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1st International e-Conference on Energies
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Improving Sustainability of Energy Conversion from Biomass Resources: the case of Bari airport CHP (combined heat and power) fuelled with bioenergy from short chain

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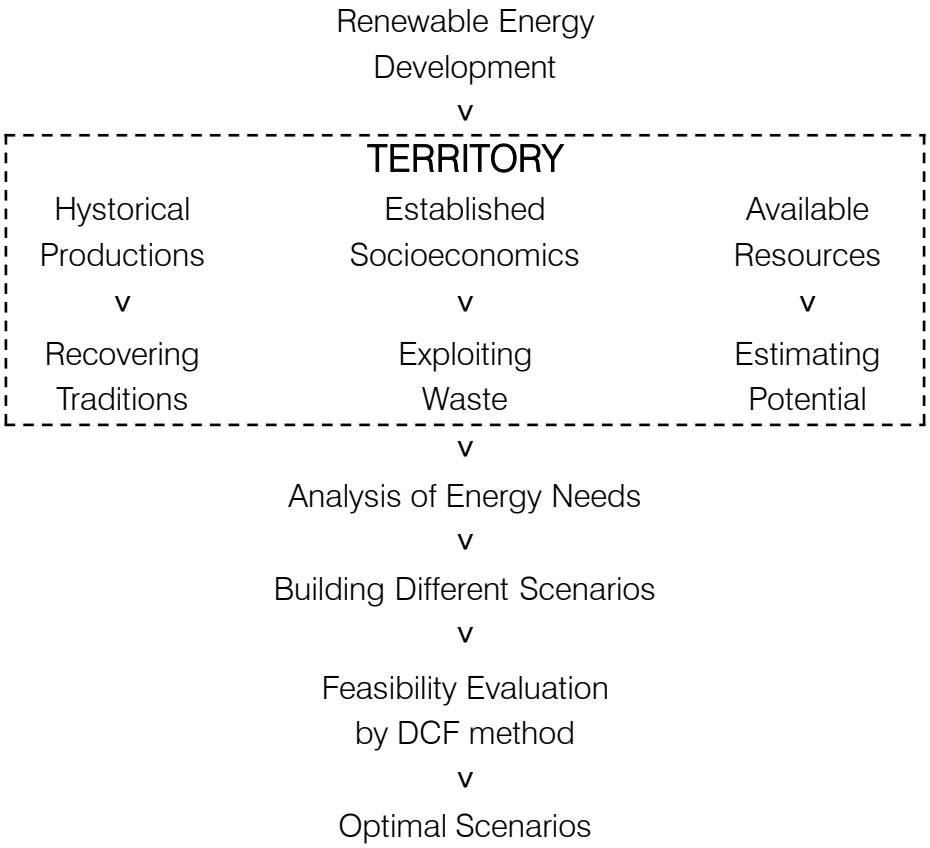
Bioenergy: option for sustainable energy strategy

Introduction

In order to improve sustainability level, it is necessary to investigate and build a new relationship with the territory, not only as the place of production and consumption. Just taking a holistic design approach allows to enhance the local impacts of energy production, meeting the territory needs, so that energy will be a driver for development.

The «Zero Kilometer Energy» (ZKE) model

Flow chart of the ZKE Design Process



Biomass resources of the Territory

As defined above, the first stage is to analyze the local context and recognize established socioeconomics and available resources.
Down line of a study focused on the climatic, pedologic and agrotechnic typical characteristics of Apulian territory close to the Bari Palese Airport, the most suitable biomass resources for the energy up-grading proposed have been identified:

- (B) organic waste from food and agricultural supply chain for the production of biogas from anaerobic co-digestion
- (O) cultivation of rapeseed and sunflower for the production of vegetable oil or biodiesel
- (W) wood chips from pruning of olive trees

