Sustainable management of livestock waste for the removal/recovery of nutrients « LIVEWASTE »

CYPRUS 2016: 4th International Conference on Sustainable Solid Waste Management
Outline

• General information about the project
• Project objectives
• Project Actions
  - Preparatory Actions
  - Design of the integrated LIVEWASTE prototype
  - Construction, installation and operation of the prototype system
  - Performance of the prototype system
  - Environmental assessment of proposed methodology
  - Socioeconomic assessment of proposed methodology
• Project outputs
• Partner projects
General Project Information

Budget
Total amount: 2,147,182 Euro
% EC Co-funding: 50%

Duration
Start: 01/09/2013 - End: 31/08/2016

Partners
Coordinating Beneficiary: Cyprus University of Technology
Associated Beneficiary(ies): Animalia Genetics Ltd; Ministry of Agriculture, Natural Resources & Environment; National Technical University of Athens; University of Verona; University of Santiago de Compostela
Project Location

LP Premises (Limassol-Cyprus)
Pilot Unit
Project Objectives

LIVEWASTE aims to:

• Develop and demonstrate an innovative system livestock waste treatment, where livestock waste becomes a source of energy, nutrients are removed/recovered from liquid part of digestate, compost is produced from the solid part of digestate and reusable treated effluent is delivered.

• Develop the baseline scenario on the existing livestock waste management in Cyprus and in Europe

• Provide guidelines for the wider application of the integrated system

• Disseminate a strategic plan on sustainable decentralized livestock waste management in line with the EU and National legislations
The project is consisted of five (5) action categories

A. Preparatory actions
B. Implementation actions
C. Monitoring of the impact of the project actions
D. Communication and dissemination actions
E. Project management and monitoring of the project progress
Assessment of existing situation regarding the production and management of livestock waste in Cyprus and in the EU

Sub-Activities:
- **Sub-Activity A1.1:** Data collection concerning the existing situation of livestock waste production and management in Cyprus.
- **Sub-Activity A1.2:** Critical evaluation of success stories and relevant legislative framework regarding livestock waste management in the EU.
Preparatory Actions

Assessment of existing situation regarding the production and management of livestock waste in Cyprus and in the EU
Preparatory Actions

Assessment of existing situation regarding the production and management of livestock waste in Cyprus and in the EU

Completed Deliverables:

• Report on the production and management of livestock waste in Cyprus

• Report on success stories dealing with the management of livestock waste in EU

• Report on the impact of legislative framework on the management of livestock waste
Preparatory Actions

Preliminary design of the prototype system for the treatment of livestock waste

Main Activities / Results
- Define the most significant aspects and characteristics of the pilot unit
- Ensure the use of environmentally friendly construction materials
- Foresee the application of methods, techniques and tools that minimize energy consumption
- Collect and analyze samples of livestock waste from the source
Preparatory Actions

Preliminary design of the prototype system for the treatment of livestock waste

Completed Deliverables:

• Preliminary drawings of main components (basic drawings)

• Report on the preliminary design (including calculations) of the prototype, integrated system for the treatment of livestock waste

• Report with the preliminary results from the laboratory analyses
Preliminary design of the prototype system for the treatment of livestock waste
Preparatory Actions

Preliminary design of the prototype system for the treatment of livestock waste

Basic Drawings of the Prototype
Final design of the integrated prototype system for the treatment of livestock waste.

Main Outputs:
Detailed drawings of:
- the anaerobic digester
- the composting unit
- the odour abatement system
- the SBR and the struvite crystallization unit
- the integrated prototype system
Final Prototype Design: 3D Designs
Final Prototype Design: PID
Prototype Construction

Construction and testing of the prototype components – Installation and start – up of the integrated, prototype system for livestock waste treatment

Main Outputs:
- Construction and testing of the various components of the integrated, prototype system;
- Assembling, installation and start-up of the integrated system treating livestock waste.
The LIVEWASTE Prototype

