# Lublin University of Technology, Faculty of Environmental Engineering

## Research on Renewable Energy Sources

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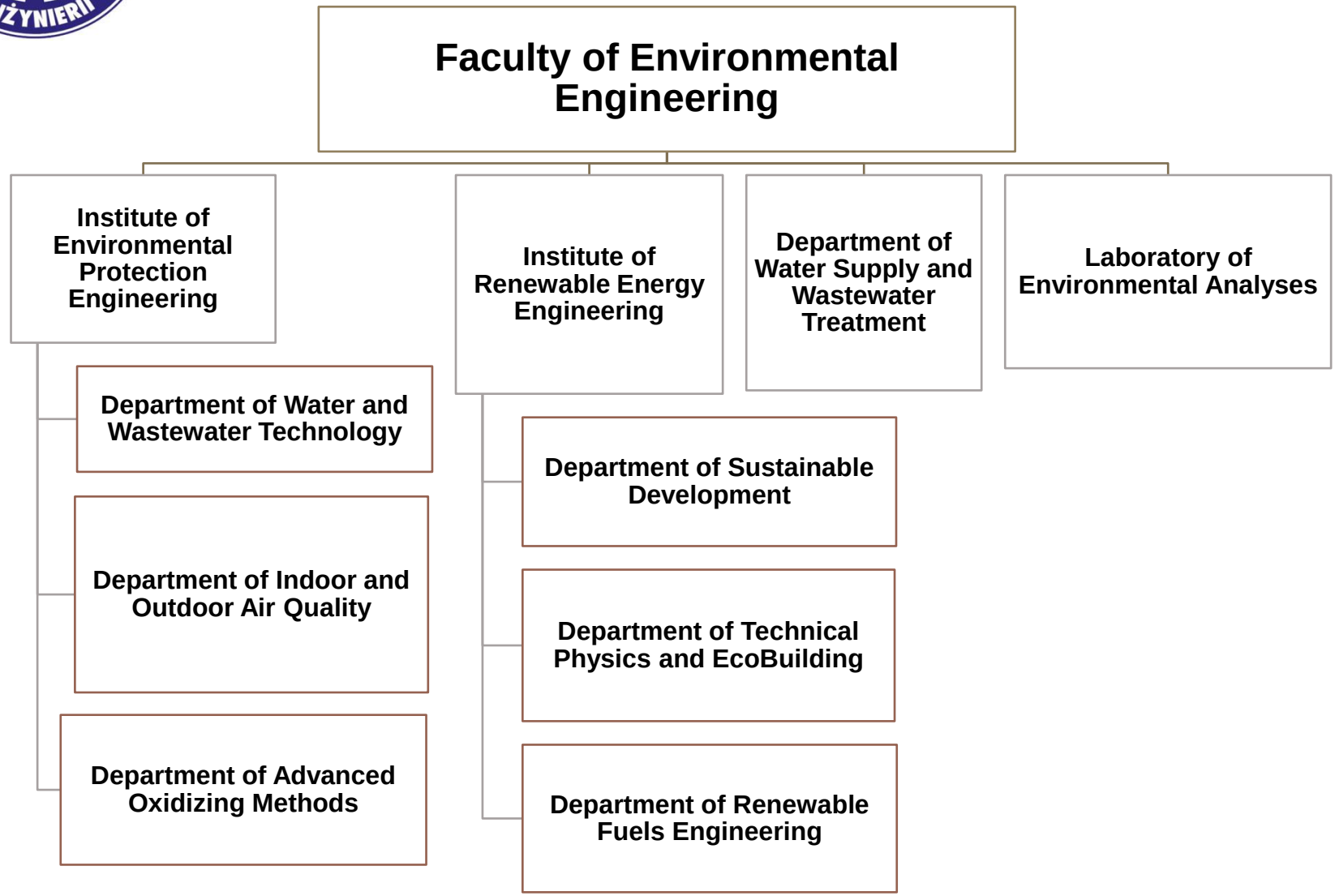
**Head of the Institute, former Dean of the Faculty: Prof. Lucjan Pawłowski Ph.D**

# Faculty of Environmental Engineering

# FACULTY OF ENVIRONMENTAL ENGINEERING



# LIST OF COURSES AND SPECIALIZATIONS:

**Engineer course:**

- Environmental Engineering
- Environmental Protection
- Technical Physics

**Master course:**

- Technology of Water, Wastewater and Solid Wastes
- Heating and Air Conditioning Systems
- Water Supply and Sewage Disposal
- Alternative Sources of Energy

