Greek Experiences in Energy Efficiency

Facts and Vision

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Greece

Industrial Systems Institute

Outline

- Who we are
  - ISI identity, aims and expertise
- Energy efficiency context
  - Energy sectors, objectives & the role of ICT
- Current situation in Greece
  - Greek figures and policies
- Engineering practices in Greece
  - Indicative projects, applications & results
- Where do we want to go?
  - Vision and priorities

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Industrial Systems Institute

- A private legal entity supervised by the General Secretariat of Research and Technology of the Greek Ministry of Development
- Location: Patras, Greece
- Foundation : February 1998
- Director: Professor Dimitrios Serpanos
- Since 2003, one of the 5 institutes comprised in the "*ATHENA Research and Innovation Centre in Information, Communication and Knowledge Technologies*"

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General Aims

- Development of high technology products and provision of advanced services
- Support of the competitiveness of the Greek industry through innovation
- Collaboration with technological and productive partners
- International presence through competitive programs
- Studies, funded research and technological projects

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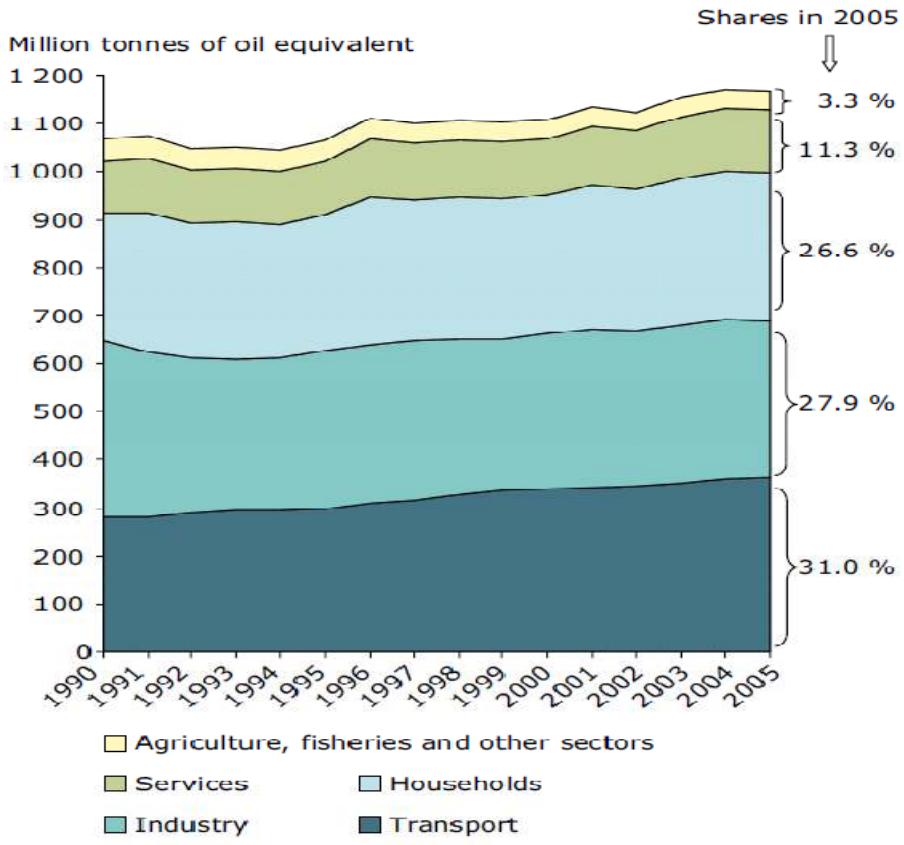
Research Areas & Expertise

Sustainable Development	Information and Communication Systems for the Industry
	Enterprise Integration
	Advanced Production Systems
	Modeling and Automation
	Electronic Systems
	Networked Embedded Systems

20-20-20 by 2020

- EU policy targets:
  - Increase the use of renewable sources:
    - **20**% of energy consumption should come from RES
  - Increase the energy efficiency:
    - **20**% lower energy consumption (projected)
  - **20**% reduction of carbon emissions

