

Sustainability Dimensions

Annual Report of the Laboratory of Heat Transfer and Environmental Engineering - Mechanical Engineering Department, Aristotle University Thessaloniki, Greece

2002

The Laboratory of Heat Transfer and Environmental Engineering belongs to the Energy Section of the Mechanical Engineering Department of the Aristotle University Thessaloniki, Greece. Founded in 1990, the Laboratory is responsible for eleven pre-graduate courses in the Mechanical Engineering Department, while also supervising thirteen doctoral candidates in the frame of their post-graduate studies. Furthermore, it has a long record of research and consulting activities, both at national and international level. The staff of the Laboratory includes 6 senior scientists, 28 young researchers and 10 technical and administrative members. More than 90% of the research funds of the Laboratory originate from competitive programmes of the European Commission. The total turnover for the year 2002 is of the order of 1.2 million €.

The present report is the first attempt to summarise the scientific activities of our Laboratory over the last 12 months. The first part consists of selected research highlights during 2002 revealing the width of the Laboratory's involvement in R & D activities. Subsequently, the new research projects with our participation are listed and services provided during the year presented. Among other significant events in 2002, the organisation of EURO-SUSTAIN 2002 deserves being especially highlighted. This combined Conference and Partnering Event was one of the main activities in the frame of the Hellenic Chairmanship of Eureka (2001-2002). Another important milestone for the Laboratory in 2002 was the completion of EUROTRAC-2 and, in particular, its subproject SATURN related to urban air pollution research.

Nine papers co-authored by Laboratory members were published in peer-reviewed journals during the year, while manuscripts of the two plenary presentations given in the last EUROTRAC-2 Symposium in March 2002 appeared as articles in the book summarising the symposium's highlights. Furthermore, in the course of 2002 we participated at 18 conferences with a total of 38 oral presentations given and 8 posters displayed.

Several high-priority activities of the Laboratory in 2002 were related to the transition to EU's 6th Framework Programme. The participation at numerous Expressions of Interest and our involvement in several networks, expert panels and *ad hoc* committees underline the ambition of our Laboratory to play an important role in the newly launched European Research Area. On a national level, we combine strengths with other nine successful AUT Laboratories in our University's "Network for Innovation, Quality and Sustainable Development". This network is in charge of establishing a "Digital Research Centre" with the aim to co-ordinate the exploitation of the scientific results arising from research projects carried out in Universities and other research institutions in our region (Central Macedonia). Moreover, we are about to enhance our involvement in actions in our country aiming at the promotion of sustainable production and at innovation in waste management practices. Last but not least, important activities of our Laboratory planned for the next period refer to environmental aspects related to the 2004 Olympic Games in Athens.

Prof. Dr. Nicolas Moussiopoulos
Laboratory Director



Aristotle
University
Thessaloniki

Laboratory of Heat Transfer and
Environmental Engineering
(LHTEE)



Environmental Assessment of the Aristotle University Thessaloniki

Based on a recommendation by the Environment Council of the Aristotle University Thessaloniki (AUT), in May 2001 the University Senate approved a project aimed at recording and analysing the environmental impacts that arise from various AUT campus activities on a qualitative basis. The project was completed in October 2002 under the coordination of LHTEE.

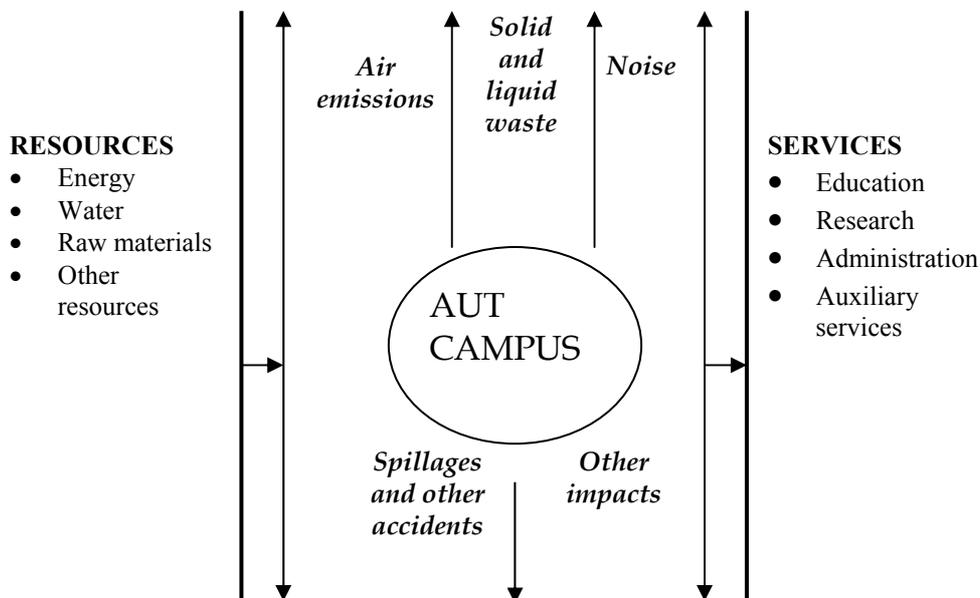
The environmental assessment was carried out on a faculty basis and included vital non-faculty services, such as the central administration department and the refectory. Information was collected based on a customized questionnaire. The information was then analysed and presented in the form of a report. The assessment has provided a systematic and homogenous presentation of the environmental issues and problems that AUT currently faces. In addition, it has presented a complete picture of the responsibilities and the structure and practices of managing campus operations, illuminating possible areas of inefficiency or malpractice. Overall, it has identified structural and administrative issues that may be posing a barrier to the implementation of sound environmental management practices.

Based on the assessment results, a series of recommendations were made, which aim to improve specific environmental problems that AUT faces. These recommendations were scaled in importance according to a set of qualitative criteria, leading to the establishment of a set of high priority recommendations, which should form the starting point for AUT's efforts to improve its environmental performance. These recommendations relate mainly to hazardous substance and waste management, emergency preparedness and management and resource consumption. In addition, a number of horizontal actions were proposed, with the objective of institutionally supporting AUT's environmental management frame-work, such as the institution of an AUT environmental policy, environmental education and training for staff and students and the development of a monitoring system.

Overall, the project has set the foundations for the adoption and diffusion of the principles of sustainable development by AUT, the largest university in Greece, which offers education to some 80.000 undergraduate and postgraduate students and employs around 4.000 academics and research associates.

Project funded by Aristotle University Thessaloniki (2001). Major partners: Other AUT Departments and Laboratories.

