European Network on New Sensing Technologies for Air Pollution Control and Environmental Sustainability - *EuNetAir*

COST Action TD1105

Action TD1105 ROUND-TABLE - Rome, 5 Dec. 2012

Action Start date: 01/07/2012 - Action End date: 30/06/2016

Year: 2012-2013 (*Starting Action*)

Michele Penza

Function in the Action: Chair

ENEA, Brindisi / Italy

COST is supported by the EU Framework Programme

ESF provides the COST Office through a European Commission contract

Outline

- **ERA** - European Research Area
- **HORIZON 2020** - The Framework Programme for Research and Innovation
- **COST** Programme - Cooperation in Science & Technology
- **COST Action TD1105 *EuNetAir*** - European Network on New Sensing Technologies for Air-Pollution Control and Environmental Sustainability
- **Inputs and Open Questions** for Discussions

European Research Area *An open space for knowledge and growth*

ERA is «*An **unified research area open to the world** based on the **Internal Market**, in which researchers, scientific **knowledge** and technology **circulate freely** and through which the Union and its Member States strenghten their scientific and technological bases, their **competitiveness** and their capacity to collectively address **grand challenges**»*

Improving Europe's research performance to promote growth and job creation

1. Europe is facing many **grand challenges**
2. Europe's **global position is weakening** measured by indicators of scientific quality, excellence
3. ERA at the heart of **Europe 2020 Strategy** and **Innovation Union**
4. Open Calls by **European Research Council** with deadline 10 January 2013 and 21 February 2013 to complete ERA in 2014 !

Robert-Jan SMITS, Director-General DG Research & Innovation

European Research Area

An open space for knowledge and growth

A reinforced partnership - Action-oriented & Responsability-based

- Member States
- Research Stakeholder Organizations
- European Commission

The Five Key ERA Priorities

1. More effective national **research systems**
2. Optimal **transnational cooperation and competition**
3. An **open labour market** for researchers
4. Gender **equality and gender mainstreaming** in research
5. Optimal circulation, access to and transfer of scientific **knowledge** including via digital ERA

Robert-Jan SMITS, Director-General DG Research & Innovation

Focusing EU Resources on Key Objectives

1. Excellent Science
   - i. European Research Council
   - ii. Marie Curie Actions
   - iii. Research Infrastructures
   - iv. Future and Emerging Technologies (FET)
2. Industrial Leadership
   - i. Leadership in enabling and industrial technologies
   - ii. Access to risk finance
   - iii. Innovation in SMEs
3. Societal Challenges
   - *i. …… see after slide …*

Communication from the EUROPEAN COMMISSION, October 2011

Focusing EU Resources on Key Objectives

1. **Excellent Science**
2. **Industrial Leadership**
3. **Societal Challenges**
    i. **Health, demographic change and wellbeing**
    ii. **Food security, sustainable agriculture and bio-economy**
    iii. **Secure, clean and efficient energy**
    iv. **Smart, green and integrated transport**
    v. **Climate action, resource efficiency and raw materials**
    vi. **Inclusive, innovative and secure societies**

The ***European Institute of Innovation and Technology*** (**EIT**) will support excellent research, education and innovation (**knowledge triangle**) primarily through the **Knowledge and Innovation Communities** (**KICs**).

Communication from the EUROPEAN COMMISSION, October 2011

WHAT IS COST ?

COST is an intergovernmental framework for European Cooperation in Science and Technology, allowing the coordination of nationally-funded research on a European level.

cost
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

COST has a very specific *mission and goal*.
It contributes to reducing the fragmentation in European research investments and opening the European Research Area to cooperation worldwide.

cost
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

MISSION OF A COST ACTION

As a precursor of advanced multidisciplinary research, COST plays a very important role in building a European Research Area (ERA). It anticipates and complements the activities of the EU Framework Programmes, constituting a "bridge" towards the scientific communities of emerging countries. It also increases the mobility of researchers across Europe and fosters the establishment of scientific excellence in the nine key domains:

- Biomedicine and Molecular Biosciences
- Food and Agriculture
- Forests, their Products and Services
- Materials, Physics and Nanosciences
- Chemistry and Molecular Sciences and Technologies
- Earth System Science and Environmental Management
- Information and Communication Technologies
- Transport and Urban Development
- Individuals, Societies, Cultures and Health

In addition, Trans-Domain Proposals allow for broad, multidisciplinary proposals to strike across the nine scientific domains.