EU-27 Energy Consumption



Source: EEA / Eurostat

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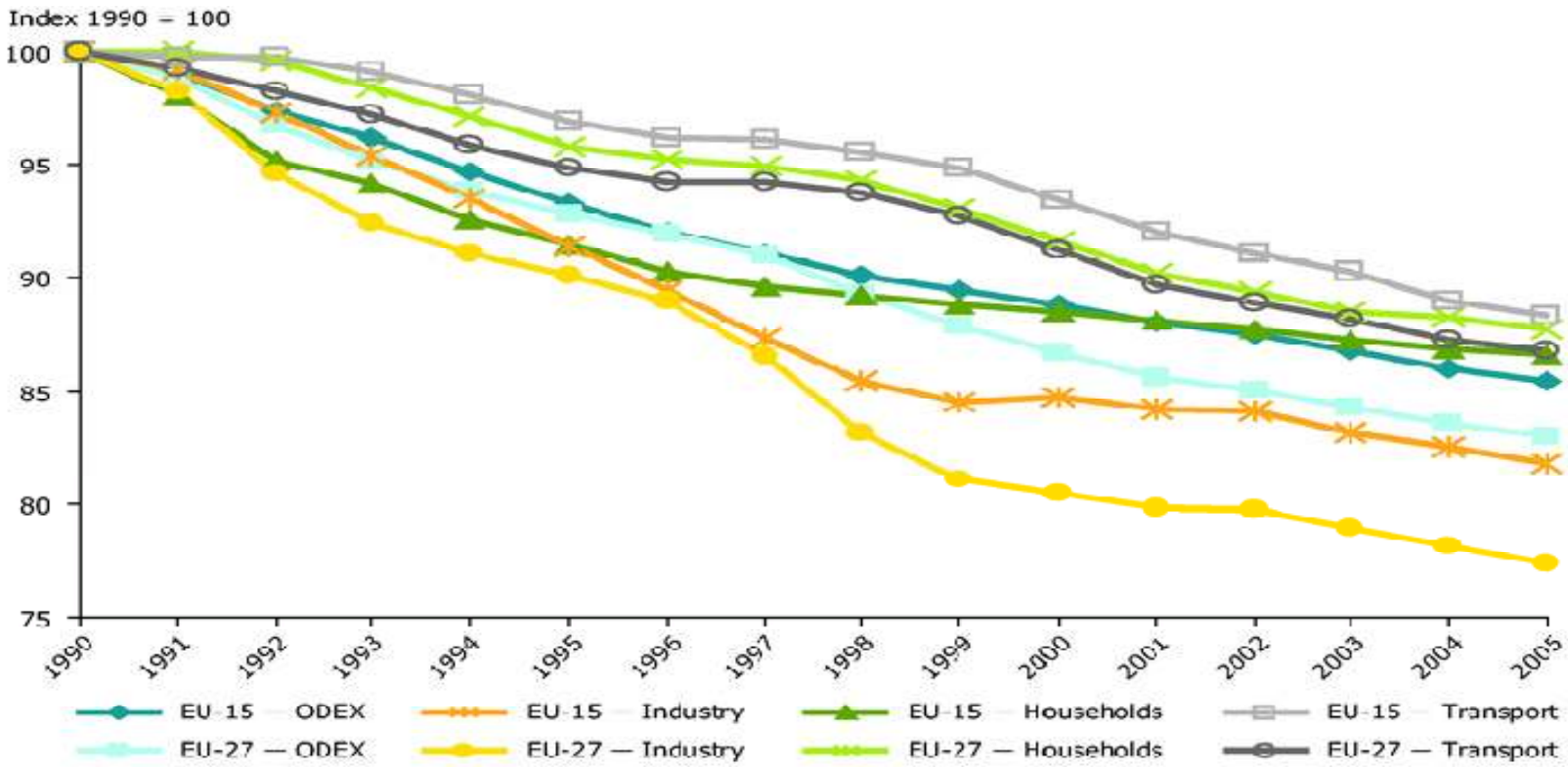
EU Energy Efficiency Indices



