Project description: Bioenergy can play an important role in addressing climate change as well as improving the security of energy supply in Europe. Small-scale heat and power generation from biomass is in principle able to deliver significant energy and emissions savings through the substitution of substantial quantities of fossil fuels. In particular, the use of biomass waste is expected to contribute to the integrated management of existing farming activities. Integrated management of cultivated species could have an enormous impact on the environment with regards to water and soil quality, biodiversity and landscape preservation. As well as energy benefits, replacing fossil fuels helps minimise the environmental impact of fossil fuel consumption, particularly in decentralised areas where the energy and environmental cost of fossil fuel use is high.

Objectives

The ‘SMARt-CHP’ project aimed to demonstrate an innovative, small-scale, mobile power production unit, which uses the agricultural residues generated in rural areas where large amounts of biomass wastes are available. This versatile unit would operate close to the place of feedstock origin, thus minimising transportation and logistic costs. The unit consists of a gasification reactor combined with an internal combustion engine that has been adjusted to work on
produced gas for electrical power and heat. It would have a high energy and environmental performance.

The project also aimed to promote the concept of bioenergy use via a decentralised electrical energy production unit – an integrated system with great potential for the sustainable development of rural regions.

Specific objectives included:
- Develop and demonstrate a technology through testing and application in real conditions;
- Promote an innovative concept for local actors and entrepreneurs in the field of renewable energy use;
- Evaluate biomass energy potential and contribute to national planning through the gathering of data on small-scale, decentralised bioenergy systems for combined heat and electricity production in rural areas.

Results

The ‘SMARt-CHP’ project demonstrated a combined heat and power mobile unit which relies on the exploitation of agricultural residues. The technology combined fluidised-bed gasification of biomass residues and an internal combustion engine to produce electricity and heat. The relatively small and mobile unit avoids transport costs and the uncertainty of weather conditions in the exploitation of agricultural residues. Instead, decentralised production of energy near the source of the agricultural residues contributes to local energy supplies and avoids the logistics of collecting and transporting wastes to another location. Given that agricultural residues can no longer be burned owing to the emission of greenhouse gases, their collection and disposal has become a problem which would be addressed by the use of this technology.

The SMARt-CHP unit consists of a gasification reactor combined with an internal combustion engine and adjusted to work on producer gas for electrical power and heat. The unit was built in Thessaloniki and transported to the premises of the two associated beneficiaries. The feedstock was made up of grape, peach and olive kernels that had been collected from the region of Western Macedonia.

During the demonstrations, several technical issues were faced and resolved, and the operation of the unit was consistently improved at each demonstration. A detailed sustainability analysis was carried assess the environmental, economic and social benefits of the new technology.

Dissemination was effectively aimed at the target groups: farmers, agricultural cooperatives, and the biomass/biofuel sector and energy companies. Lessons learnt during the project were published in a good practice guide, which could serve to further promote the technology following the end of the project. The good practices will be included into the planned ‘eco school’ on renewable energy that will be developed by the Kilkis education department.

Decentralised electricity production is likely to play a major role in the future. Facilities using local renewable sources and designed to supply local communities and decentralised energy users are in the forefront of EU energy and environmental policies. Small-scale biomass installations that produce
electrical and thermal power are among the most promising technologies for
decentralised energy generation. SMARt-CHP is an integrated flexible technology
and has the potential to penetrate the electricity production market, thus
promoting regional development and enhancing agricultural sector reinforcement.

The After-LIFE plan (included in the project's final technical report) aims to
establish an energy cooperative body in Karditsa that will organise the collection
of biomass and move towards electricity production using the SMARt-CHP
technology. Moreover, the district heating company of Ptolemaida is developing a
bioenergy plan for the use of biomass and the municipality of Amyntaion is
aiming to secure funding for biomass utilisation units of less than 1 MW.

Further information on the project can be found in the project's layman report
(see "Read more" section).