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AUT environmental assessment framework

Studying Atmospheric Pollution in Urban Areas - SATURN

The state-of-the-art in urban air pollution research was considerably improved in the frame of SATURN. This EUROTRAC-2 subproject aimed at a better understanding of urban air pollution as a prerequisite for finding effective solutions to air quality problems and for a sustainable development in the urban environment. The main achievements of SATURN may be summarised as follows:

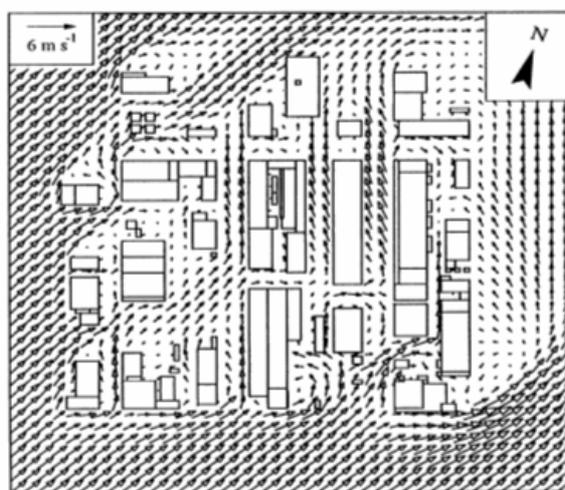
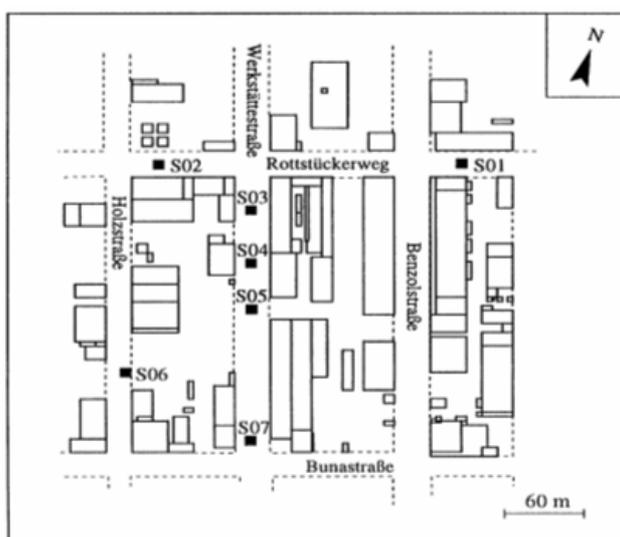
- Field experiments led to a better insight into the characteristics of air pollution at the urban and local scales. Particular emphasis was put into studies of urban aerosols, including tools for the assessment of contributions from various emission sources.
- Urban scale air pollution models were considerably improved in SATURN. Efficient interfaces were developed for linking such models to suitable regional scale models. In addition, improved parameterisation methods were developed, urban aerosol modules formulated and numerical techniques refined.
- Both the concept and the application range of local scale models progressed significantly. Applications include simulations of the air motion, turbulent field and heat fluxes close to building walls as well as their effect on pollution dispersion. Scientific research in SATURN led also to valuable new insight regarding the validation of local scale air pollution models.

The policy relevance of the above scientific achievements is obvious, given their direct influence on the formulation of improved tools for urban air quality assessments. Hence, in the last years new methods to determine the contributions of various sources to air pollution in conurbations were developed and existing ones were improved. Such methods may be utilised by urban authorities wishing to have insight in the possibilities to reduce air pollution levels or to control anticipated increases of levels. Furthermore, methods were refined for predictions of the effect of long-term emission changes. Such methods may considerably help formulating and evaluating air pollution abatement strategies.

Knowledge and tools acquired within the framework of SATURN were integrated in order to make them directly suitable for applications related to environmental policy and to support urban air quality management. Gradually, the integrated modelling tools for modelling and predicting air pollution improve in quality and efficiency, while novel telematics techniques are being applied for informing the public on air pollution.

Project funded by the National funding agencies from 16 European countries and CEC (1997-2002). The SATURN coordination was financially supported by the General Secretariat of Research and Technology of the Greek Ministry of Development. Major partners: Meteorological Institute, University of Hamburg, Germany, Ecole Centrale de Nantes, France, National Environmental Research Institute (NERI), Roskilde, Denmark, TNO/MEP, Apeldoorn, The Netherlands, University of Aveiro, Portugal, University of Cambridge, UK, Environment Institute, Joint Research Centre, Ispra, Italy.

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Wind flow over the BASF site calculated with the MEMO- MIMO multiscale model cascade at a resolution of 4 m (Ehrhard *et al.*, 2000, *Journal of Wind Engineering and Industrial Aerodynamics*, 85, 163-176)

An Environmental Information Services System - APNEE

The need for providing access to information related to the state and the management of the urban atmospheric environment increased rapidly over the last decades. Urban air quality management and information systems are more frequently required to include advanced capabilities for quick, effective and easy to understand environmental information. These systems are based on the need of city authorities and national governments to establish a framework, which enables them to take actions, in order to ensure that air quality is improved and relevant standards are maintained.

APNEE (Air Pollution Network for Early warning and online information Exchange in Europe) started as an EU-funded project in January 2000 and lasted for two years, while its follow up (APNEE-TU) continues until April 2004. It aims at increasing the knowledge of citizens on air quality by establishing user-friendly personalised information services for the citizens and communities to improve the quality of life in Europe, that include: 1) Real time information, early warning and forecasting of air pollution, 2) Cross border information exchange between cities and professionals, Fixed and mobile information channels, based on telecommunication technologies, 3) Interfaces to electronic street panels, voice and mail servers.

The project establishes services for a human centred management of cities in building an information portal for air quality in cities.

At a technical level, APNEE builds an easy-to-use novel interface on air pollution data for citizens by combining several data sources with online population providing different technology access methods, either current (Web - GIS, WML-WAP, street panels), or future (GPRS, UMTS etc). APNEE also serves EU-directives on information citizens about health threatening air pollution states. In order to do so, it provides an interface to air pollution management systems and characterises dedicated information to affected groups of citizens. Thus, APNEE provides to citizens a dedicated information service and informs them about potential impacts of their behaviour.

The application is being developed for a number of European cities. For Greece it focuses on Athens and Thessaloniki.

Projects funded by CEC, Information Society Technologies Programme (APNEE: 2000-2001, APNEE-TU: 2002-2004). Major partners (both APNEE and APNEE-TU): Airmaraix, France, Expertel Consulting, Group France Telecom, France, FAW, Ulm, Germany, NILU, Kjeller, Norway, NORGIT AS, Norway, Siemens, Greece, Telefonica I+D, Spain, 8.t-info, Germany, Universidad Politecnica de Madrid, Spain.

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Δίκτυο έγκαιρης πληροφόρησης για την ατμοσφαιρική ρύπανση στην Ευρώπη

Το APNEE στο κινητό σας

Το APNEE σας δίνει τη δυνατότητα να πληροφορηθείτε σχετικά με την ατμοσφαιρική ρύπανση μέσω του κινητού σας τηλεφώνου με τη χρήση του πρωτοκόλλου WAP στη διεύθυνση

<http://www.apnee.gr/ApneeWAP/index.wml>

Μπορείτε να δείτε τις σελίδες WAP στον υπολογιστή σας κάνοντας κλικ **εδώ**.

Για να ρυθμίσετε το κινητό σας ώστε να είναι δυνατή η χρήση WAP μπορείτε συμβουλευτείτε την αντίστοιχη ιστοσελίδα του παροχέα σας.

- **Cosmote**
- **Vodafone**
- **Telestet**

Home page of APNEE-TU in Greece introducing the Thessaloniki application

The Application of Air Quality Models as Part of a Study for Optimised Urban Transport in Thessaloniki - SUTRA

Transportation problems are among the most pressing strategic development problems in many cities, often a major constraint for long-term urban development in general. The high (and often hidden) costs of urban transportation in both socio-economic and environmental terms require a comprehensive approach in order that problems can be solved.