**Doctoral course**

# FACULTY OF ENVIRONMENTAL ENGINEERING

- Modern building
- Well equipped lecture theatres with audio visual aids
- Computerized design rooms
- Test laboratiories

# RESEARCH PROJECT LABORATORIES

- Laboratory of Wastewater and Sewage Sludge Technology
- Laboratory of Environmental Microbiology
- Laboratory of Environmental Chemistry
- Laboratory of Earth's Surface Protection
- Laboratory of Thermal Techniques
- Laboratory of Fluid Mechanics
- Laboratory of Advanced Oxidizing Techniques in Environmental Engineering
- Laboratory for the Application of Ion-Exchange Methods for Wastewater Treatment
- Laboratory for Studies of Methane Oxidation in Biofilters and Landfill Covers

**HPLC Waters serii 500 – *Waters***


**System GC-MS/MS, TriPlus/Trace Ultra/PolarisQ (Thermo)**

**System HPLC-MS/MS**


**Laboratory of Molecular Biology**

# RESEARCH LABORATORIES

Very precise analyses of organic and inorganic trace contaminants in all environmental matrix: **soil, water, sediment, waste** and **air.**

→ Second centre in Poland that performs **analyses of dioxins (PCDD/Fs)**

→ The only one that performs **analyses of dioxin-like compounds-sulfur analogues of dioxins on the basis of own analytical procedures.**

# MAIN ACTIVITIES - RESEARCH

- simultaneous nitrification and denitrification,
- removal of endocrine active substances from water and wastewater,
- thin-film photovoltaic technology,
- the production of biogas and alternative fuels,
- biochemical oxidation of methane,
- removal odorous compounds from waste gases,
- assessment of the risks of indoor air pollution and the elimination of these risks.

The Faculty cooperate with scientific and research centers in **Denmark, China, Russia, France, Spain, and Japan.**

# Waste – to – Energy – *via* biomethanization

http://www.canaleenergia.com/waste-business-worldwide-e-sicuro

# AIM OF THE INVESTIGATIONS

**Enhancement of biomethane production from sewage sludge by codigestion and/or bioagumentation**

# EXPERIMENTAL SET UP

Experimental set up consists of:

- 6 semi-continuous flow bioreactors, working in mesophilic conditions and wet anaerobic digestion process is examined.
- substrate supplying and collection systems
- biogas outlet installations


**Part of the experiemental set up for examination o biogas production from waste**

# BIOREACTOR CONSTRUCTION

- The stainless steel hermetic container, with an active capacity of 40 $dm^3$. The reactor diameter is 400 mm, the active height of the tank is equal to its diameter.
- The conical-cylindrical shape is appropriate for the typical constructions of the digesters used on an industrial scale.
- Each of the reactor is located inside a stainless steel cylindrical tank, filled with distilled water and covered with a removable cover, working as a water jacket for the reactor.
- The reactors work under total mixing conditions. Mixing is continuous by means of a mechanical stirrer at a slow rotation speed of 50 rpm.
- The biogas installation connected to the reactor highest point includes biogas pipes, a pressure equalization tank, an Aalborg gas flowmeter and equipment such as cut-off valves, a drainage valve and nozzles with a rubber membrane, which allows gas samples to

# TEAM EXPERIENCE

The team has already conducted research on sewage sludge co-digestion with appropriately selected co-substrates that can **significantly** increase **the production of biogas**.

The research was conducted using two and trisubstrate mixtures:
-co-digestion of sewage sludge with leacheate from landfill with different age,
-co-digestion of sewage sludge and organic fraction of municipal waste mixed with leachate from landfills and distillers grains from the agricultural distilleries,

- digestion and co-digestion process bioagumented by methanogenic *Archaea* biopreparations (Arkea® a commercial product from Transtech, USA)
- digestion and co-digestion process of substrate preatreated by freezing/thawing and hydrodynamic cavitation
- The developed co-digestion of a trisubstrate mixture technology

# TEAM EXPERIENCE

The measurable **effect of the investigations** carried out in relevant scope are:

- several papers in scientific journals and chapters in monographs
- 1 finished Sc.D. dissertation, 1 finished Ph.D. dissertation, 1 Ph.D. dissertation in progress
- several presentations on the conferences
- 2 patents, and over 20 patent applications
- 1 implemented technology