Source: EEA / Odyssee Database

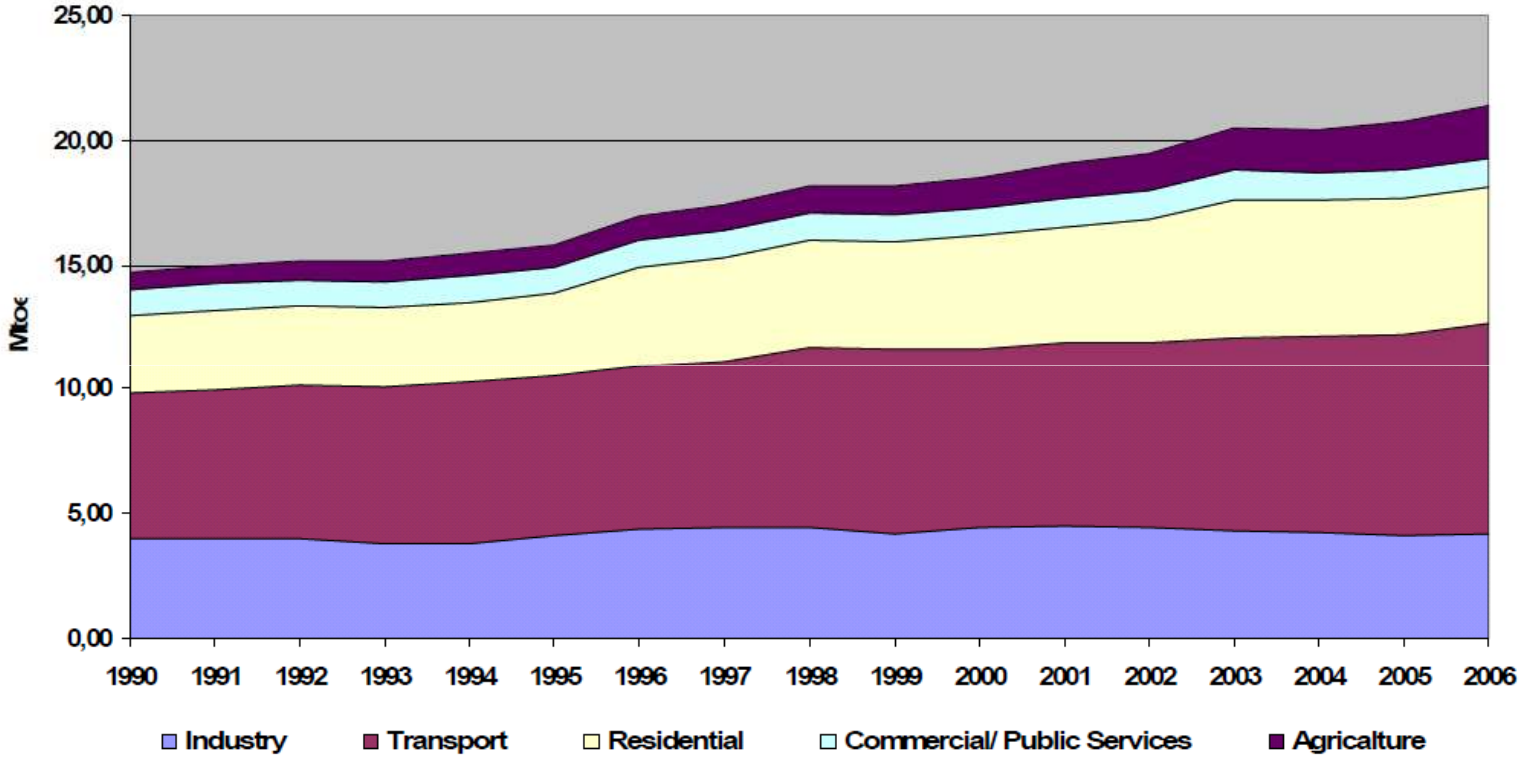
Improvement Potential

- Buildings
  - 40% of energy consumption
    - 50% of it, electrical power
  - Larger potential for energy savings in residential and commercial buildings (~30%)
- Transportation
  - Vehicle technology based (improve lt/km)
  - Freight logistics based (per unit)
  - Public transportation efficiency
- Energy transformation
  - Dominated by electricity generation
  - Distribution (power grid)

The role of ICT

- Provide the tools and methodologies for
  - Accurate and verifiable quantification of energy performance
  - Direct, cognitive energy management and cost-effective optimization of complex systems
- Deliver relevant enabling innovative technologies
  - e.g. thin-clients, grid computing, OLED displays, battery-less wireless devices, nano-electronics
- Change business models
  - Restructure operations towards more energy-efficient alternatives (e.g. eCommerce, eGovernment)
- Lead by example
  - Address itself in pilot, energy usage examples (e.g. data centres)