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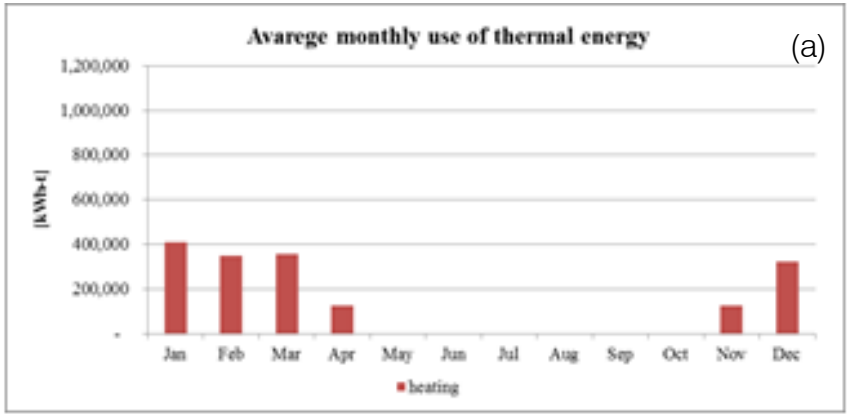
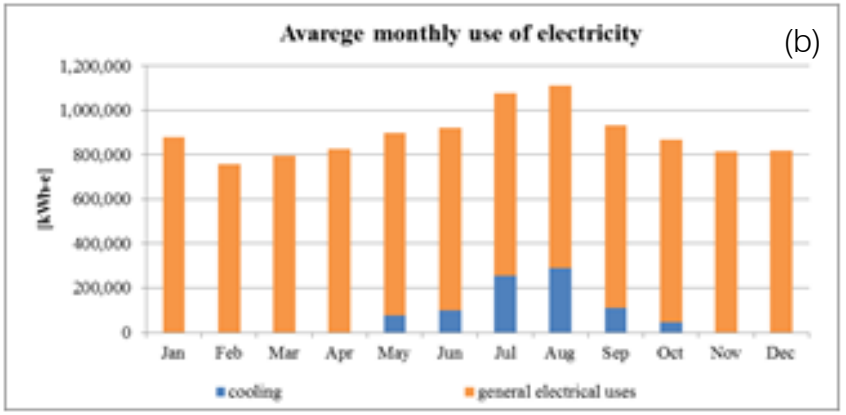
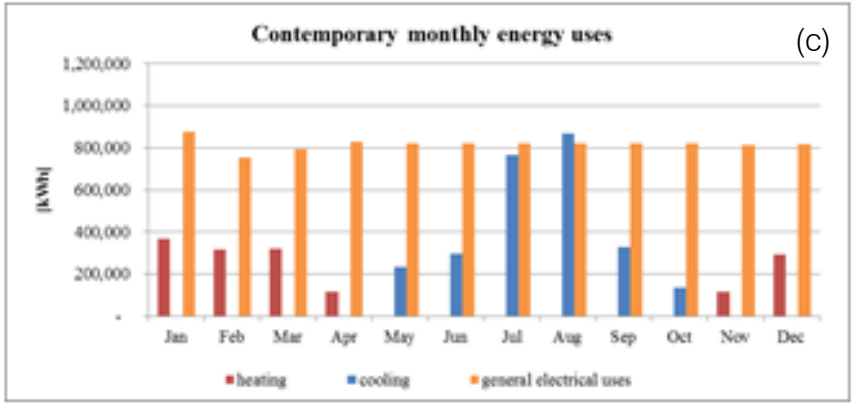
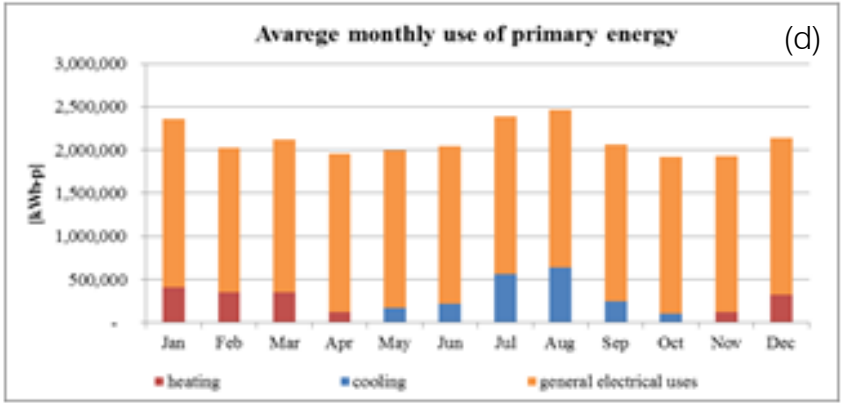
Energy Characterization of the case study: Bari-Palese airport

(a) Average monthly consumption of thermal energy. (b) Average monthly consumption of electricity. (c) Contemporary monthly energy use highlighting. (d) Average monthly consumption of primary energy.









