

ENVIRONMENT AND ENERGY

First issue

**edited by
Giuseppe Ioppolo**

**preface by Santi Trovato
introduction of
Maria Claudia Lucchetti
and Gerald Vogel**

FrancoAngeli

*Editorial series of Italian Commodity Science
Academy and Engineering Association
of Messina*

*Editorial Series of Italian Commodity Science Academy
and Engineering Association of Messina*

The editorial series *Environment and Energy* is an international and interdisciplinary annual book of the “Italian Commodity Science Academy – AISME” and “Engineers Association of Messina – Italy”, with the advocacy of International Society of Commodity Science and Technology – IGWT.

The scope of *Environment and Energy* embraces several Commodity Science topics: innovative tools, methods and experiences for environmental and energy improvement; technology and quality assessment for sustainability applications.

All papers published in *Environment and Energy* are first selected by the Editorial Advisory Board and then subjected to double-blind peer review.

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PREFACE

*Santi Trovato**

The book *Environment and Energy* is an annual book for the publication of peer reviewed, original research for all aspects of management and the managed use of the Environment and Energy. Critical review articles are also welcome; submission of these is strongly encouraged.

Environment and Energy represents the international and interdisciplinary annual book of the “Italian Commodity Science Academy AISME” and “Engineers Association of Messina (Italy)” (economics support), with the advocacy of International Society of Commodity Science and Technology.

The book provides a forum for the exchange of ideas and information from the diverse range of disciplines and interest groups which must be combined in order to integrate energy and environmental academy research with engineering experiences.

The scope of Environment and Energy embraces several Commodity Science topics: engineering, economics, planning, politics, pricing, forecasting, investment, conservation, with particular attention to sustainability and environment. The first edition concerns the technological, social, economic, environmental, planning aspects related to researches and territory experiences.

In this book, research areas include, but are not exclusive, to:

- Environment Management and territorial sustainability;
- Energy Methods and Tools;
- Industrial Ecology and Environmental tools.

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All papers have a double blind review from international experts and Professors; beside, the papers are also approved by the Editorial Advisory Board that involves CNR, ENEA, ACCREDIA, OICE, MAB UNESCO, and several Italian University. A special thanks to Eng. Giuseppe Ioppolo, Researcher to University of Messina, that as Editor in-chief has managed the book edition.

INTRODUCTIVE ARTICLES FOR 1ST ISSUE

ENVIRONMENT AND ENERGY: A NEW AISME EDITORIAL SERIES

*Maria Claudia Lucchetti**

The term resources in the contest of Commodity Science Academy, represents materials, energy, environment and wastes. The Commodity Science analyzes, studies and develops, methods and technologies to rich an improving in term of environmental, economic and social sustainability in the territorial context, at global and local level also.

The methodology used by Academy is based on a quality and quantitative research to measure the territorial and production performances, applying specific tools, such as Life Cycle Assessment, Material Flow Analysis, Input-Output Analysis, etc.. In this sense, the Italian Commodity Science Academy (AISME) aims to share knowledge and experiences in order to build an integrated multi-criteria approach and to define a common vision focused to face environmental management problems.

The research fields that sink sustainability aspects are very extensive and the complexity begins a barrier to a detailed depth, therefore AISME proposes an editorial series focused on Environment and Energy aspects, to publish an annual volume that summarizes experience results and knowledge advances.

The editorial series is directed to commodity science context but also to the engineers involved in resource management and environmental management. Indeed, the territorial dimension that encompasses the concept of sustainable development must consider the non linear and non direct relation between environmental and economic variables. This dualism lies at the very heart of understanding the complexity of the territory and requires these two distinct spheres to be investigated in order to then bring them together.

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Environmental and energy management is a broad term referring to the process of identification, measurement, accumulation, analysis, preparation, interpretation, and communication of integrated informations used by management for planning, evaluation, and control within an organisation, and for ensuring of management for its resources. Environmental Management serves as a mechanism to identify and measure the full spectrum of environmental impacts, with related costs of current production processes and the economic benefits of pollution prevention or cleaner processes, and to integrate these costs and benefits into day-to-day business decision making.

While management systems are traditionally viewed as matters internal to a firm, the potential social benefits resulting from widespread use of environmental management tools calls for active a new form of eco-governance, with a co-management approach, involvement in promoting such systems.