Energy Consumption by Sector in Greece



Source: M. Iatridis, CRES / Odyssee Database

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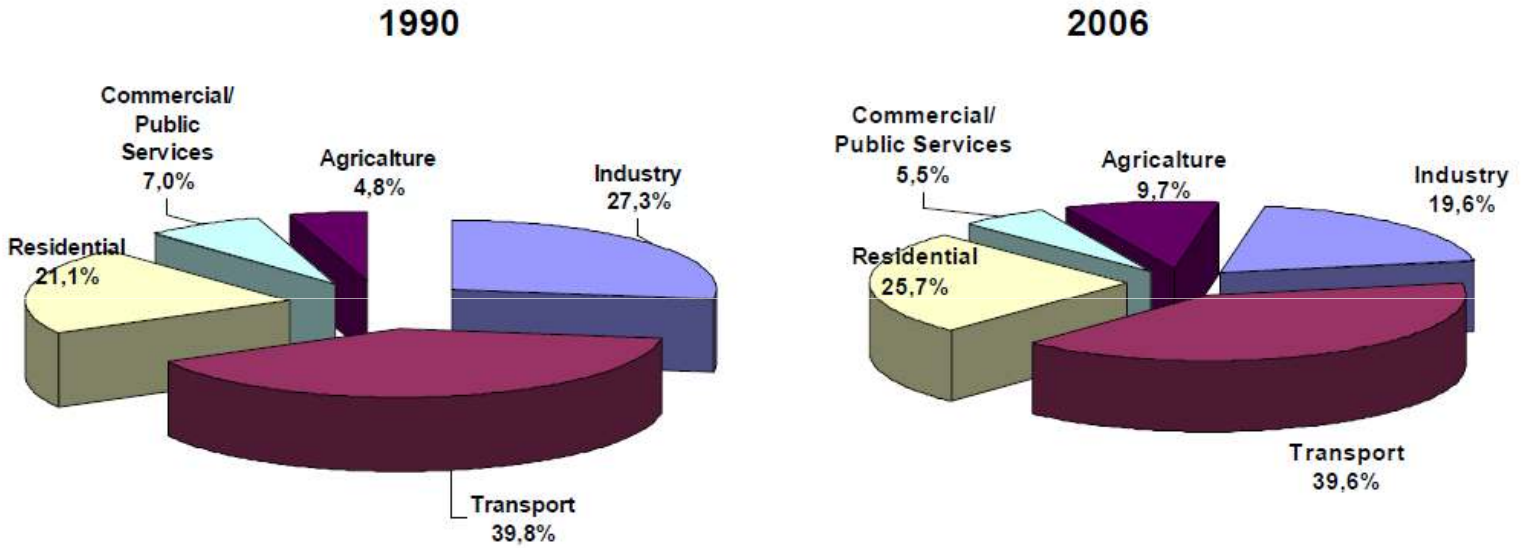
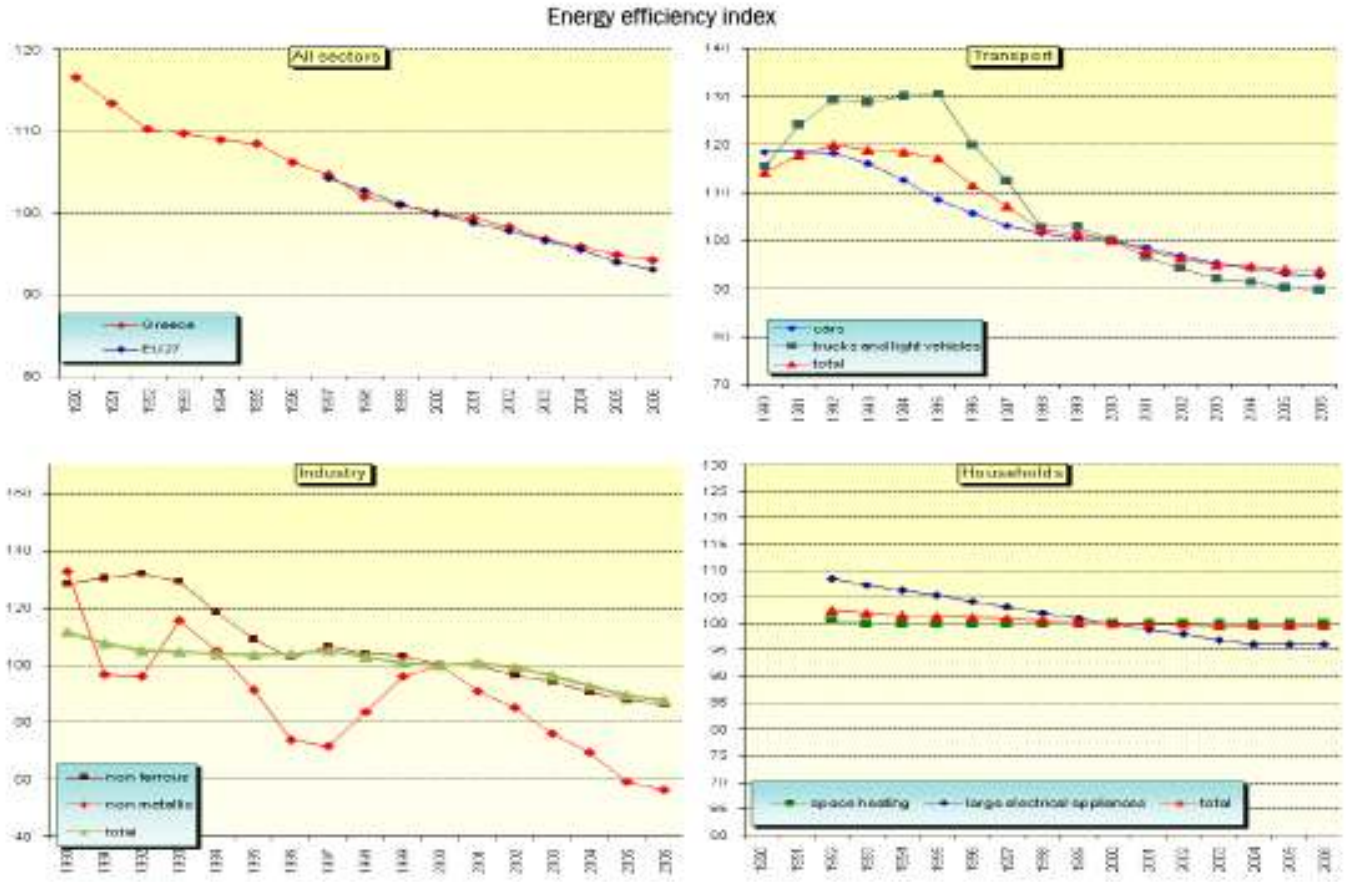
Shares of total energy consumption



Source: M. Iatridis, CRES / Odyssee Database

Efficiency indices in Greece



Source: CRES / Odyssee Database

Remarks on energy figures

- Industry & transportation sectors perform well
  - Industry: 22% improvement in Greece (12% in EU-15)
  - Transportation: 16% improvement in Greece (9% in EU-15)
- Households
  - Only 2% improvement (11% in EU-15)
- Agriculture
  - More than doubling of power consumption since 1990 (9.7% share while ~3.3% in EU-15)

Legislation Measures in Greece

- Buildings
  - Law 3661/2008: (Late) Adoption of directive 2002/91/EU for the reduction of energy consumption in buildings
    - Energy audits
    - Energy performance certificates
      - All new buildings
      - All renovated buildings above 1000m^2
      - All buildings when sold
- Industry
  - ETS implemented to 151 industries since 2005
  - Law 3299/2005: Up to 40% subsidies to industrial & tertiary sector companies for energy efficiency and RES investments
- Transportation
  - New law under submission, connecting taxes with emissions

Relevant Projects of ISI

- Guidelines & awareness
  - Soustenergy
- Smart buildings
  - Hospital BAS
  - Smart metering / PPC
  - eServices integration
- Agriculture
  - Irrigation pump remote monitoring & control
- ICT energy efficiency
  - IST Projects BETSY, uSWN