Eligible Costs and Reimbursement Rules

Costs are incurred along these following categories:

- **Travel and subsistence** allowances for meeting participants
- Organisation of **meetings** (Local Organiser Support)
- Short-Term Scientific Missions (**STSMs**)
- **Training Schools**
- **Dissemination**, e.g. Scientific Publication, Action website, Action promotion for Meetings and Training Schools, Communication, Outreach activities
- **Other Expenses** Related to Scientific Activities (such expenses need an approval from the COST Office)
- **Financial and Scientific Administration and Coordination** of the Action (*Fee up to 15% of the actual science expediture*)

NO FUNDING FOR RESEARCH !

Estimated Action Total BUDGET for 4 Years: € 620.000

COST ACTION *EuNetAir*: *WHY* ?

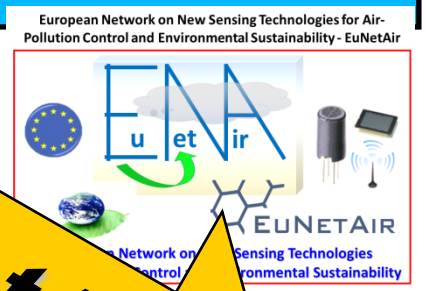
PROPOSED SOLUTION

Networking of Coordinated Action on Integrated and Multidisciplinary Scale of Science and Technologies:
NANOMATERIALS, GAS SENSORS, WIRELESS TECHNOLOGY, AIR-QUALITY MODELLING, STANDARDS & PROTOCOLS

TARGETED OPEN PROBLEMS

- AIR QUALITY CONTROL
- INDOOR/OUTDOOR ENERGY EFFICIENCY
- ENVIRONMENTAL SUSTAINABILITY
- CLIMATIC CHANGES MONITORING
- HEALTH EFFECTS OF AIR-POLLUTION

EuNetAir



BENEFIT & IMPACT

European Leadership on AQC Science & AQC Technologies
Development of Green-Economy
Support to Sustainable Development
Monitoring System for Clean Air for Europe

cost EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

COST Action TD1105 EuNetAir: Leadership

- **CSO Approval: 01 Dec. 2011**
- **Kick-off Meeting: 16 May 2012**
- **Start of Action: 01 July 2012**
- **End of Action: 30 June 2016**

MC Chair:	Dr. Michele Penza, ENEA, IT michele.penza@enea.it
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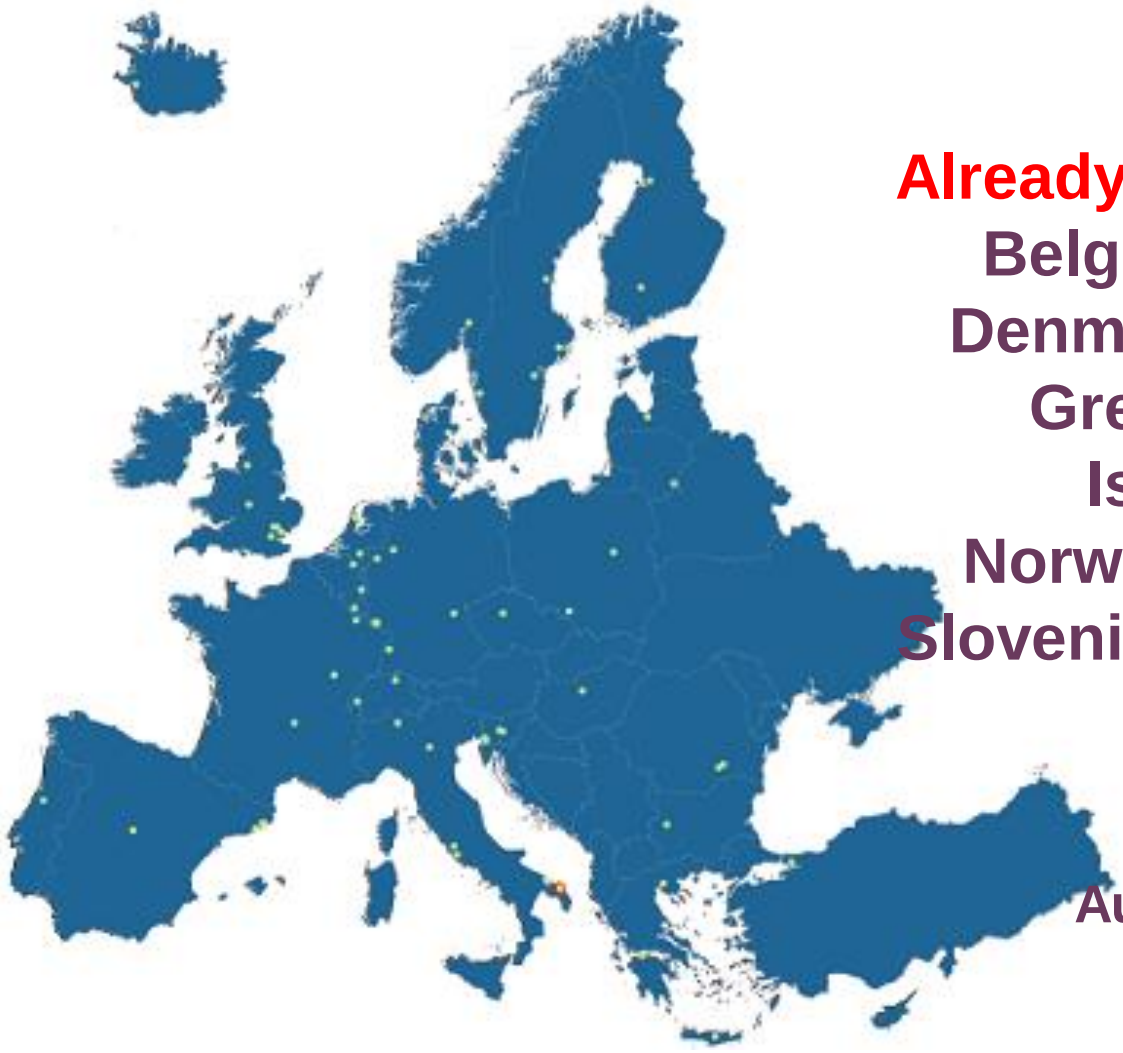
Rapporteur CMST:	Prof. Antonio Lagana (IT) lagana05@gmail.com