In the frame of the SUTRA (Sustainable Urban Transportation) project, a multi-disciplinary, integrated approach is used to study the transport related problems of the city of Thessaloniki and a number of models are applied in order to provide the necessary elements for a comprehensive study. The project is EU funded and will be completed in June 2003.

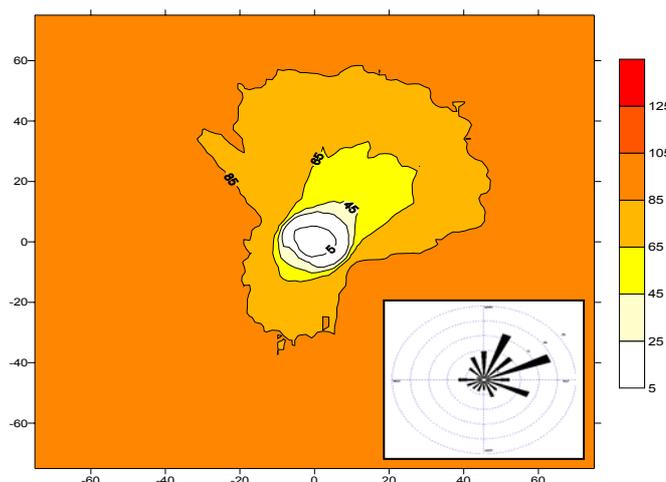
The methodology followed in the current approach consists firstly of defining the set of indicators that will be used to evaluate the current and future status of the city in terms of economic, environmental, social issues, as well as provide a common set of criteria to be used as a basis for city intercomparison. The indicators cover the various elements of the driving forces, pressures, state and impact (DPSI) framework. The data needed to calculate the various indicators under each of the DPSI categories was either collected or computed by one of air pollution, energy or traffic models applied.

The modelling system which was applied for the wider urban area of Thessaloniki, consisted of the following mathematical models:

- The transport model VISUM, used to evaluate alternative transportation strategies related to the reformation of the transport infrastructure and policies in the study area.
- The Transport Emission Model for Line Sources (TREM), used to estimate the quantity of air pollutants that come from anthropogenic activities in the study area.
- The energy model MARKAL, applied in order to analyse the city's energy system and forecast energy demand aiming to estimate the minimum application cost of alternative transportation scenarios.
- Two air quality simulation models: The local scale model VADIS, describing urban street canyon air pollution due to traffic road emissions and the estimation of local hot-spots, and the OFIS photochemical model, which allows an adequate description photochemical transformation processes in an urban plume.

Project funded by CEC, Environment and Sustainable Development Programme (2000-2002). Major partners: ESS GmbH, Gumpoldskirchen, Austria, PTV Planung Transport Verkehr AG, Karlsruhe, Germany, Fondazione ENI Enrico Mattei, Italy, Universidade de Aveiro, Portugal, University of Geneva, Switzerland, Fundacion Universidad de Belgrano, Buenos Aires, Argentina.

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Number of days with maximum 8hour running average ozone concentration exceeding $120\mu\text{g}/\text{m}^3$, calculated by the OFIS model, for a $150 \times 150\text{km}^2$ area surrounding Thessaloniki, and wind rose of prevailing wind during the summer semester of 1995

Incorporation of an Aerosol Module in the OFIS Model – Preliminary Results

OFIS is a robust and efficient model for simulating the formation of photochemical pollutants in an urban plume. The model was developed to serve a twofold aim; allowing authorities to assess urban air quality by means of a fast, simple and still accurate model and refine a regional model simulation by estimating the urban subgrid effect on pollution levels. The model uses an 1D eulerian framework calculating numerically pollutant concentrations advected upwind and downwind of the city assuming constant wind features and varying mixing height. Laterally to the wind trajectory passing through the city, pollutant levels are estimated by means of a box-model of varying height. All model calculations are performed using a lumped atmospheric chemistry mechanism such as the EMEP MSC-W mechanism and CBM-IV. In its most recent version OFIS-2, an aerosol module was incorporated to OFIS in order to calculate particulate matter concentrations.

OFIS-2 describes the dispersion of emitted particles and the formation of new ones, due to condensation of equilibrated inorganics and oxidation of volatile organics. Particles consist of sulphate, nitrate, ammonium, sodium, chloride, water, elemental and organic carbon and undefined species. The particle mass is assumed to be distributed to three overlapping lognormal size distributions, corresponding to nucleation, accumulation and coarse particles. All modes are chemically active while the nucleation and accumulation modes are also coagulating.

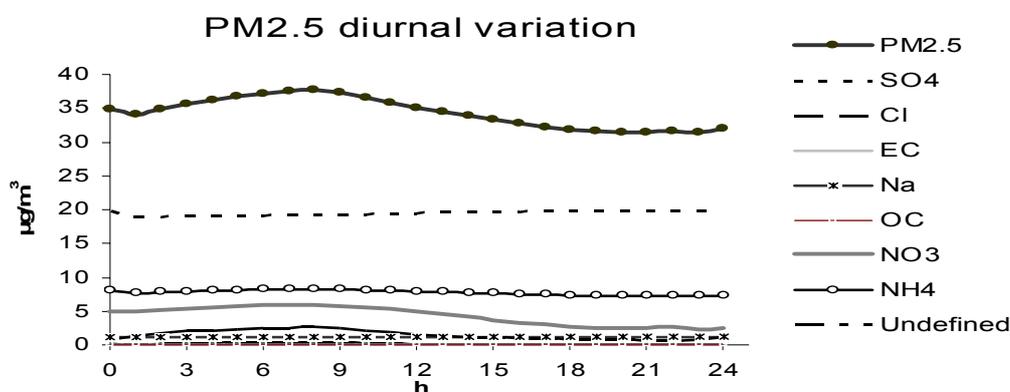
The model calculates the change due to each process individually and integrates the results using a semi-implicit, second order integrator originally developed for atmospheric chemistry problems.

The model performance is analysed within the framework of the EU 5th FP project MERLIN. OFIS is applied to simulate the urban plume formation of 20 European cities, well distributed over the continent, and for a period of one year.

These simulations are based on large-scale meteorological data, long-range transport information and wind statistics during this period. The EMEP MSC-W regional model provides boundary conditions for the model application, while emissions originated from different sources, including those within the City-Delta exercise of the Clean Air for Europe Programme and European-wide emission databases. Preliminary model results for the city of London are presented in the below figure as diurnal variation of speciated particulate matter. Most particulate mass seems to be secondary inorganic while elemental and organic carbon levels are unrealistically low due to low primary PM emission estimates. Further investigation towards attaining more accurate emission data is required to improve the simulation quality.

Project funded by CEC, Environment and Sustainable Development Programme (2001-2003). Major partners: University of Stuttgart, Germany, University College London, UK, Norwegian Meteorological Institute, Norway, Insitute for Ecology of Industrial Areas, Poland, ECOFYS, The Netherlands.

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Speciated particulate matter diurnal concentrations for London, estimated in preliminary calculations with the OFIS model

Liquid Hydrogen Fuelled Aircraft Concept - CRYOPLANE

Liquid Hydrogen (LH) is the only known fuel suitable for aircraft to be produced from renewable energy and offering extremely low emissions (zero CO₂, very low NO_x). Use of LH can eliminate the dependency of aviation upon dwindling crude oil resources reducing dramatically the contribution of aviation to the anthropogenic greenhouse effect.