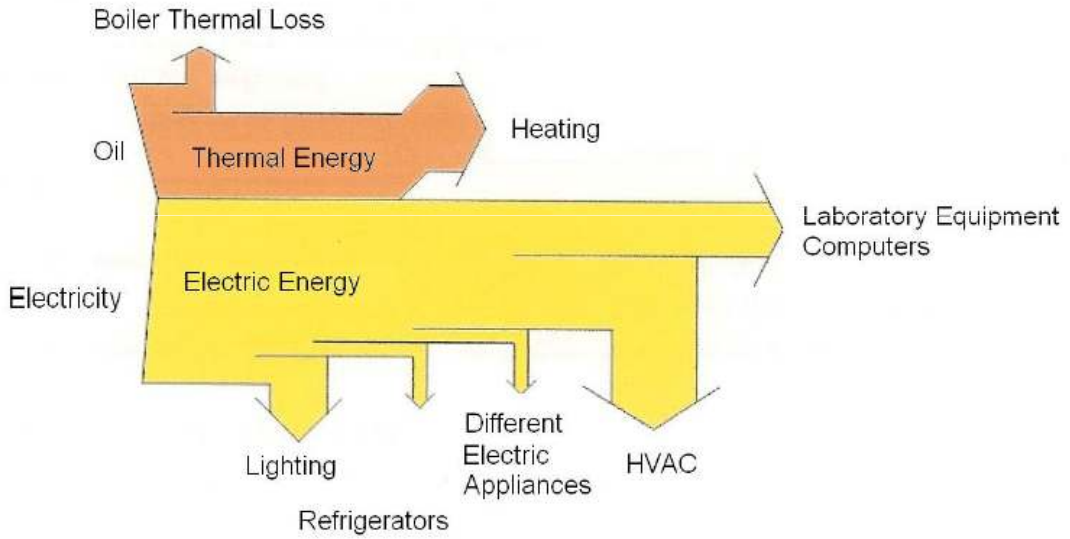
Project SOUSTENERGY

- Supported by the EU (ERDF) under INTERREG IIIC programme (INTERREG IIIC SOUTH 3S0128I)
- Promotes a change in the energy culture of the European society through the deployment of common methodologies to formulate regional and local strategies related to energy efficiency and savings.
- Compiles a roadmap with all Good Practices:
  - Local Government
  - Neighborhood
  - Schools
  - Dissemination
  - Efficient Buildings
  - Sustainable Mobility
  - Responsible Consumption
  - Industry

Project SOUSTENERGY

Energy Audit & Intervention Study at the Building of Electrical & Computer Engineering Dept., University of Patras