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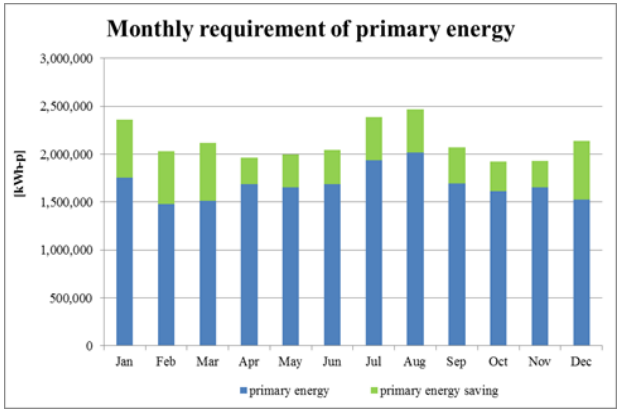
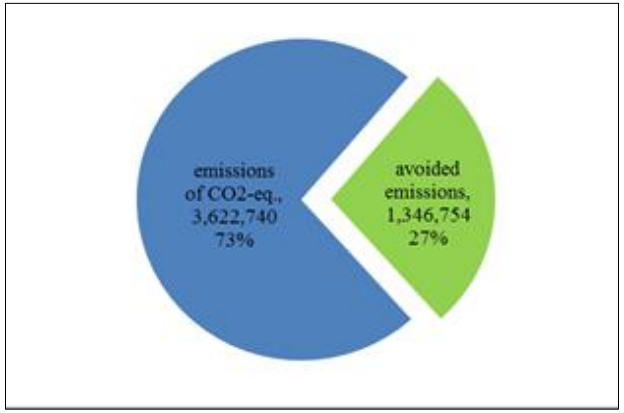
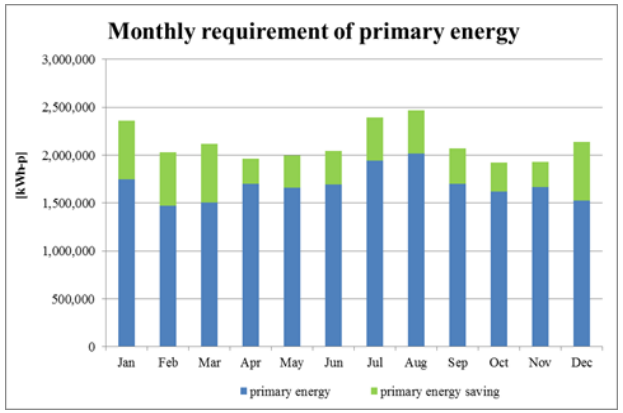
Apulian Region (Italy): Analysis of available bioenergy

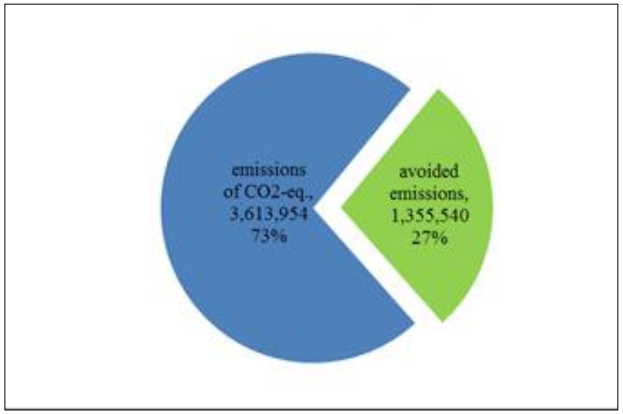
Biogas from food waste
Primary Energy and CO_2 Emissions Saving



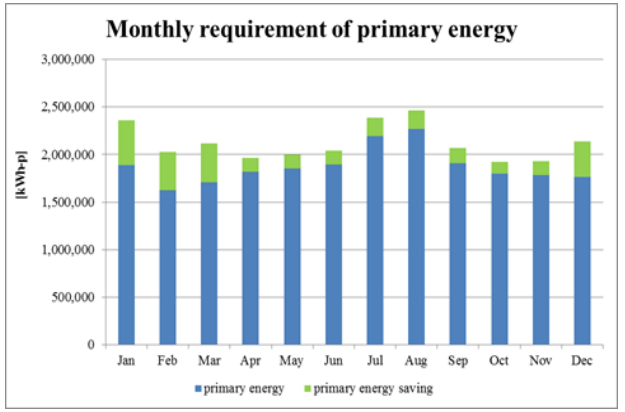


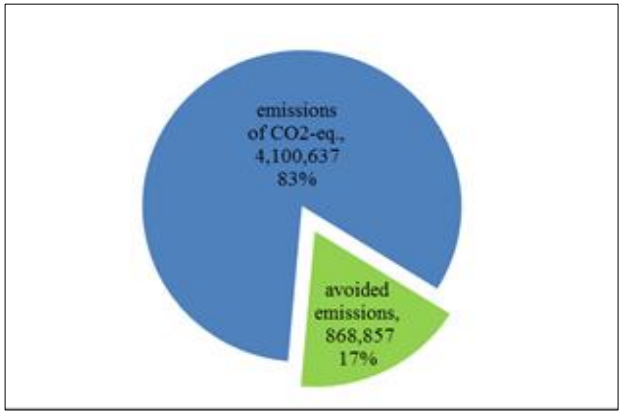
Vegetable Oil / Biodiesel
Primary Energy and CO_2 Emissions Saving