The CRYOPLANE project addressed aircraft configuration/performance, systems and components, propulsion, safety, environmental compatibility, infrastructure and operation, and scenarios for the transition from kerosene to H₂. 36 partners from Austria, Belgium, France, Germany, Greece, Netherlands, Norway, Spain, Sweden, United Kingdom, representing industry, research institutes and universities with the coordination of Airbus Deutschland GmbH took part at the project.

H₂ can be produced by electrolysis of water using electrical power from any renewable energy source. The primary combustion products are water and very small amounts of NO_x. Liquid H₂ offers the prospect of long-term growth of aviation in full agreement with the need to protect the environment. The energy content per weight of H₂ is 2.8 times higher than for kerosene. Hydrogen's liquid state (-253°C) requires insulated spherical or cylindrical tanks. Its volume is 4 times greater than for kerosene and that requires significant configuration changes. Emission of water is by a factor of 2.5 larger than for kerosene.

Due to missing condensation nuclei the contrails are expected to be optical thin. Validation is foreseen. The safety level will remain the same.

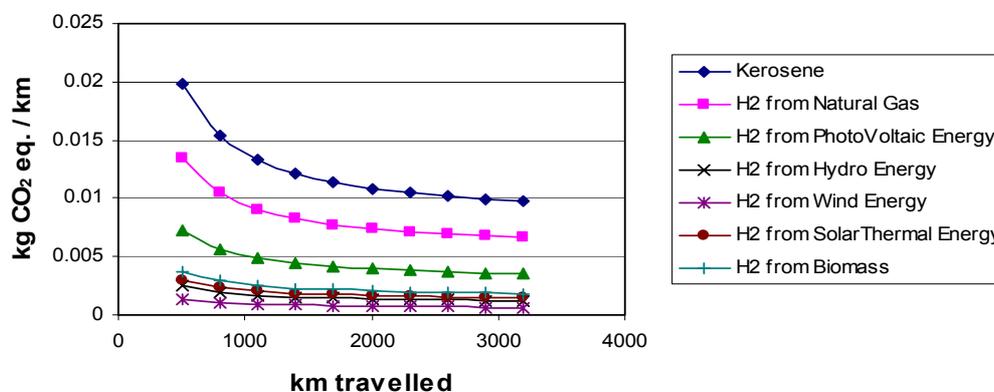
A very large number of environmental burdens result from the operation of the different fuel cycles. Life Cycle Analysis (LCA) is a powerful tool in the evaluation of the environmental impacts of chemical processes. Its main advantage in environmental decision making lies in the provision of a quantification basis for assessing potential improvements in environmental performance of a system throughout its life cycle. The life cycle of aviation fuel includes the production and the use of the aviation fuel in different types of aircrafts. In the case of hydrogen, all production methods are examined.

Life Cycle Analysis of kerosene is the first step for comparing the environmental impacts with those from different production chains of hydrogen fuel. A complete and accurate identification and quantification of air emissions, water effluents, and other life-cycle inputs and outputs has been performed. The environmental performance of kerosene that has been determined by the LCA study has been used as a reference point for the evaluation of hydrogen as an aviation fuel.

Although hydrogen is generally considered to be a clean fuel, it is important to recognize that its method of production plays a very significant role in the level of environmental impacts. Examining the inputs and outputs from the life cycle of different production paths in comparison with that of kerosene gives a complete picture of the environmental burdens associated with aviation fuel production and use.

Project funded by CEC, Growth Programme (2000-2002). Major partners: DaimlerChrysler Aerospace Airbus GmbH, Hamburg, Germany, VKI, Turbomachinery Department, Brussels, Belgium, Airbus Industrie, Toulouse, France.

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Life cycle CO₂ equivalent emissions of an Airbus A3319-100 aircraft per km travelled

Waste Charging Policy According to the Pay-As-You-Throw Principle - PAYT

Waste charges constitute an important financial aspect in waste management: They are paid by the waste producer, as a means to cover the costs for collection, treatment and disposal of residual wastes. The contemporary trend worldwide in this field is variable-rate pricing (or unit pricing), as an alternative to the traditional flat-rate system, since this trend is in accordance with the Polluter-Pays Principle in waste management (Pay As You Throw - PAYT).

PAYT is conceived as a means to actively provide incentives to the waste producers (both household and non-household ones) for waste avoidance, reduction and recycling. Basis for this is that these activities will help reducing the amount of residual wastes that will be finally set out for collection, further treatment and disposal. The reason for this is that the calculation of the imposed waste charges is based on this amount of residual wastes and thus, on the service provided for their collection.

The waste charging policy in a PAYT system determines the calculation mode of the service level to be charged and may be one of the three following types:

- Neutral waste charging policy: Each collection unit (bin, container, etc.) costs the same for the citizen, regardless of the number of units set out for collection.
- Passive waste charging policy: The second collection unit set out from the same waste

producer costs less than the first, the third less than the second, etc.

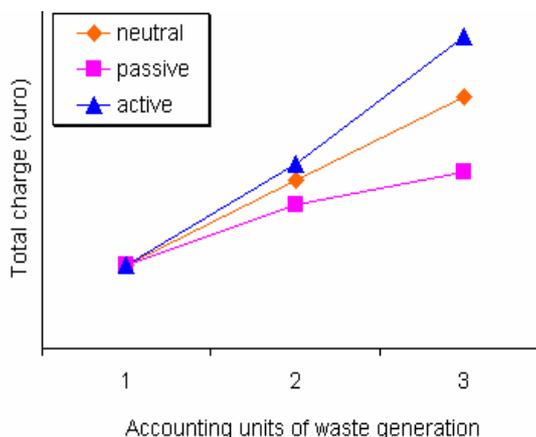
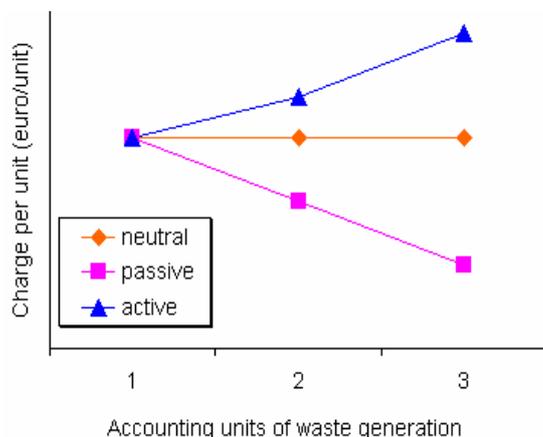
- Active waste charging policy: The second collection unit set out from the same waste producer costs more than the first, the third more than the second, etc.

Variable waste calculation systems may be either weight- or volume-based. In the former case, wastes are weighted, whereas in the latter the volume set for collection is the basis for the calculation. The variation of waste charges according to the number of collection units in a volume-based system is illustrated in the left panel of the below figure. The right panel shows the variability of waste charges according to the followed policy and the number of waste collection units, again in a volume-based system.

The PAYT project aims also to develop ways for overcoming the major problems (e.g. illegal dumping, waste tourism, social unfairness and inequity, etc) that may appear if the implementation mechanism is not efficiently adjusted to the local conditions and peculiarities and if adequate waste diversion paths are not made available. Simulation scenarios for Greece will be compiled and evaluated, representing different possible ways of implementing PAYT according to the international state of the art.