Feasible Savings:
- 40% in Lighting
- 30% in HVAC
- 6% in central heating



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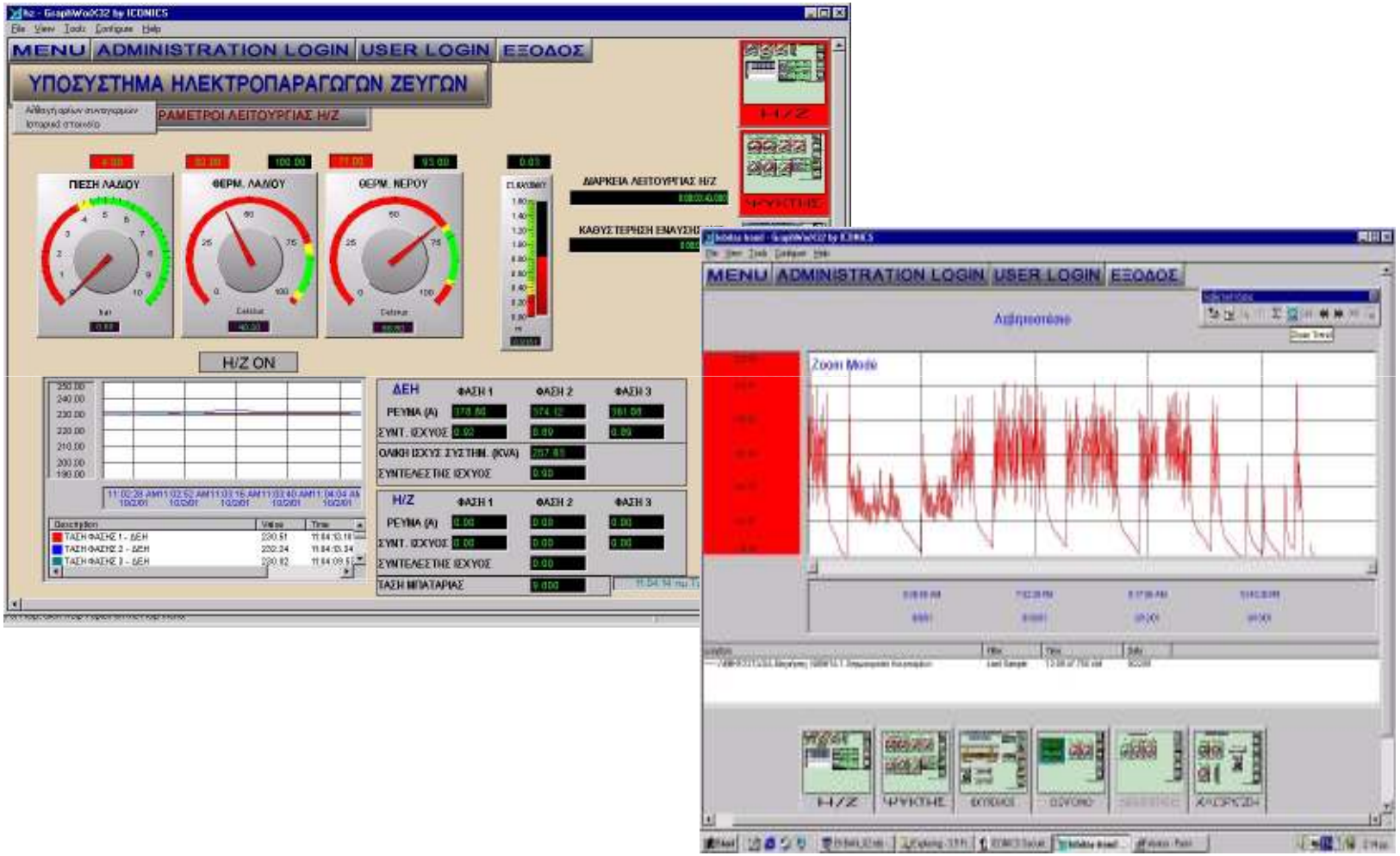
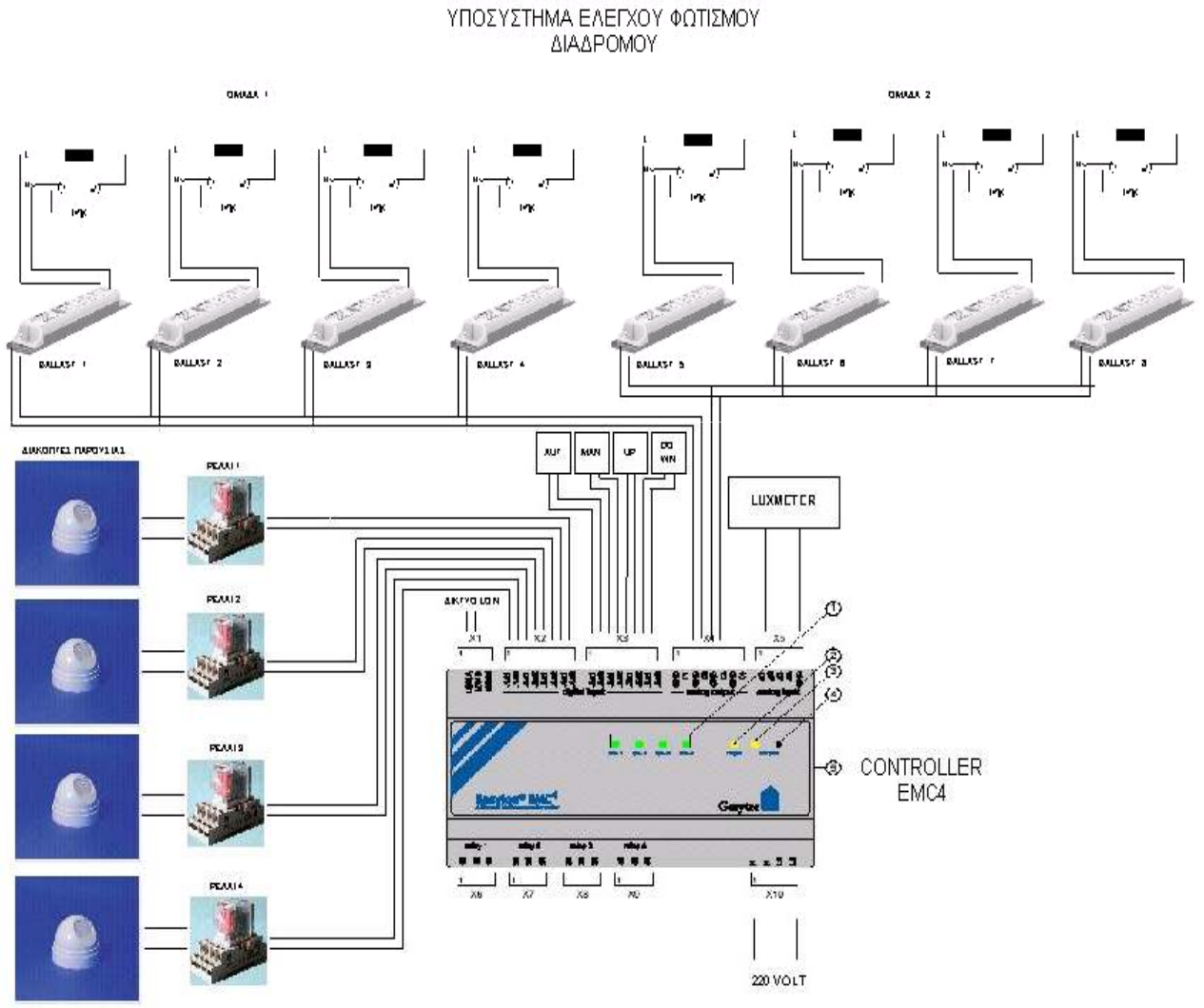
Hospital BAS

- Monitor and Control of sub-systems at the Local General Hospital
  - Supported by National Funds (GSRT)
- Major Objectives
  - Monitor and Control infrastructure
  - Implementation of Energy Efficiency Scenarios
  - Energy Consumption reduction
  - Autonomous and Automated functioning of the systems
  - Custom Reports generation
- Sub-Systems
  - AC, Heating Units, Power Generators, Oxygen Supply and Lighting Control