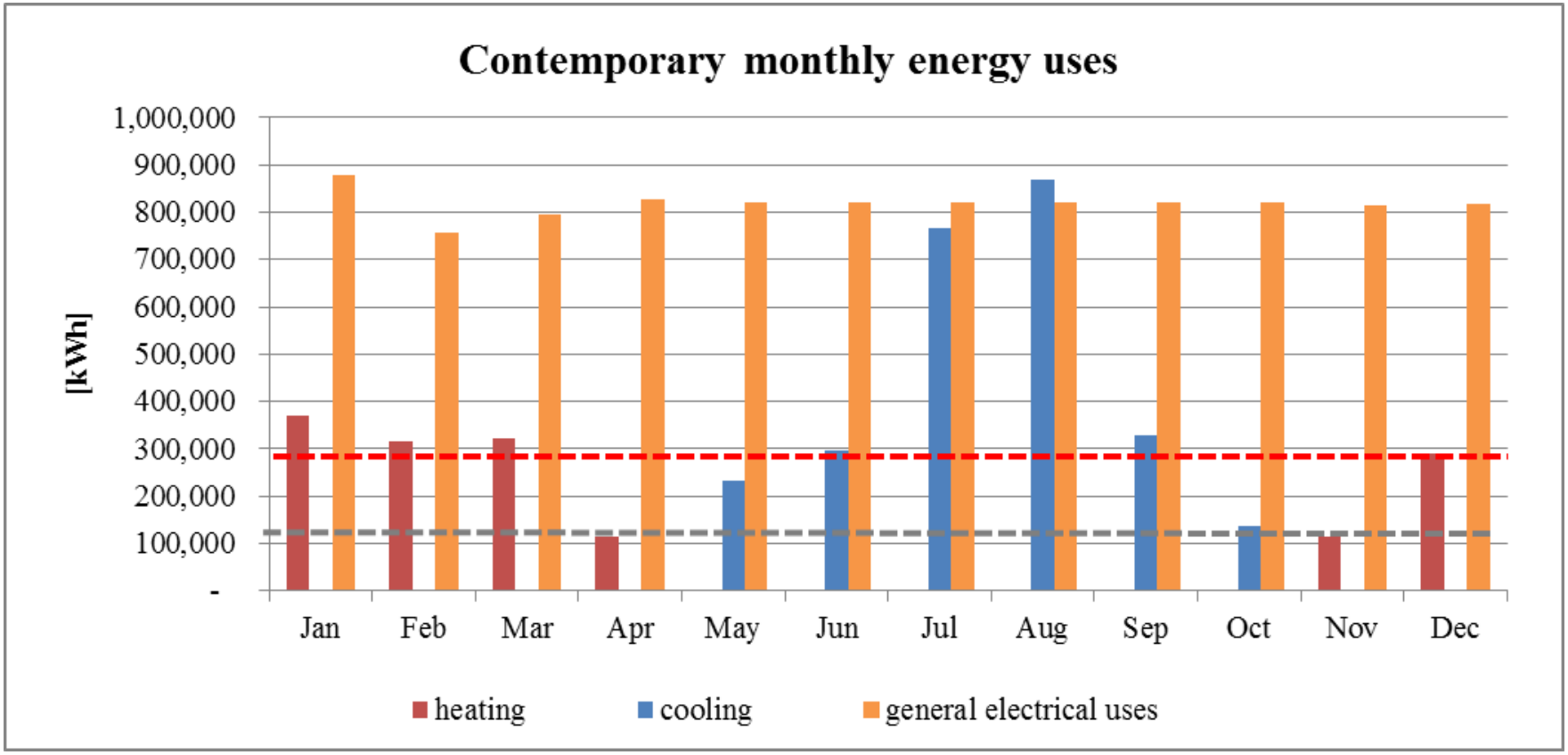
Wood Chips from pruning
Primary Energy and CO_2 Emissions Saving





Sizing of the Tri-generation Plant

Grey Power break line(150 kW) covers minimum thermal energy needs, the Red one (400 kW) covers all thermal energy needs but it has thermal losses in 30% of months. 300 Kw is the optimal plant size.