Project funded by CEC, Environment and Sustainable Development Programme (2000-2003). Major partners: Technische Universitaet Dresden, Germany, Joint Research Center, Institute for Prospective Technological Studies, Seville, Spain.

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Demonstration of the variability of waste charges (left panel: unit, right panel: aggregate) for an example of 3 accounting units according to the followed waste charging policy in a volume-based system. Accounting units refer to the number of bins or bags

Establishment of Regional Design Advice and Support Units to Promote Use of Renewable Energy in Buildings by Local Actors - REASURE

Communities and the buildings, which constitute the urban fabric, play a significant role in energy consumption in Europe. In 1995, the domestic and tertiary sectors represented approximately 40% of total final energy consumption in EU, with this value remaining fairly constant over the decade 1985-1995 (average annual growth of 0.3%). Higher energy efficiency in new buildings produced a dampening effect. However, increased living standards and urbanisation have resulted in larger living areas in residencies and in greater appliance penetration.

The aim of the project is to combine and adapt scientific and technological knowledge with best engineering and architectural practice and to design, establish, develop and operate a number of Regional Design and Advice Support Units (DASUs) around Europe, which will aim, train and support the local actors (architects, engineers, designers, practitioners, etc.) on the use and integration of energy efficient Renewable Energy Sources systems and techniques, either when rehabilitating the building stock or when constructing new buildings.

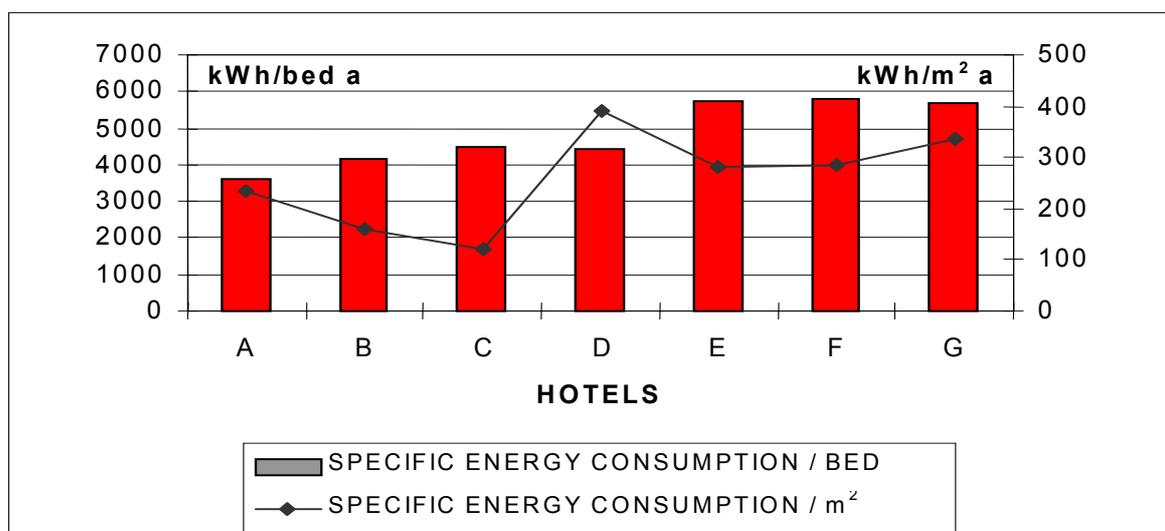
The specific objectives of the project include: the adaptation of already developed practical educational material and design tools to the local conditions, so that they are suitable for use within the scope of the project, the organisation of specific events (like architectural competitions, seminars, etc.) promoting the use of RES in buildings among local actors, the assessment of the energy characteristics of each involved regions' building stock and the development of a specific ready-to-use rehabilitation plan for the buildings located within the region giving emphasis to a number of specific important buildings.

So far DASUs have already been established and operate in five European countries. Emphasis was placed in the adoption of a common methodology for the recording of each area's building stock, the evaluation of its energy behaviour and the elaboration of appropriate energy saving measures.

In Greece, the DASU was established in Pieria and has already performed a series of consultancies and audits, focusing on the hotel and the public sector. The results of the research have led to the production of guidelines for the efficient energy management in buildings, as well as for successful energy renovation measures.

Project funded by CEC, ALTENER Programme of DG TREN, (2002-2003). Major partners: Pieriki Development, University of Thessaloniki, University of Athens, Greece, AICIA, Spain, National University of Ireland, University of Strathclyde, UK, WIP KG, Germany, SOEDAN, Spain, Tramore Development Trust Ltd, UK.

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Results of the energy audits in Pieria's hotels' stock

Research

Environmentally Viable Electronic City (ENV-e-CITY)

Objective: The project objective is to develop an internet-based application for environment information related services. The e-content domain extends over four environmental application areas: air emission, air quality, topography and meteorology.

LHTEE contribution: Co-ordination and scientific support in requirements analysis (needs of city authorities, EIA experts, citizens), system architecture design and development.

Funded by: CEC, eContent-European digital content on global networks (2002-2003).

Planning-Implementation and Operation of a Pilot Project on Environmental Management

Objective: The project is composed of a qualitative review of the environmental impacts caused by the activities of each Department that is situated on the Aristotle University Thessaloniki campus. The qualitative review will be carried out according to ISO 14001.

LHTEE contribution: Project coordination.

Funded by: Aristotle University Thessaloniki (2001- 2002).

Air Pollution Network for Early Warning and On-line Information Exchange in Europe, Take Up (APNEE-TU)

Objective: Enabling citizens to access and exchange information on air pollution in urban regions via 2.5 G mobile phone telecommunication technologies and SMS, WAP, GIS over the web, voice servers and street panels, by implementing and testing the services developed in the frame of the APNEE project.

LHTEE contribution: Study the user requirements of the overall system; development of the system for Thessaloniki evaluation co-ordination, system component adaptation.

Funded by: CEC, Information Society Technologies Programme (2002-2004).

Photocatalytic Innovative Coverings Applications for Depollution Assessment (PICADA)

Objective: To reduce the cost and increase the performances of the innovative coverings for sheet-like applications in order to make available affordable, really sustainable products whose large applications

may be combined with already existing techniques, and to improve the quality of urban built environment.

LHTEE contribution: Urban depollution modelling, In-situ tests.

Funded by: CEC, Growth Measurements & Testing, Infrastructures (2002-2005).

Databases and Web Site for the Adoption of IPP in SMEs (e-LCA II)

Objective: The eLCA 2 is a cross sectorial project between Integrated Product Policy (IPP), Small and Medium sized Enterprises (SMEs) and Information Society (IS) with a general objective to realise “Databases and Web site for the adoption of Integrated Product Policy by SMEs” through the implementation of a Web site finalised to promote the adoption of IPP by SMEs, provided with specialised databases, information/training and tools, and managed in an innovative public-private partnership model.

LHTEE contribution: Web site design and content implementation, cotton textile product chain database development, dissemination activities.

Funded by: CEC, eContent Programme (2002-2004).

Digital Research Center of Central Macedonia

Objective: 1) To disseminate the research results of Central Macedonia Higher Education and Research Institutes, 2) To promote exploitation of the research results by the Private Sector, 3) To provide support to the research institutes for the exploitation of their products through the development of spin-offs and technology transfer. This will be achieved through the development of a website.

