



WASTE MANAGEMENT AND ENERGY PRODUCTION

amra

■ analysis and monitoring of environmental risk

AMRA ACTIVITIES

The increasing production of solid wastes requires that sustainable waste management systems act as a “filter” between human activities and the environment.

AMRA activities in this area include **Waste management and the development of technologies for energy production** with special emphasis on the possibility to improve the value of energy and materials output using innovative processes.





AMRA has the expertise needed to:

1. develop the basic process design for pyrolysis and gasification of different kinds of solid wastes;
2. approach and solve the main problem of gas cleaning within or downstream of the gasification and pyrolysis processes;
3. develop applied and back up research and technology transfer in technical and management sectors both of the urban and industrial waste cycle (from issues of collection and sorting, to those of material and energy recovery and those of final disposal);
4. evaluate pollution effects on soils, air and water.



MAIN OBJECTIVES

Main objectives of this area of research are:

- protection of health and the environment;
- conservation of resources such as materials, energy and space;
- after-care-free waste management, meaning that neither landfills nor incineration, recycling or other treatments leave problems to be solved by future generations.

On the other hand, the study of the effects of pollutant agents is aimed at:

- reducing the hazards of adverse effects of the pollution;
- minimizing emissions in groundwater, surface water and atmosphere, within the period needed for bioremediation.





EQUIPMENT

Our research activity is supported by equipment unavailable elsewhere in Italy and through much of Europe:

- **pilot scale fluidized bed gasifier for waste and alternative fuels**, an industrial scale unit to verify the technical and economical feasibility of gasification and pyrolysis process of several alternative fuel (biomass, RDF, PDF, mixed plastics, etc.);
- **integrated laboratory (CARMA) for environmental analyses** also of elements found in trace amounts;
- analytical and simulation laboratory for soil characterization and restoration (**Mesocosm**, in the figure below);
- innovative equipment for characterization and detection of fine and ultra-fine particles.



MAIN PROJECTS

EUROPEAN COMMISSION FP7

SoilCAM, Soil Contamination: Advanced integrated characterisation and time-lapse Monitoring.

The goal of the SoilCAM project is to better understand the physical, chemical, and biological behaviour of the root zone and the layers that are between root zone and groundwater level.

CONAI, ITALIAN NATIONAL CONSORTIUM FOR PACKAGINGS

Research program (2006-2008) to define operating and design criteria for fluidized bed gasifiers of packaging-derived fuels (PDF) and refuse-derived fuels (RDF).

PRIVATE COMPANIES

Specific test on different PDFs and RDFs to test the feasibility of gasification process.

ANSALDO ENERGY

Research program to test different materials and surface coatings to be used in gasification and pyrolysis reactors.

BIOTEN (BIOMASS-TO-ENERGY)

Research program to test the feasibility of co-gasification process where the organic fraction of municipal and industrial solid waste is processed together with paper and plastic wastes.

CONAI, ITALIAN NATIONAL CONSORTIUM FOR PACKAGINGS

Research program (2008-2010) to optimizing the design of a gasifier to be fired with two PDFs.

ARPAC, ENVIRONMENTAL PROTECTION AGENCY OF ITALY – DEPT. OF CAMPANIA

Planning of industrial waste management for the Regione Campania (an area in the South of Italy with about 6 millions of inhabitants), with definition of type and capability of treatment plants and their localization.

ENVIRONMENTAL DEPARTMENT OF REGIONE CAMPANIA

Substance Flow Analysis (SFA) of MSW management in Regione Campania and definition of future scenarios of waste management.



MAIN SCIENTIFIC PAPERS

U. Arena, F. Di Gregorio, M. Santonastasi

A techno-economic comparison between two design configurations for a small scale, biomass-to-energy gasification based system

Chem. Eng. Journal, 162: 580-590, 2010

M.L. Mastellone, U. Arena, L. Zaccariello

Co-gasification of coal, plastic waste and wood in a bubbling fluidized bed reactor

Fuel, 89: 2991-3000, 2010

U. Arena, F. Di Gregorio, L. Zaccariello, M.L. Mastellone

Fluidized bed gasification of biomass: a substance flow analysis

in S. Done Kim, Y. Kang, J. Keun Lee, Y. Chil Seo (eds.), Fluidization XIII, Engineering Conferences International, 805-812, 2010

U. Arena, L. Zaccariello, M.L. Mastellone

Gasification of natural and waste biomass in a pilot scale fluidized bed reactor

Combustion, Science & Technology, 182: 1-15, 2010

U. Arena, L. Zaccariello, M.L. Mastellone

Fluidized bed gasification of waste-derived fuels

Waste Management, 30: 1212-1219, 2010

M.L. Mastellone, P.H. Brunner, U. Arena

Scenarios of waste management for a waste emergency area: a substance flow analysis

J. Industrial Ecology, 13/5:735-757, 2009

U. Arena, L. Zaccariello, M.L. Mastellone

Tar removal during the fluidized bed gasification of plastic waste

Waste Management 29, 783-791, 2009

M.L. Mastellone, U. Arena

Olivine as a tar removal catalyst during fluidized bed gasification of plastic waste

AIChE Journal, 54: 1656-1667, 2008

U. Arena, L. Zaccariello, M.L. Mastellone

Gasification of a plastic waste in a fluidized bed of olivine

Proc. of CFB9 – 9th Int. Conf. on Circulating Fluidized Beds, J. Werther, W. Nowak, K.-E. Wirth, E.-U. Hartge (eds.), 691-696, ISBN 978-3-930400-57-7, 2008

U. Arena, E. Romeo, M.L. Mastellone

Recursive operability analysis of a pilot plant gasifier

J. Loss Prevention in the Process Industries, 21/1: 50-65, 2008



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