# SELECTED PUBLICATIONS


1. Montusiewicz A., Lebiocka M., 2011, Co-digestion of intermediate landfill leachate and sewage sludge as a method of landfill utilization. ***Bioresource Technology***, Vol. 102, pp. 2563-2571.
2. Montusiewicz A., Lebiocka M., Rożej A., Zacharska E., Pawłowski L, 2010, Freezing/thawing effects on anaerobic digestion of mixed sewage sludge. ***Bioresource Technology***, Vol. 101, Issue 10, May 2010, pp. 3466-3473.
3. Lebiocka M., Montusiewicz A., Pawłowska M., 2011, Variability of heavy metal concentrations in the co-digestion. ***Proceedings of the EURASIA Waste Symposium***, Istanbul, Turkey, 14-17 November 2011.
4. Lebiocka M., Montusiewicz A., Zdeb M., 2010, Anaerobic co-digestion of sewage sludge and old landfill leachate***. Polish Journal of Environmental Studies***, Vol. 2, pp. 141-145.
5. Montusiewicz A., Lebiocka M., Pawłowska M., 2008, Characterization of the biomethanization process in selected waste mixtures. ***Environmental Protection Archives***, Vol. 34, No. 3, pp. 49-61.
6. Montusiewicz A., 2008, Environmental factors affecting the biomethanization process. ***Environmental Protection Archives***, Vol. 34, No. 3, pp. 265-279.
7. Rożej A., Montusiewicz A., Lebiocka M., 2008, Characteristics of microbial communities in biomethanization process. ***Environmental Protection Archives***, Vol. 34, No. 3, pp. 299-307.

# SELECTED PATENT AND APPLICATIONS

Method for the production of organic fertiliser granules from sewage sludge after anaerobic digestion. Pawłowski L., Pawłowska M. Patent 209847 dated 13th May 2011

Method and equipment for the recovery of methane from landfill gases of low methane content. Pawłowski L. Pawłowska M., Dadej W., Patent 210541 dated 16th August.2011

Method and Equipment for intensifying biogas production from municipal sewage sludge, Montusiewicz A., Pawłowski L., Ozonek J., Pawłowska M., Lebiocka M., Patent Application No: P 386330 dated 22nd October 2008.

Method of intensifying methane production from sewage sludge, Montusiewicz A., Pawłowski L., Lebiocka M., Patent Application No: P 386436 dated 4th November 2008.

Sewage sludge disposal integrated with energy recovery, Pawłowski L., Pawłowska M., Wójcik W., Fijałka T., Pilipczuk I., Patent Application No: 385432, dated 13th June 2008

Method for producing biogas from sewage sludge, Pawłowski L., Montusiewicz A., Poleszak A., Duklewski W., Jaśkowski R., Patent Application No: P-393015 dated 24th November 2010.

Method for producing biogas from sewage sludge, Pawłowski L., Montusiewicz A., Poleszak A., Duklewski W., Jaśkowski R., Patent Application No: EP10197094.5 dated 27th December 2010.

Method of production of emulsified fuel from sewage sludge, Pawłowska M., Montusiewicz A., Pawłowski L., Patent Application No: EP 08173044.2 dated 29th December 2008.

Method and device for intensification of biomass production from communal sewage sludge, Montusiewicz A., Pawłowski L., Ozonek J., Pawłowska M., Lebiocka M., Patent Application No: EP 08173043.4 dated 29th December 2008.

# PROJECTS

PBZ-MEiN-3/2/2006 "The engineering of processes to limit emissions and the oxidation of greenhouse gases", Task 4.2 "Technological and technical process modifications which eliminates methane emissions at source (2006-2009)

Research project No. 7405/B/T02/2011/40 "Bioaugumentation of sewage sludge codigestion  with landfill leachate" (2011-2013)

# NEXT STEPS

- Research Programme on the usage of **sugarbeet and agricultural waste** in the production of **bioethanol and biogas**

  Consortium:

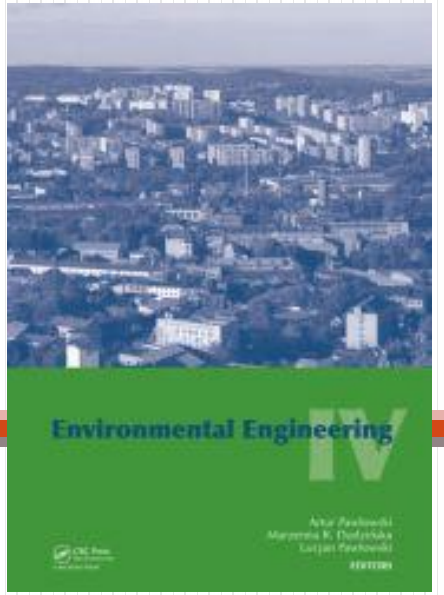
  - **Lublin University of Technology,**
  - University of Life Sciences in Lublin, Poland
  - University of Warmia and Mazury in Olsztyn, Poland
  - **University of Applied Sciences, Germany**
  - the Mineral and Energy Economy Research Institute of the Polish Academy of Sciences,
  - Kruszywa Niemce S.A.
  - the Lublin Development Foundation
  - Lotos S.A.