LHTEE contribution: Design and development of the content and structure of the Digital Research Center. A market research on identifying the needs for research results and products of the Private Sector.

Funded by: Innovative Actions European Regional Development Funds (2002-2004).

Advanced Tools for Rational Energy Use towards Sustainability with Emphasis on Microclimatic Issues in Urban Applications (ATREUS)

Objective: To improve the present knowledge in the field of sustainable urban development, by optimising heating, ventilation and air-conditioning systems as well as maximising the benefit from the large potential of renewable energy sources.

LHTEE contribution: Co-ordination, numerical modeling of mean and turbulent flow around buildings, energy behaviour of buildings, field measurements.

Funded by: CEC, TMR Programme (2002-2005).

Establishment of Regional Design Advice & Support Units to Promote Use of Renewable Energy in Buildings by Local Actors (REASURE)

Objective: To establish a number of Regional Design and Advice Support Units around Europe, which will aid the local actors in implementation Renewable Energy Sources systems and techniques in the building environment.

LHTEE contribution: Creation of a complete map on the energy characteristics of all types of local buildings, development of a complete energy-retrofitting plan for the building stock in Pieria and development of a ready to apply specific technical and economic rehabilitation plan for a series of important public and private buildings in Pieria.

Funded by: CEC, ALTENER programme of DG TREN (2002-2004).

Development of a System for the Integrated Management of Contaminated Land (PEPER)

Objective: The project's main objective is to develop and implement an integrated methodology for the systematization of the evaluation and decontamination process of polluted sites. It also aims at the pilot-scale application of decontamination techniques, in order to study and optimize them both technically and financially. Finally, it will contribute to the registration of contaminated sites in Greece and the development of a national policy regarding their evaluation, management and treatment.

LHTEE contribution: Field study, G.I.S. development.

Funded by: PEPER 2000, Intergeo Ltd. (2002).

Ecological and Aesthetic Rehabilitation of Solid Waste Deposition Sites (PENED)

Objectives: 1) Study of the effects of urban solid waste deposition sites on natural ecosystems, 2) Prescription of the necessary steps for the rehabilitation of the ecosystem's natural functions, 3) Site restoration for use from the local population.

LHTEE contribution: Study of the area, bibliographic data, various field activities related to resource reclamation from the landfill.

Funded by: General Secretariat of Research and Technology, PENED 2001 Programme.

Services

During the year the Laboratory provided consulting and other services in the following cases:

- Development of a computational tool for an integrated management and design of desalination systems that use renewable energy sources (solar, wind, geothermal) as their energy carrier
- Consultancy services in the solid and toxic waste management study for the PETROLA HELLAS refinery
- Assessment of the thermal pollution and the potential impact on local climate from the operation of the planned natural gas fired thermoelectric unit of Hellenic Petroleum
- Impact on air quality from the use of pet coke as a fuel in the furnaces of the ceramic products industry TERRA S.A.

Articles in Books

Dourala N., Boura A. and Moussiopoulos N. (2002) Teaching Sustainability at the Aristotle University of Thessaloniki, Greece, in **Teaching Sustainability – towards curriculum greening** (W. Leal Filho, ed.), Peter Lan Scientific Publishers, Bern, 391 - 404

Moussiopoulos N. and Louka P. (2002) Advanced local scale models for simulating air flow and pollutant dispersion in street canyons, in Proceedings of the EUROTRAC-2 Symposium 2002, **Transport and Chemical Transformation in the Troposphere** (P. Midgley, M. Reuther, eds.), Margraf Verlag, Backhuys Publishers, 175 - 181

Moussiopoulos N. (2002) Refined multiscale modelling tools, in Proceedings of the EUROTRAC-2 Symposium 2002, **Transport and Chemical Transformation in the Troposphere** (P. Midgley, M. Reuther, eds.), Margraf Verlag, Backhuys Publishers, 189 - 195

Books

N. Moussiopoulos, K. Karatzas, eds (2002) SATURN / EURASAP: Proceedings of a Workshop on Urban Air Quality Management Systems, 123 pp.

N. Moussiopoulos, C. J. Koroneos, N. Dourala and E.-A. Kalognomou, eds (2002) EURO-SUSTAIN 2002: Proceedings of the Conference: Implementing the Integrated Product Policy, 30 pp (accompanied by a CD-ROM).

Papers in Journals

Klaic Z.B., Nitis T., Kos I. and Moussiopoulos N. (2002)

Modification of the local winds due to hypothetical urbanization of the Zagreb surroundings, *Meteorology and Atmospheric Physics* **79**, 1-12.

Karatzas K., Moussiopoulos N. and Arvanitis Th. (2002)

On the influence of sea-surface temperature on mesoscale flows: an example from the city of Athens, Greece, *International Journal of Environment and Pollution* **8**, 85-90.

Slini Th., Karatzas K. and Moussiopoulos N. (2002)

Statistical analysis of environmental data as the basis of forecasting: An air quality application, *The Science of the Total Environment* **288**, 227-237.

Koroneos C.J., Spachos Th. and Moussiopoulos N. (2002)

Energy analysis of renewable energy sources, *Renewable Energy* **28**, 295-310.

Papadopoulos A. and Theodosiou T. (2002)

Feasibility and effectiveness of renovation measures at the buildings' shells to reduce their heating demand, *KTIRIO*, Scientific Edition, A, 69-76. (in Greek)

Papadopoulos A., Theodosiou T. and Karatzas K. (2002)

Feasibility of energy saving renovation measures in urban buildings: The impact of energy prices and the acceptable pay back time criterion, *Energy and Buildings* **34**, 455-466.

Sahm P., Louka P., Ketzl M., Guilloteau E. and Sini J.-F. (2002)

Intercomparison of numerical urban dispersion models – Part I: Street canyon and single building configurations, *Water, Air and Soil pollution: Focus* **2**, 587-601.

Ketzl M., Louka P., Sahm P., Guilloteau E., Sini J.-F. and Moussiopoulos N. (2002)

Intercomparison of numerical urban dispersion models – Part II: Street canyon in Hannover, Germany, *Water, Air and Soil pollution: Focus* **2**, 603-613.

Tourlou P.M., Sahm P. and Moussiopoulos N. (2002)

Integrated assessment of air pollution abatement strategies in urban areas: Application to the greater Athens area. *Water, Air and Soil Pollution: Focus* **2**, 731-744.