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Design of Different Scenarios

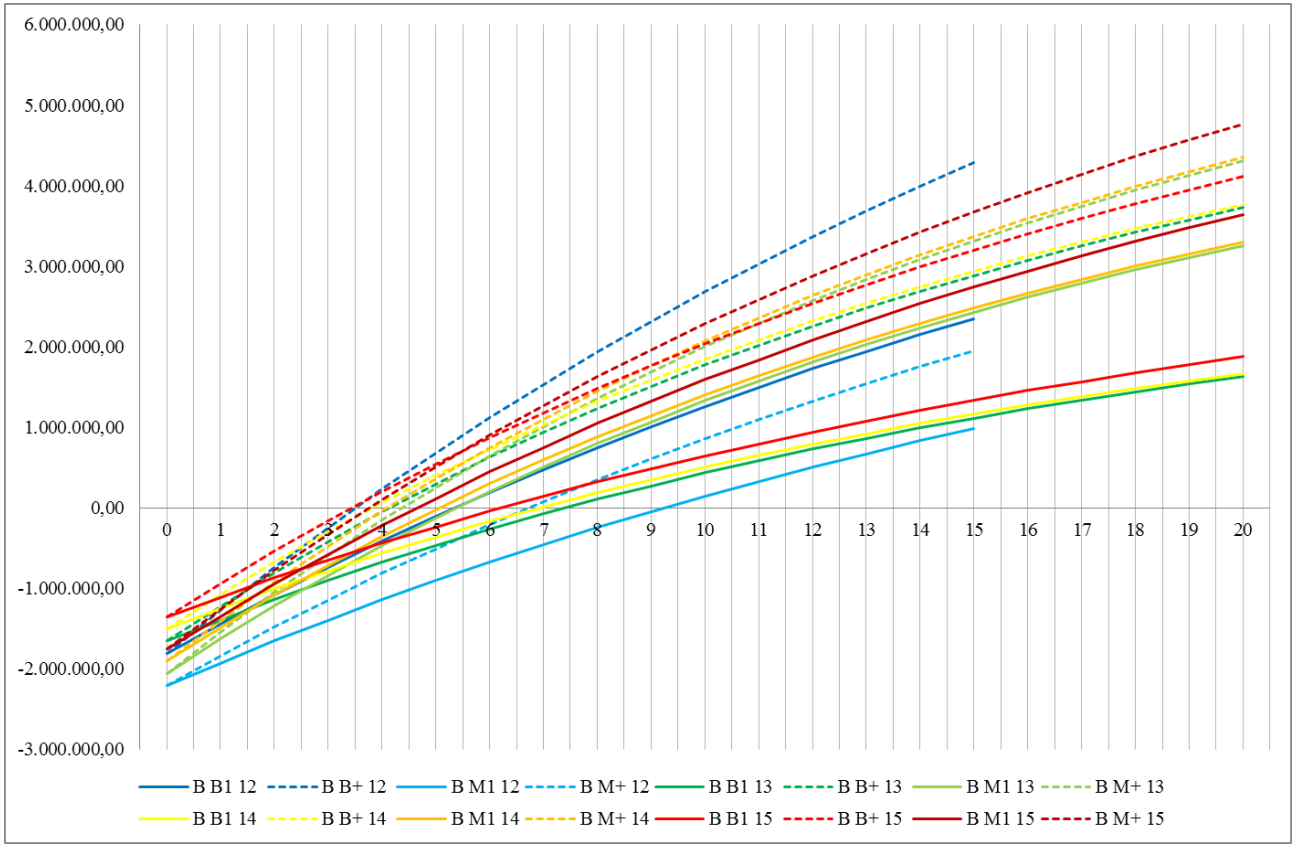
Table of alphanumeric codes of the scenarios

Biogas				Vegetable Oil / Biodiesel				Wood Chips			
B B1 12	B B1 13	B B1 14	B B1 15	O B1 12	O B1 13	O B1 14	O B1 15	W B1 12	W B1 13	W B1 14	W B1 15
B B+ 12	B B+ 13	B B+ 14	B B+ 15	O B+ 12	O B+ 13	O B+ 14	O B+ 15	W B+ 12	W B+ 13	W B+ 14	W B+ 15
B M1 12	B M1 13	B M1 14	B M1 15	O M1 12	O M1 13	O M1 14	O M1 15	W M1 12	W M1 13	W M1 14	W M1 15
B M+ 12	B M+ 13	B M+ 14	B M+ 15	O M+ 12	O M+ 13	O M+ 14	O M+ 15	W M+ 12	W M+ 13	W M+ 14	W M+ 15

(**X** X0 00) B Biogas, O Vegetable Oil / Biodiesel, W Wood Chips
(X **X**0 00) B Basic Incentive, M Maximum Incentive
(X X**0** 00) 1 Conventional Biomass Supply Chain, + Biomass from short chain
(X X0 **00**) 12 Start of production before 31/12/2012, 13 Start of production before 31/12/2013
14 Start of production before 31/12/2014, 15 Start of production before 31/12/2015

