awareness measures

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