Pilot plant operating in Cyprus
**System performance:**

- The anaerobic digestion process removes more than 75% of Total COD.
- The biogas production is estimated in 1.6 m$^3$ biogas per day.
- Dewatering unit and ceramic membrane retain 92% of Total Solids.
- SBR is estimated to remove 89 % of N & P.
## Overall System’s Performance: Compost Analysis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water content</td>
<td>45.7%</td>
</tr>
<tr>
<td>Density</td>
<td>645 g/l</td>
</tr>
<tr>
<td>Water retention</td>
<td>249%</td>
</tr>
<tr>
<td>C/N ratio</td>
<td>18.0</td>
</tr>
<tr>
<td>Organic content</td>
<td>86.0%</td>
</tr>
<tr>
<td>Ash</td>
<td>14.2%</td>
</tr>
<tr>
<td>Total carbon</td>
<td>49.8%</td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>2.8% (dry base)</td>
</tr>
<tr>
<td>Nitrates-N</td>
<td>less than 20% of TN</td>
</tr>
<tr>
<td>Nitrites-N</td>
<td>0 mg/kg</td>
</tr>
<tr>
<td>Sulfates</td>
<td>0 mg/kg</td>
</tr>
<tr>
<td>Total Phosphorous</td>
<td>1780 mg/kg (dry base)</td>
</tr>
<tr>
<td>pH</td>
<td>7.8</td>
</tr>
<tr>
<td>Conductivity</td>
<td>2200 mS/cm</td>
</tr>
<tr>
<td>Maturity index</td>
<td>&gt;50%</td>
</tr>
</tbody>
</table>
The LIVEWASTE Prototype: Monitoring
Environmental Assessment

Evaluation of the environmental impacts resulting from livestock waste management in Cyprus before and after the project’s implementation

Main contributors to environmental impact (hotspots)

Environmental benefits from the production of valuable products are evaluated

Climate change (CC), Ozone depletion (OD), Terrestrial acidification (TA), Freshwater eutrophication (FE), Marine eutrophication (ME), Photochemical oxidant formation (POF), Fossil depletion (FD) and Malodours air (MA).
Environmental Assessment

Normalization results

Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5

LIVEWASTE
Socioeconomic Assessment

Evaluation of the socioeconomic impacts resulting from livestock waste management in Cyprus before and after the project’s implementation.
Evaluation of the socioeconomic impacts resulting from livestock waste management in Cyprus before and after the project’s implementation

- **Misunderstanding about risk perception:** Erroneous risk perception is usually linked to NIMBY syndrome
- **People tend to overestimate risk regarding livestock operation**
- **Incomplete information:** National/local administration needs to stress that any type of livestock waste treatment system leads to better health condition or a minor environmental impact
- **The main problem related to livestock operations is odor emission:** Maximum effort has to be addressed from R&D in the field of livestock waste management sector to reduce this problem
- **Underestimation of socioeconomic impact of livestock waste management sector:** Modern livestock waste management systems could increase significantly the percentage of green energy and contribute to create new markets (e.g. fertilizer) that could help to stimulate economy
Policies Tackled:

• LIFE LIVE-WASTE promotes the implementation of the Nitrates Directive (91/676/CEE) and the Water Framework Directive (2000/60/EC).

• The project provides an integrated, effective solution to the problem of biowaste treatment, thus enhancing sustainable waste treatment practices and reducing non-sustainable ones, such as landfill disposal of livestock waste. This is in-line with the targets of the Landfill Directive (1999/31/EC) for reducing the amount of organic waste disposed to landfills and of the Waste Framework Directive (2008/98/EC) for enhancing materials/energy recovery from waste.

• Furthermore, the eco-design character of the prototype system and the resulting energy recovery from waste will aid the implementation of the energy end-use efficiency and energy services Directive (2006/32/EC).

• Finally, the project is in-line with the concept of green growth, and the Kyoto Protocol commitments, contributing to the reduction of greenhouse gas emissions and the mitigation of climate change.
Dissemination

Website - Social media

www.livewaste.org

Facebook and Twitter Accounts

![Facebook and Twitter icons]
Dissemination

Informative material - Publications in press
Journal Publications


Conference Publications – Seminars

2. Seminar: “Seminario técnico dirigido a empresas y centros tecnológicos Tecnologías Avanzadas para el Tratamiento y Valorización de Aguas Residuales”, Santiago de Compostela, 18-20 June 2014 (Spain).
3. Keynote communication in 2nd International Conference on Sustainable Solid Waste Management Athens, 12-13 June 2014 (Greece).
4. Poster presentation at Open Week UNIVR, Student’s Day – Campus del talent, 9 July, Verona (Italy).
5. Poster presentation at VenetoNight: la notte europea dei ricercatori a Padova, Venezia e Verona. Friday 26 September 2014 (Italy).
6. Oral presentation at the Final LIFE-DAIRIUS conference, June 24, 2015, Limassol (Cyprus).
8. Poster presentation at Biogas Science 2014 – Vienna, Austria – 26-30 October
11. 5 Oral presentations at International Conference on Sustainable Solid Waste Management 2015
12. Poster presentation at SETAC Meeting, Barcelona (Spain) – 3-7 May 2015
14. Oral presentation at International Conference on Environmental Science and Technology. 3-5 September 2015. Rhodes (Greece)
Thank you!

Project LIVEWASTE: www.livewaste.org