Hospital BMS – Power Generator



Hospital BAS – Lighting



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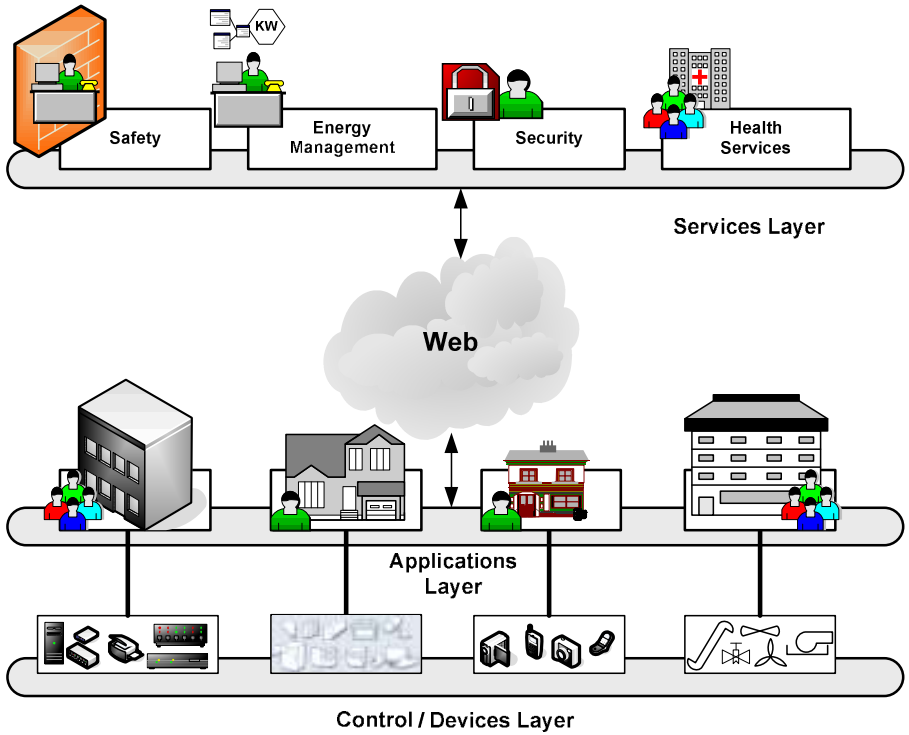
eServices Integration

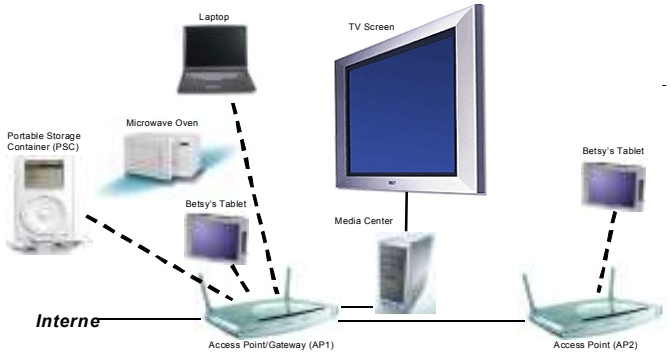
- Implementation of an integrated platform and system for the provision of electronic services to habitants
  - Safety
  - Security
  - Health Services
  - Energy Efficiency

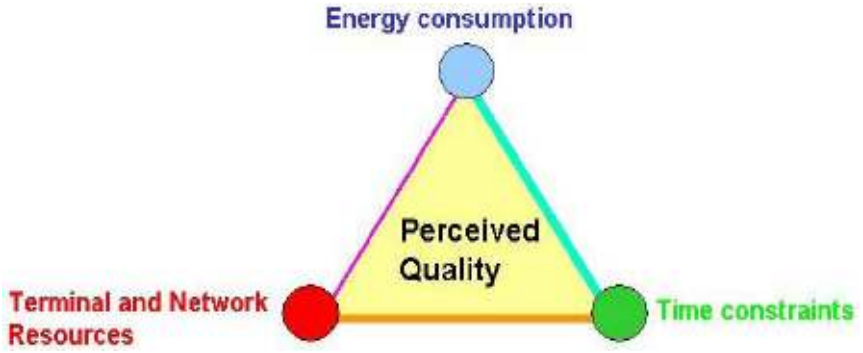


Project BETSY (FP6-IST)

BEing on Time Saves energY

- Multimedia streams on wireless hand-held devices seamlessly adapted to fluctuating network conditions and available terminal resources while reducing the energy consumption of the stream processing.
- To achieve this, trade-offs are needed between the use and consumption of network and terminal resources.