In this context, environmental management of the territorial system is a fundamental stage in the development of the local policy lines that govern the processes of defining local policy and is a critical factor that determines success in planning sustainable development strategies. Environmental and Energy wants to bring together the academic contest with practitioners in order to develop a new eco-forum to support government, authorities, enterprises, NGO, stakeholders, etc., involved in these fields.

For the first issue, the Editor in-chief support by a widespread and excellent Editorial Advisory Board, after a blind peer review, has selected 13 papers in which the authors face three linked aspects: environment and territorial sustainability, energy innovation to reduce consumption and the environmental improving in the production system throughout the industrial ecology methodology and tools.

This volume presents a special introduction of Prof. Gerhard Vogel, about the relationship between technology, innovation and environmental management. This paper together the papers of Prof. Rodica Pamfilie and of the others co-authors, represent the participatory of the International Society of Commodity Science and Technology – IGWT. Finally a special relevance takes on the article proposed by Prof. Reinout Heijungs, that represents the point of view of Institute of Environmental Sciences (CML) - Leiden University on LCA methodology improvement.

In this first issue the researches of several commodity science academy schools, in particular Torino, Pescara, Molise, Salerno, Messina and Roma 3, are published, but all the Editorial Advisory Board is deeply convinced that the international level and timeliness of the topics covered, represents a reliable basis for growth and involvement.

THE RELATIONSHIP BETWEEN TECHNOLOGY, INNOVATION AND ENVIRONMENTAL MANAGEMENT

Ways to a sustainable consumption behaviour and a sustainable economy

*Gerhard Vogel**

Abstract – The sustainable development of our societies and economies can only be safeguarded if we significantly reduce the material turnover, volume and hazard potential of production, distribution and consumer waste going to landfills. What we need are sustainable solutions which provide social and economic welfare to all humans and which also take the aspect of resource management – expressed in terms of energy/raw materials/environmental burden/renewability – into account.

There are two approaches to achieving sustainable consumption:

- Dematerialisation;
- Immaterialisation.

Dematerialisation:

Avoiding or reducing the input of resources and the production of waste, especially toxic and hazardous wastes (quality aspect), other materials and energy, ranging from product or process design via production and distribution to consumption and disposal/recovery/recycling;

Immaterialisation:

Avoiding or reducing the input of resources and the production of waste by changing public consumption patterns:

- from a lifestyle which supports the purchase and use of as many products, commodities and services as possible and the squandering of existing resources;
- to a lifestyle focused on the purchase of “bare essential” products and commodities as well as services in the following sectors:
- culture, health;
- education, social services;

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- and other leisure activities such as sports.

Keywords – Waste prevention, waste reduction, cleaner production, eco consumption, environmental management, economic instruments, environmental labeling.

Introduction

Resources, energy and the regenerability of the eco-system form the natural basis of our global economic activities. The materials contained in our industrially manufactured goods will sooner or later return to the eco-system, depending on how they are used, reused, and recovered or recycled. Within the eco-system, these materials circulate in a closed loop and become nearly 100% available for reuse in the following cycle. In the framework of our economic processes, however, this happens only to a limited extent. In a sustainable system, the movement of materials required for the performance of economic activity reaches its natural limits with respect to material turnover. This fact is (still) largely ignored in our contemporary global economy. Especially our western economies pretend that no such limits exist. The propagated closed-loop economy and also the zero emission concept make people believe that all it takes is a recycling effort to allow our economy, which is based on the manufacture and use of commodities, to grow endlessly. Many scientists have meanwhile come to reject this purely economic position with reference to the law of entropy, and demand restrictions in the turnover of materials in keeping with the sustainability principle. This forms the scientific basis for the request to make a considerable effort towards new innovative technologies and new environmental management tools, especially in the field of eco-consumption.

The overuse of our regional and global eco-systems with regard to climate change has reached dimensions which pose a threat to humans, especially those of future generations. For this reason, it is essential to redefine the relationship between human beings and their natural basis of existence [1]. The sustainable development of our societies and economies can only be safeguarded if we significantly reduce the material turnover, volume and hazard potential of production, distribution and consumer waste going to landfills. And we need a pact of generations to assure that future populations will encounter the same living conditions as our current populations [2]. This requires a new way of thinking and acting as

- problems can only be solved in a complex manner and only through systemic thinking;

- purely technical and economic actions must be corrected by ethical considerations;
- exponential developments have to be mastered;
- sustained chronic environmental damage may have a long latency period which can be followed by a sudden onset;
- some problems migrate before they can be identified and assessed;
- globally attuned research and cooperation activities are needed [3].