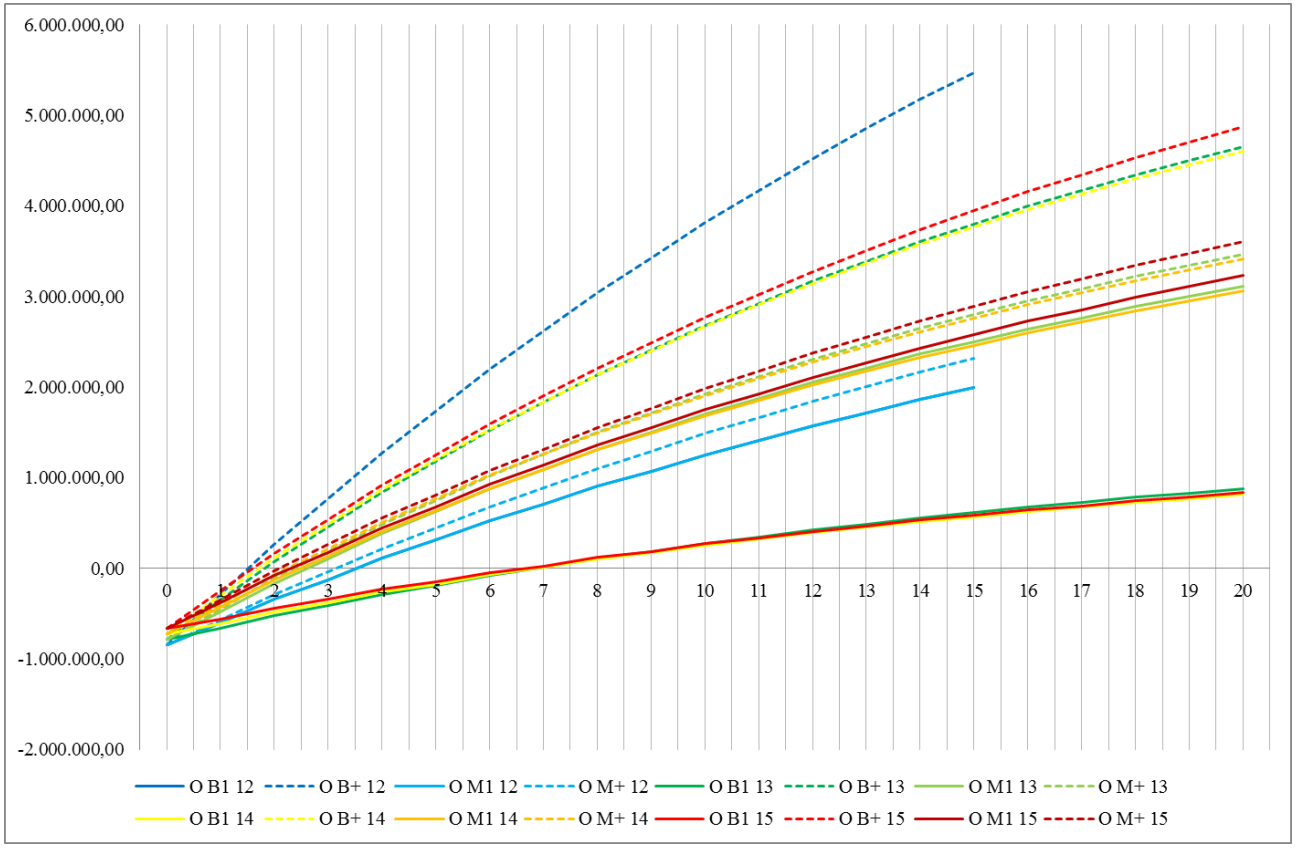
Performances of Cumulative Discount Cash Flow