Environmental issues addressed:

Themes

Waste - Agricultural waste
Climate change Mitigation - Renewable energies

Keywords

use of waste as energy source, rural area, energy supply, biomass energy,
agricultural waste, renewable energy

Target EU Legislation

- Waste
  Framework Directive) (19.11.200 ...)
- COM(2015)614 - "Closing the loop - An EU action plan for the Circular
  Economy" (02.12.2015)
- Climate Change & Energy efficicency
- Directive 2009/28 - Promotion of the use of energy from renewable sources
  (23.04.2009)

Natura 2000 sites

Not applicable
Beneficiaries:

Coordinator: Research Committee Aristotle University of Thessaloniki
Type of organisation: University
Description: Two Aristotle University of Thessaloniki (AUTh) laboratories will be involved in the project: the Laboratory of Applied Thermodynamics (LAT/AUTh) and the Laboratory of Chemical Process and Plant Design (LCPPD/AUTh).

Partners: Union of Agricultural Cooperatives of Amyntaion, Greece District Heating Municipal Company of Ptolemaida, Greece

Administrative data:

Project reference: LIFE08 ENV/GR/000576
Duration: 01-JAN-2010 to 31-DEC -2012
Total budget: 947,287.00 €
EU contribution: 450,143.00 €
Project location: Kentriki Makedonia(Ellas)

Read more:

Poster: Title: "Demonstrative Operation of a Small Scale Mobile Agricultural Residue Gasification Unit for Decentralized Combined Heat and Power production" (890 KB) No of pages: 1
Poster: Title: "From biomass gasification to large scale liquid biofuels production" (657KB) Author: T. Damartzis, A. Zabaniotou Year: 2011 Editor: Aristotle University of Thessaloniki No of pages: 1
Poster: Title: "Assessment of a small mobile CHP integrated biomass gasification-internal combustion engine (ICE): The smart LIFE plus project" (0.98MB) Author: A. Zabaniotou, Z. Samaras, N. Antoniou, D. Mertzis Year: 2012 Editor: Aristotle University of Thessaloniki No of pages: 1
Poster
Title: "From biomass gasification to large scale liquid biofuels production" (658 KB) Author: T. Damartzis, A. Zabaniotou Year: 2011 Editor: International Conference on Materials and Technolo No of pages: 1

Project web site
Project's website

Publication: Layman report
Title: Layman report Year: 2013 No of pages: 11

Publication: Layman report
Title: Layman report (Greek version) Year: 2013 No of pages: 11

Publication: Technical report
Title: Project's Final technical report Year: 2013 No of pages: 111

Publication: Technical report
Title: "Results and sustainability analysis / Best practice guidelines Part A: Demonstration results analysis" (4.19 MB) Author: Z. Samaras, D. Mertzis, S. Tsiakmakis Editor: Aristotle University of Thessaloniki No of pages: 55

Publication: Technical report
Title: "Deliverable 4 - Part B: Sustainability analysis & best practice guidelines" (1.46 MB) Author: P. Manara, A. Zabaniotou, S. Tsiakmakis Editor: Aristotle University of Thessaloniki No of pages: 100

Publication: Technical report
Title: "Inception report : Covering the project activities from 01/01/2010 to 31/07/2010" (948 KB) Year: 2010 Editor: SMARt-CHP No of pages: 23

Slides Presentation
Title: Project's slides presentation (1.06MB) Year: 2012 Editor: Aristotle University of Thessaloniki No of pages: 19

Slides Presentation
Title: "Simulation of gas engine operating on gasification gas" (1.37 MB) Author: Dimitra Gkipatidou, Stefanos Tsiakmakis, Dimitris Year: 2011 Editor: Graz No of pages: 22

Slides Presentation
Title: "1st Michelangelo Workshops of Civitavecchia: The Mediterranean is facing major challenges through its Youth 11-13 September 2011, Civitavecchia, Italy" (1.97 MB) Author: Panagiota Manara, Anastasia Zabaniotou Year: 2011 Editor: ARISTOTLE UNIVERSITY OF THESSALONIKI No of pages: 5

Slides Presentation
Title: "Meeting on Green Metrics in Lyon : Mediterranean lignocellulosic materials valorization into energy and high-added value components" (1.82 MB) Author: Yiota Manara, Anastasia Zabaniotou Year: 2012 Editor: ARISTOTLE UNIVERSITY OF THESSALONIKI No of pages: 3

Slides Presentation
Title: "Project's slides presentation" (1.43 MB) Year: 2012 Editor: Aristotle University of Thessaloniki No of pages: 19