Industry's current efforts to improve efficiency may be successful but, if considered in isolation, inadequate to achieve sustainability. One of the main reasons is that the improved input-output ratio in production/distribution/use/disposal makes products cheaper, and so in most cases the material and energy savings and the lower environmental burden are offset by the higher sales per unit ("rebound effect"). What we need are sustainable solutions which provide social and economic welfare to all humans and which also take the aspect of resource management – expressed in terms of energy/raw materials/environmental burden/renewability – into account. All stakeholders – political decision-makers, the media as well as schools, universities, colleges and other educational institutions – need to make an active contribution towards sustainable development.

The desirable change in values towards sustainable consumption must not be associated with a lower quality of living or constraints and restrictions of personal freedom. Sustainable consumption may indeed be compatible with a more joyful life and more freedom; but broad public acceptance will only be achieved if consumers are not (constantly) told to sacrifice their amenities. Additionally, it needs to be apparent that all stakeholders join forces and actively implement the sustainability principle in their own field of competence [4]. One prerequisite to this badly needed restructuring of our global societies and economies is to take consistent waste prevention and reduction measures.

1. Approaches towards sustainable consumption and a sustainable economy within the EU

On 16 July 2008, the European Commission published its Communication regarding an "Action Plan on Sustainable Consumption and Production and Sustainable Industrial Policy", in which it explicitly dealt with the enforcement of sustainable consumption and production patterns. Previously, attention had already been drawn on consumers within the European Union

and their supportive role in establishing and improving sustainable production structures.

The following section presents a number of action plans and strategies related to sustainable consumption.

Action Plan for Integrated Product Policy (IPP)

In 2003, the European Commission released its Communication on an Integrated Product Policy (IPP) [5]. The challenge underlying the IPP Action Plan was to reconcile environmental protection and a better lifestyle or wellbeing which, according to the Commission, is often directly influenced by products.

The IPP Action Plan sought to evaluate the environmental performance of sustainable products across their entire life cycle (cradle-to-grave) and to assign consumers the role of “initiators” of sustainable production. To foster the demand for sustainable products, member states were requested to provide the necessary incentives for consumers. To establish the IPP, the European Commission suggested the introduction of the following tools and measures:

- tax and subsidy schemes to support sustainable production and consumption; these shall be developed individually by the member states;
- promotion of a “green” public procurement policy;
- eco-labels to provide consumers with detailed information on energy-efficient products;
- EMAS (Community Eco-Management and Audit Scheme);
- identification of environmentally harmful products and development of pilot projects in conjunction with industry and other relevant stakeholders [6].

In May 2001, the Commission presented its Sustainable Development Strategy (SDS), which was reviewed and revised by the European Council and the European Commission in June 2006. The updated Sustainable Development Strategy identified sustainable consumption and production as a key challenge for establishing sustainable development.

The objectives and targets in the field of consumption and production included:

- fostering sustainable consumption and sustainable production by integrating economic, social and ecological components;
- decoupling economic growth from environmental damage;

- improving environmental and social compatibility of products and production processes;
- promoting a “green” public procurement policy;
- expanding the market of environmental technology and ecological innovation on a global scale.

To implement these objectives, the following measures were proposed:

- developing an action plan on sustainable consumption and sustainable production;
- establishing a dialogue between the European Commission, member states, trade and industry and other relevant stakeholders to set up common guidelines for assuring environmental and social compatibility of products and production processes;
- evaluating the “green” public procurement schemes practised in the member states;
- fostering ecological innovation and environmental technologies through research and market penetration;
- Commission Proposal on the Extension of Performance Specifications for Electrical Appliances and Motor Vehicles;
- supporting the launch of information campaigns for agricultural products (applies to member states and retail trade) [6].

It becomes evident that the European Union is well aware of the problem in its documentation, but reluctant to take effective measures which would really change consumption and production patterns to the extent necessary to bring about sustainable development in the future; responsibility is still shifted to the member states. It needs to be noted, however, that the EU has already established a number of remarkable rules which vitally contribute to sustainability, as is also illustrated in the chapter on case studies.

2. Pathways to sustainable consumption and a sustainable economy

There are two basic approaches to achieving sustainable consumption.

Dematerialisation: Measures towards sustainable development before/at the point of sale (POS).

Avoiding or reducing the input of resources and the production of waste, especially toxic and hazardous wastes (quality aspect), other materials and energy, ranging from product or process design via production and distribu-