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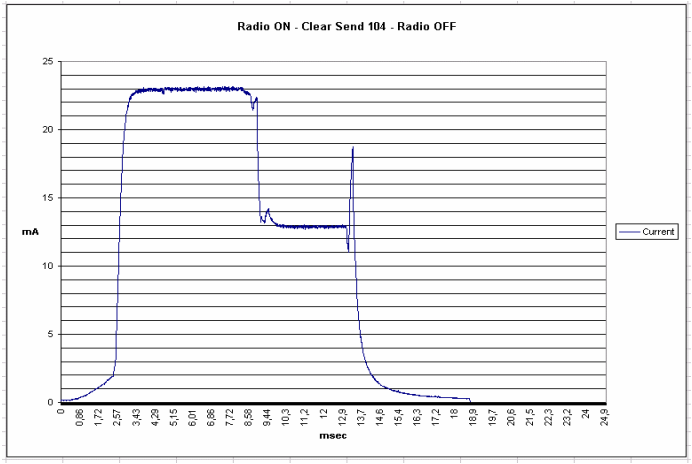
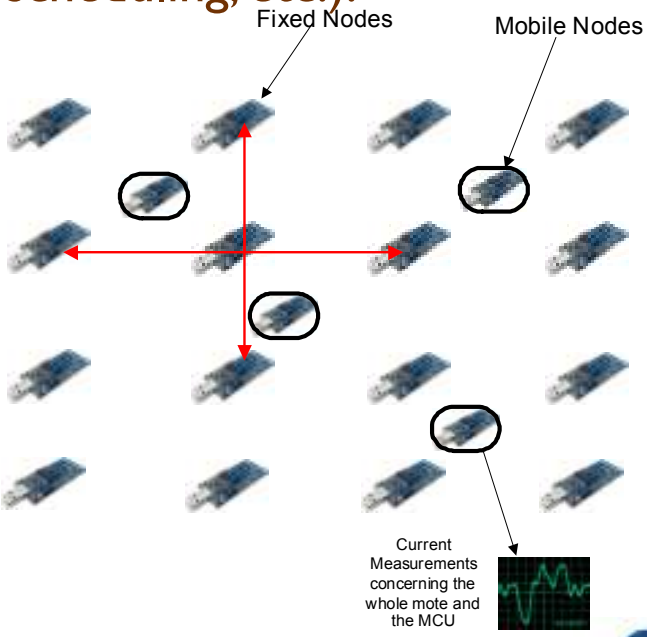
Project uSWN (FP6-IST)

Solving Major Problems in WSN

- Development of a series of generic and reusable paradigms for optimal deployment of WSN, encompassing hardware (structure of heterogeneous motes, physical networking, energy consumption) as well as software and architectural aspects (energy-aware inter-communication and routing strategies, optimal placement algorithms, energy-saving operation scheduling, etc.).





Other projects in Greece

GreenBuilding / GreenLight partners

Piraeus Bank S.A.
Energy Sav.: 476,8 MWh/year
Op. Cost Sav.: 48000 €/year
IRR: 10%

GEK S.A.
Energy Sav.: 325 MWh/year
Op. Cost Sav.: 32500 €/year
IRR: 20,46%

Athens International Airport
Energy Sav.: 3760 MWh/year
Op. Cost Sav.: 225440 €/year
IRR: 456%

Source: F. Karamani, CRES (www.cres.gr)

Other projects in Greece

GreenBuilding / GreenLight partners

Princess Lannasa Hotel
Energy Sav.: 40 MWh/year
Op. Cost Sav.: 4000 €/year
IRR: 20%

Greek Postal Savings Bank
Energy Sav.: 210 MWh/year
Op. Cost Sav.: 23100 €/year
IRR: 11,8%

AKTOR S.A.
Energy Sav.: 980 MWh/year
Op. Cost Sav.: 98670 €/year
IRR: 15,9%

Source: F. Karamani, CRES (www.cres.gr)

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ΚΑΠΕ CRES

GreenBuilding Programme (GBP)

- www.eu-greenbuilding.org
- National Contact Point, Greece:
  - Centre of Renewable Energy Sources, CRES (www.cres.gr)
- GreenBuilding Endorsers, Greece:

Thelcon Energy Constructions Ltd
http://www.thelcon.gr/

ΔΕΚΤΙΝΣ ΣΥΜΒΟΥΛΟΙ ΜΗΧΑΝΙΚΟΙ ΕΠΕ
http://www.dektis.gr/

ΠΑΝΤΕΧΝΙΚΗ
http://www.pantechniki.gr/

Γραφείο Δοξιάδη
http://www.doxiadis.com/

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Green Buildings

The evolution of the "Modern Home" concept

- Multi-disciplinary engineering
  - Architecture (bio-climatic design)
  - Materials
  - Energy sources
  - ICT infrastructure (BAS)
  - Habitants Behavior

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Priorities

- Increase awareness and co-operation
  - Habitants, building owners
  - Construction companies
- Acquire more experience at the application level
  - Usability assessments, measurements comparison
  - Increase the ‘test-bed’ size
- Invest in enabling technology R&D

Efficient Residential Lighting

- Lighting shares of residential electricity consumption:
  - Average EU-15: 11%
  - Min EU-15: 6,43% (France)
  - Max EU-15: 18% (Greece)

- Lighting efficiency improvement measures seem easier to be widely adopted
  - Immediate cost-effectiveness by simple lamp technology substitution
  - No substantial installation efforts for lighting automation sub-systems
    - Wireless sensors will make it easier
  - Ambient conditions and scene setting capabilities are an attractive option besides cost savings

ICT Research Agenda

- Applications & User Interfaces
  - Innovations for energy consumption awareness
    - e.g. embedded displays, usage of TVs / mobile phones
  - New or augmented scenarios / use cases
    - e.g. multiple, low-cost wireless sensors lead to more fine-grain space coverage
- Wireless Sensor Networks
  - Efficient implementations for battery-less devices
  - Energy consumption characterization & modeling
- Engineering of BAS
  - Reduce the design, installation and testing complexity

Thank you for your attention

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