Participation at Conferences

1st International Conference of Hellenic Solid Waste Management Association, Athens, Greece, 28 February -1 March

Oral presentations

Mining of disposed solid wastes from semi - and un-controlled landfills: Experience, practice and perspectives (N. Moussiopoulos)

Locating facilities for treatment and disposal of solid wastes: A review of current literature (A. Karagiannidis)

“Pay-as-you-throw” An innovative solid waste-charging system for variable pricing of waste collection (A. Karagiannidis)

1st Environmental Conference of Macedonia, Thessaloniki, Greece, 1-4 March

Oral presentations

Sampling field work and laboratory analyses in the frame of integrated investigation of municipal solid waste management in Thessaloniki, Greece (G. Perkoulidis)

Development of a model system for the prediction and management of air quality in Thessaloniki-Application for alternative transportation scenarios (P. M. Tourlou)

EUROTRAC-2 Symposium 2002 Garmisch-Partenkirchen, Germany, 11-15 March

Oral presentations

Refined multiscale modelling tools (N. Moussiopoulos)

Advanced local scale models for simulating air flow and pollutant dispersion in street canyons (N. Moussiopoulos)

In addition, 8 posters were displayed

1st Preconference of the World Energy Conference 2002, Kozani, Greece, 21-23 March

Oral presentation

Integrated product policy: design and implementation (C.J. Koroneos)

SATURN/EURASAP Workshop on Urban Air Quality Management Systems, Rhodes, Greece, 3 April

Oral presentations

Integrated assessment of air pollution abatement strategies in urban areas: Application of OPUS-AIR to the Greater Athens area (N. Moussiopoulos)

Integrated urban air quality management and information systems (K. Karatzas)

EURO-SUSTAIN Conference: Implementing the Integrated Product Policy, Rhodes, Greece, 2-4 April

Oral presentations

Towards an environmentally viable city
(N. Moussiopoulos)

Sustainable human-centric services towards sustainable cities (K. Karatzas)

The use of hydrogen as an alternative fuel – CRYOPLANE (K. Koroneos)

2nd Preconference of the World Energy Conference 2002, Euboa, Greece, 18-20 April

Oral presentation

Environmental evaluation of hydrogen as an aviation fuel - the CRYOPLANE project (N. Moussiopoulos)

12th Annual Meeting of the Society of Environmental Toxicology and Chemistry (SETAC), Vienna, Austria, 12-16 May

Oral presentations

Life cycle analysis of brick production
(C. J. Koroneos)

Life cycle analysis of the Dodecanese power generation system (C. J. Koroneos)

Life cycle analysis of kerosene (C. J. Koroneos)

6th Balkan Conference on Operational Research, Thessaloniki, Greece, 22-25 May

Oral presentations

Dimensioning autonomous renewable energy systems with the multicriteria analysis method ELECTRE III
(S. Oxizidis)

The Greek public power corporation's capacity development: A system dynamics approach
(C. G. Vlahokostas)

World Energy Conference 2002, Athens, Greece, 12-15 June

Oral presentation

Some remarks on the environmental dimension of the European sustainable development strategy
(N. Moussiopoulos)

11th International Symposium-Transport and Air Pollution, Graz, Austria, 19-21 June

Oral presentation

A modelling method for estimating transboundary air pollution in south-eastern Europe (N. Moussiopoulos)

6th Conference on Protection and Restoration of the Environment VI, Skiathos Island, Greece, 1-5 July

Oral presentations

Environmental impact of insulating material at the end of their useful lifetime (A. Karamanos)

Assessment of the collection of urban solid wastes
(A. Karagiannidis)

Flow field and fire simulations in tunnels (I. Ossanlis)

Conference on Passive and Low Energy Architecture 2002 Design with the Environment, Toulouse, France, 22-24 July

Oral presentation

Reducing the cooling loads whilst renovating a medieval Mediterranean tower into a museum
(A. Papadopoulos)

8th FECS Conference on Chemistry and the Environment, Athens, Greece, 31 August - 4 September

Oral presentation

Recent achievements in urban air pollution research
(P. Louka)

16th Int. Conference: Informatics for Environmental Protection, Vienna, Austria, 25-27 September

Oral presentation

Environmental communication in the information society (K. Karatzas)

8th International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes, Sofia, Bulgaria, 14-17 October

Oral presentations

The contribution of SATURN to a better understanding of urban air pollution (N. Moussiopoulos)

Evaluation of MEMO using the Escompte pre-campaign dataset (N. Moussiopoulos)

Correlation of air pollution and meteorological data using Neural Networks (K. Karatzas)

An environmentally viable electronic city application (ENV-e-CITY) towards harmonization in the use of environmental information (K. Karatzas)

3rd European Conference on Energy Performance & Indoor Climate in Buildings, Lyon, France, 23-26 October

Oral presentation

Integration of renewable energy systems in urban buildings: From energy conservation to feasible energy supply (A. Papadopoulos)

7th National Conference in Renewable Energy Sources, Patra, Greece, 6-8 November

Oral presentations

Dimensioning of RES systems in autonomous insular areas: A case study for the Karpathos – Kassos system (A. Papadopoulos)

Energy planning on a regional level: A case study for the region of Central Macedonia (A. Papadopoulos)

Innovative temporary storage of solid wastes by a system of collection and compaction chambers (G.Tantsis)

Events

In the framework of the Hellenic Chairmanship in Eureka (the European programme for promoting innovation in industrial research), our Laboratory organised 2-4 April 2002 in Rhodes EURO-SUSTAIN 2002. This combined Scientific Conference and Eureka Partnering Event aimed primarily at highlighting the major aspects of Integrated Product Policy and identifying the impediments for its adoption. Representatives of industry, academia and various international associations participated at EURO-SUSTAIN 2002 thus contributing to its success. The thematic areas addressed were Eco-Design, Sustainable Production, Life Cycle Management and Sustainable Services & Systems.

The Laboratory is actively involved in the activities of the Hellenic Solid Waste Management Association (HSWMA). In 2002 it contributed to the success of HSWMA's first national conference. Furthermore, the Laboratory Director initiated the formation of a task force of HSWMA in Northern Greece. This task force organised a first meeting of HSWMA members and other individuals interested in the activities of HSWMA on 20 May 2002 in Thessaloniki. Moreover, the task force agreed on a sequence of actions to be organised in the winter 2002-2003, including workshops on the role of local authorities in Solid Waste Management and on the innovative methods for Thermal Treatment of Wastes.

News

The fluctuation of co-workers is a characteristic feature for any University institution. After gaining experience and improving their capabilities, mature scientists leave the University to join industry or to continue their career in various authorities or other academic institutions.

During 2002, 12 new co-workers joined the Laboratory: M. Theodoseli, I. Theodoridou, Ch. Karavakas, Ch. Naneris, D. Panoglou, D. Papadopoulou, A. Papathanasiou, M. Chrissochoou, G. Theodosiou, E. Agorastoudi, D. Alexiou and D. Panokostas (the first 9 of them as young researchers; Christos Naneris returned to our Laboratory after his military service). We wish to all a fruitful time in our Laboratory. In the same period, 9 co-workers left our Laboratory: M. Behl, E. Georgiadou, G. Katsikas, K. Mandikou, Th. Baba, I. Panagiotakopoulos, M. Savopoulos, Paraskevi-Maria (Evelina) Turlou and Petroula Louka. Evelina belonged to the Laboratory's staff for 7 years. After receiving her PhD in June 2000 she led the Laboratory's Assessment group being in particular responsible for our involvement in the European Topic Centre for Air and Climatic Change. In March 2002 Evelina joined the Greek Ministry of Transport being responsible for the technical inspection of vehicles and the emission control card. Petroula joined our Laboratory in November 2000 as a post-doc researcher and has led the Laboratory's Modelling group in the period August 2001-October 2002. For personal reasons she decided to move to Athens where she established already a collaboration with the Laboratory of Meteorology of the University of Athens. We wish Evelina and Petroula as well as to all other former staff members of our Laboratory much success in the continuation of their professional career.