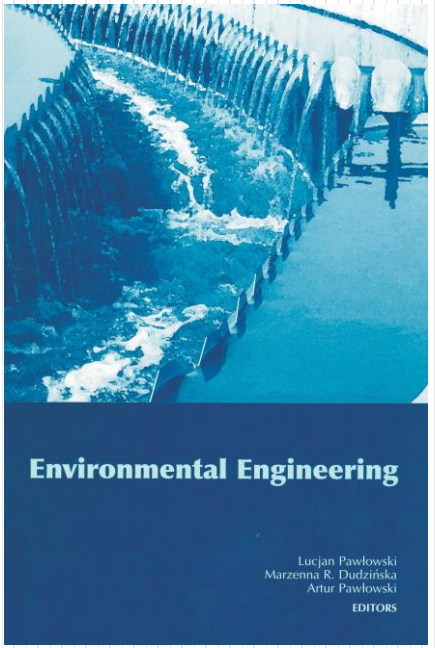
# NEXT STEPS

- Research on pyrolysis,
- Assessment of the usage of biochar in soil conditioning,
- Carbon capture and sequestration,
- Anaerobic digestion,
- Etc.

# CONGRESSES

Four national Congresses, that sumarize the Polish Research in area of Environmental Engineering.



# PROBLEMY EKOROZWOJU

## Problems of Sustainable Development

European Academy of Science and Arts, Salzburg, ISSN: 1895-6912

**Wersja polska**

The sustainable development concept was formulated at a time when humankind had the technical means at its disposal to engage in pretty much any transformation of the world it wanted. No surprise then that it tends to become lost in the objectives that transformations of the kinds referred to are meant to serve. For many years now, our technical capabilities have been quite up to the task of achieving the biosphere's total destruction, and even if that does not actually happen, there remains a real and immediate prospect of the world's fossil-fuel and other resources being severely depleted or exhausted. Moreover, the state of the natural environment globally is worsening steadily (even if locally - as in Poland - certain improvements might even be observable). The disparities between rich and poor countries grow. While global production of food has remained great enough to give everyone enough, millions continue to go hungry. There is also an intensification of social conflicts whose causes must often be sought in poverty. At the same time, increasing automation is encouraging unemployment, and leading to a feeling among whole groups in society that they are somehow surplus to requirements, living on the margins of contemporary civilisation and experiencing progressing exclusion from it.

Even these selected challenges are enough to make clear just how complicated and difficult the situation today's world finds itself in really is. Is it possible that the all-too-visible crisis looming over us can be counteracted? It was precisely to do that that the sustainable development concept was formulated - not merely as yet another programme to protect the natural environment, since the scope and perspectives as regards necessary action extend so very much more widely. While the voice of the naturalist remains an important one, points of view from the philosophical, economic and technical sciences are also to be taken account of.

With all that in mind, we hereby hand to the reader this issue of our biannual journal devoted to all matters sustainable development-related and ecophilosophical. **While the first four editions came under the aegis of the Man and the Environment Committee of the Polish Academy of Sciences, it is now the European Academy of Sciences and Arts in Salzburg that has taken up the reins.** While it has happily proved possible to draw a whole large group of outstanding Polish scientists into this new venture, it must still be recalled that these are "early days yet". **We therefore encourage and invite you to cooperate with us in creating and shaping this journal!**

**Here you can find summaries from all articles published in the journal "The Problems of Ecodevelopment".**

**Instructions for authors**

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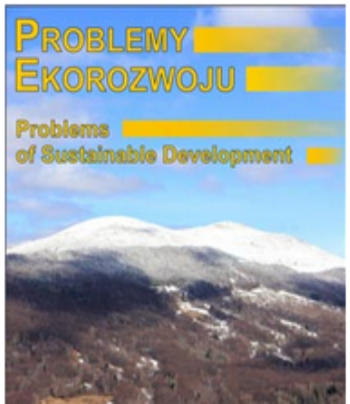


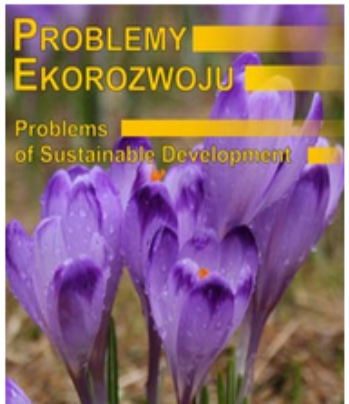

# Thank you for your attention.

**For further questions:**

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