Biogas from food waste



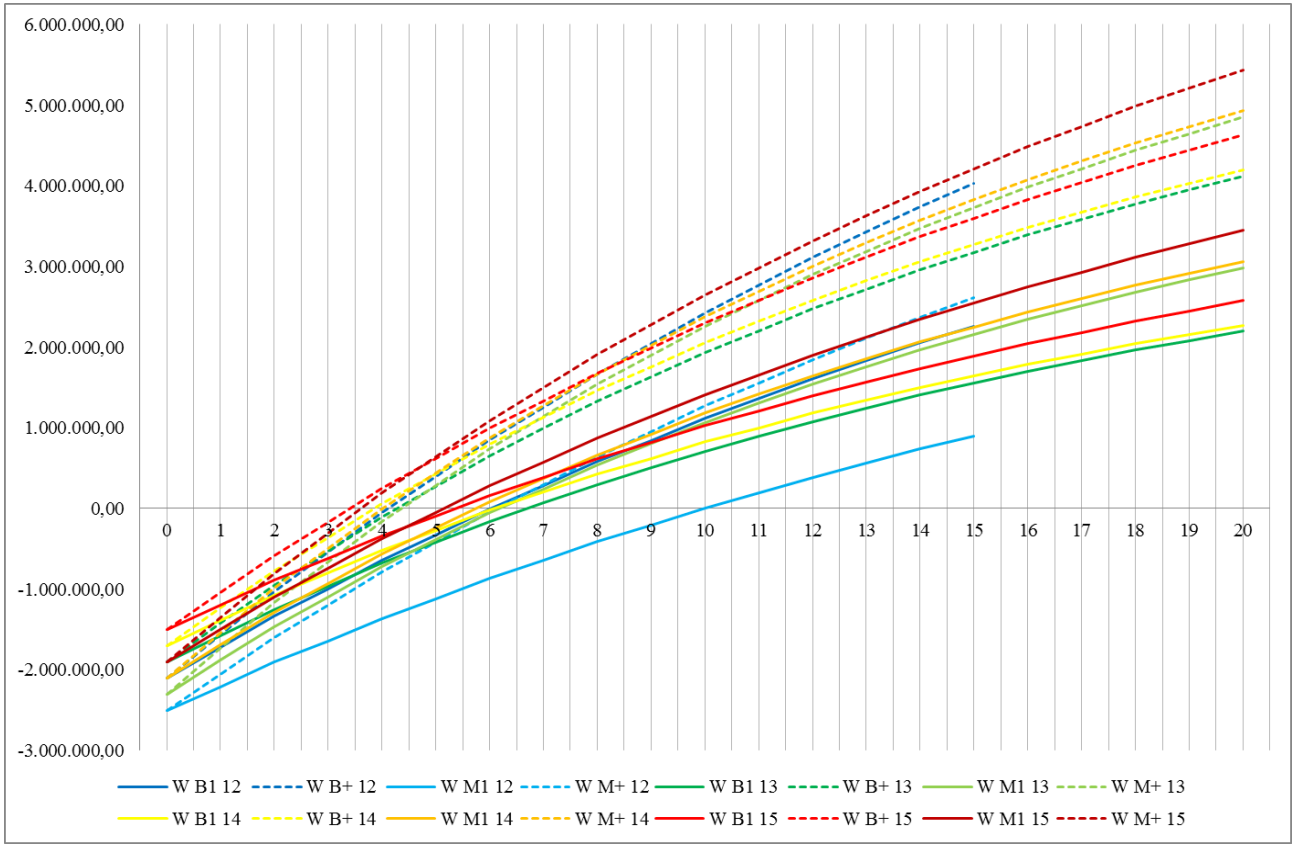
Performances of Cumulative Discount Cash Flow

Vegetable Oil / Biodiesel



Performances of Cumulative Discount Cash Flow

Wood Chips from pruning



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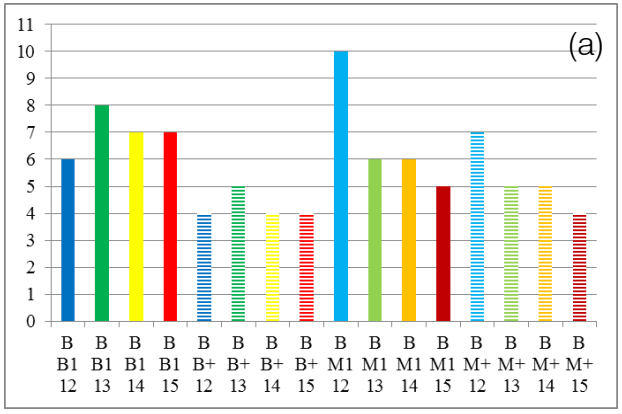
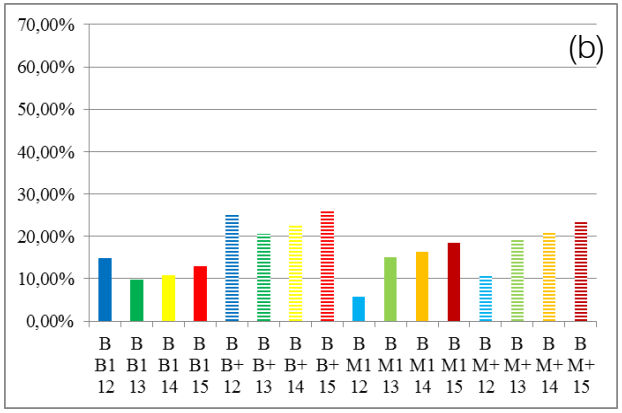
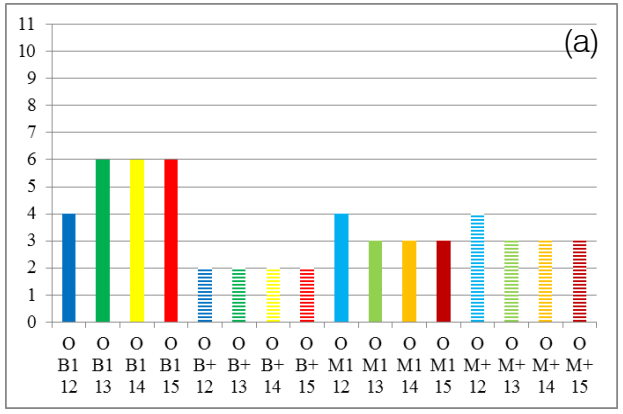
PayBack Period and Internal Rate of Return Parameters