After twelve years of collaboration with our Laboratory, Avraam Karagiannidis was appointed Assistant Professor for Thermal Engineering with emphasis on Waste Management issues in Aristotle University's Department of Mechanical Engineering. Avraam finished his PhD in September 1996, but already prior to this he has been leading the Waste Management group of the Laboratory. As the third faculty member of the Laboratory, he will certainly contribute to a further increase of our research and other academic activities in his fields of expertise.

The Director of the Laboratory Professor Nicolas Moussiopoulos became in 2002 a full member of Leopoldina, the German Academy of Natural Scientists. He is presently the only Greek member of this Academy and the first Greek to become a member of Leopoldina's Technology Section. Moreover, Professor Moussiopoulos was awarded in 2002 the Bundesverdienstkreuz, the Order of Merit of the Federal Republic of Germany.

Laboratory Personnel

| | |
|-----------------------|--------------------------------------|
| Nicolas Moussiopoulos | Professor, Dr.-Ing. habil (Director) |
| Agis Papadopoulos | Assistant Professor., Dr.-Eng., MSc |

Researchers with Co-ordinating Functions

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|----------------------|------------------|
| Avraam Karagiannidis | Dr.-Eng., MSc |
| Kostas Karatzas | Dr.-Eng. |
| Christopher Koroneos | PhD |
| Athanasios Arvanitis | Mech. Engineer |
| E.-A. Kalognomou | Physicist, MPhys |

Researchers and PhD Students

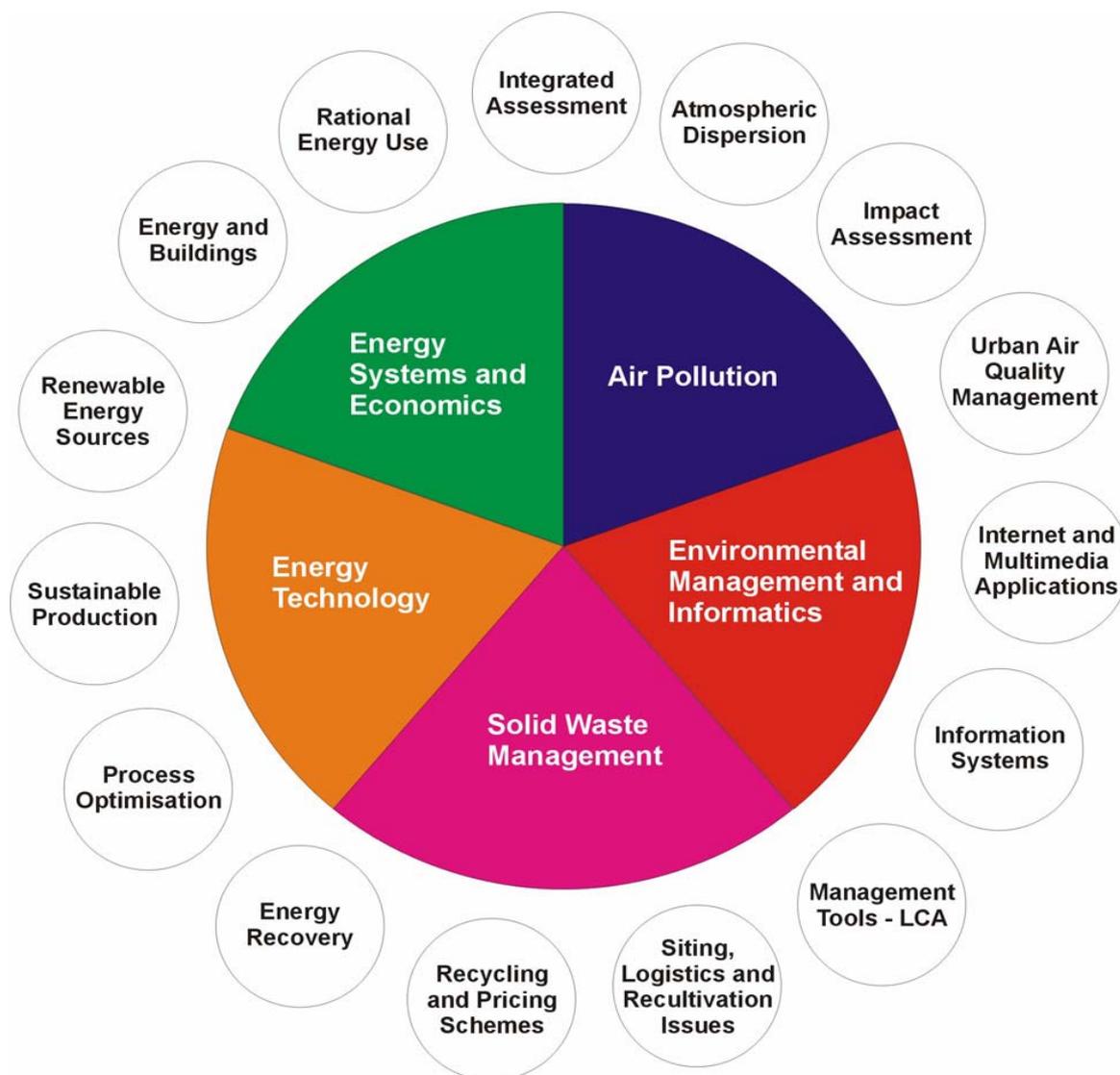
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|----------------------|---------------------------|-------------------------|--------------------|
| Georgios Perkoulidis | Dr.-Eng. | Christos Karavakas | Mech. Engineer |
| Eleni Chliopanou | Mech. Engineer, MSc | Asterios Masouras | Mathematician |
| Athina Kaprara | El. & Comp. Engineer, MSc | Christos Naneris | Environmentalist |
| Ioannis Ossanlis | Mech. Engineer, MSc | Symeon Oxizidis | Mech. Engineer |
| Ioanna Theodoridou | Civil Engineer, MSc | Despoina Panoglou | Materials Engineer |
| Fotios Barbas | Aerosp. Engineer, MSc | Despoina Papadopoulou | Economist |
| Aristotelis Avgelis | Mech. Engineer | Apostolis Papathanasiou | Physicist, MPhys |
| Charoula Balla | Mech. Engineer | Georgios Roubas | Chem. Engineer |
| Maria Chrissochoou | Physicist | Lora Slini | Mathematician |
| Aristidis Dobros | Chem. Engineer | Maria Theodoseli | Environ. Engineer |
| Natasha Dourala | Economist, MA | Georgios Theodosiou | Engineer |
| Ioannis Douros | Physicist, MPhys | Christos Vlahocostas | Mech. Engineer |
| Efrosini Giama | Mech. Engineer | Anna Xirogiannopoulou | Mech. Engineer |
| Anastasios Karamanos | Mech. Engineer | | |

Technical Staff and Secretariat

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|---------------------|--------------------------|-----------------------|------------------------|
| Lazaros Dinakis | Tech. & Software Support | Afentoula Koukounaris | Administration Manager |
| Giannis Papaioannou | Tech. & Software Support | Dimitra Alexiou | Administrative Support |
| Lazaros Sotiriadis | System Administrator | Eugenia Agorastoudi | Administrative Support |
| Dimitris Panokostas | System Administrator | Georgia Spiridou | Administrative Support |
| Sofia Eleftheriadou | Automation Engineer | Eleni Kobogianni | Secretary |



AUT/LHTEE's Research Fields



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