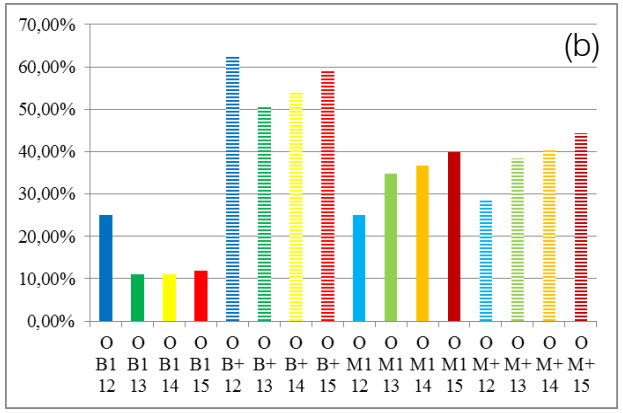
Biogas from food waste
PBP (a) and IRR (b)



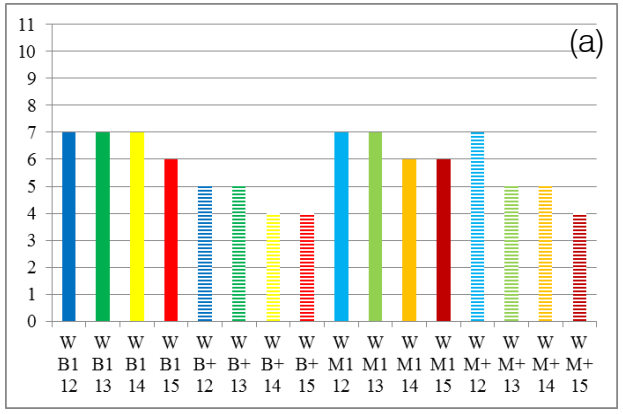


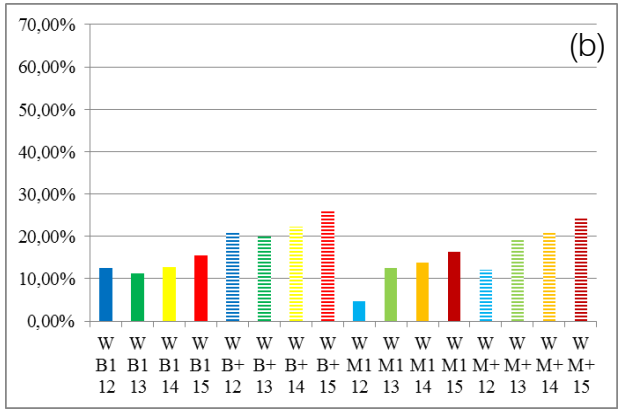
Vegetable Oil / Biodiesel
PBP (a) and IRR (b)





Wood Chips from pruning
PBP (a) and IRR (b)





Conclusions

Sustainability means recognizing the local vocation to offer a development consistent with its resources and potential.

Highlighting the local formed economy, based on olive oil production and consequently the wide availability of pruning, allows to identify **Wood Chips** (W) as the most sustainable bioenergy resource.

Defining the question of an optimal and sustainable energy infrastructure as territorial problem and combining the biomass short chain, the production and distribution systems into one integrated model (ZKE) offer the possibility to systematically analyze the interdependencies between the land resources, the size of the bioenergy plant and the needed biomass in accordance with the local socio-economic context, so as to identify the "**territorial energy vocation**" (TEV).

Thus, renewable energy is identified as a driver for sustainable development.

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Thank you for your attention

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