COST Action TD1105 EuNetAir: Dimension



PARTIES

Already accepted MoU: 25 Countries

Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Latvia, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom.

Non-COST Countries: 5

Australia, Canada, China, Russia, USA

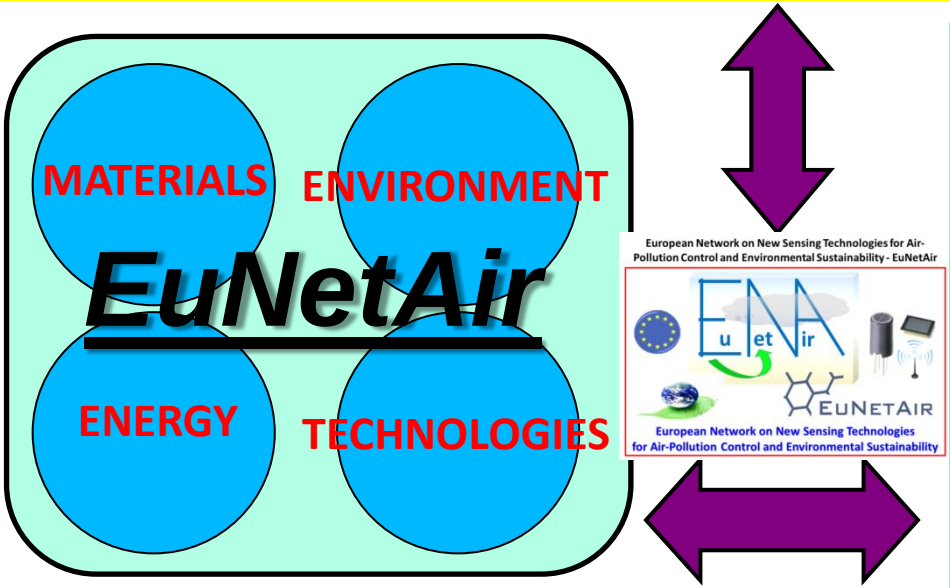
Number of Participants: > 100

N.r of Research Teams including Academia, Research, Industry, Agencies: > 60

COST Action EuNetAir: FEATURES AND INNOVATION

Complementarity with other COST Actions:

- **ES0602 Chemical Weather Forecasting and Information Systems**
- **MP0701 Composites with Novel Functional and Structural Properties by Nanoscale Materials**
- **MP0901 Designing Novel Materials for Nanodevices: From Theory to Practice**
- **TU0902 Integrated Assessment Technologies to Support the Sustainable Development of Urban Areas**



European Network on New Sensing Technologies for Air-Pollution Control and Environmental Sustainability - EuNetAir

European Network on New Sensing Technologies for Air-Pollution Control and Environmental Sustainability

RELATED FP6-FP7 PROJECTS:

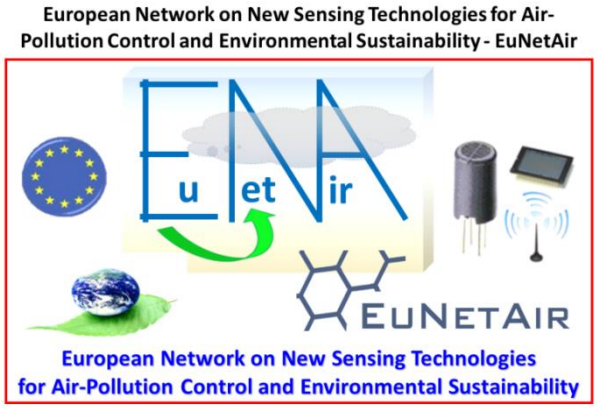
- **NANOS4, NMP**
- **S3, EU-RUSSIA COOPERATION**
- **ORAMA, NMP**
- **NANO2HYBRIDS, NMP**
- **AIRMONTECH, ENV**
- **AQUILA, ENV**
- **OFFICAIR, ENV**
- **GOSPEL, Network of Excellence in Artificial Olfaction**
- **FLEXSMELL, PEOPLE Marie-Curie Action**

INNOVATION of ACTION:

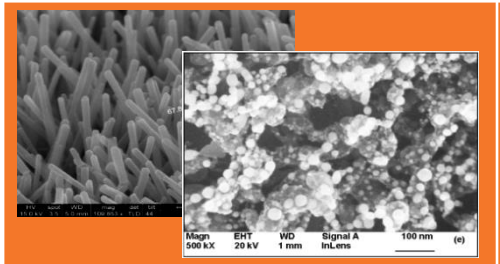
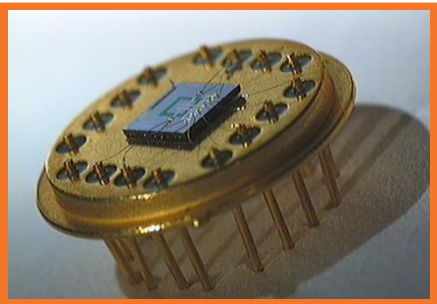
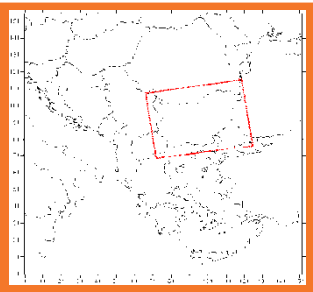
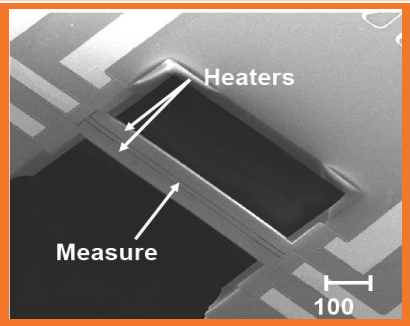
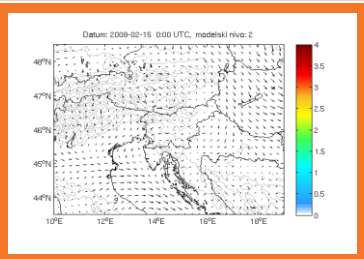
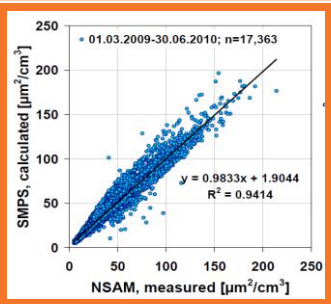
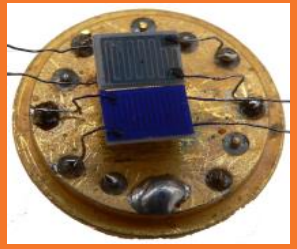
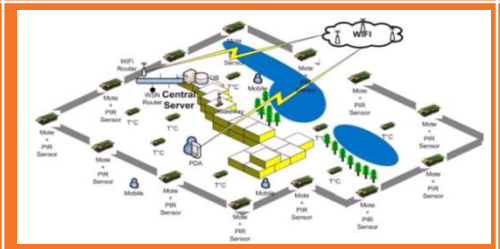
Integrated approach **on AQC for environmental sustainability by cooperative networking of multidisciplinary research on nanomaterials, gas sensing technologies, wireless sensor technologies and networks, environmental measurements, ambient intelligence, air quality modelling, chemical weather forecasting, harmonisation of measurements, protocols, methods, standards and procedures for commercialisation of low-cost AQC sensors.**

Challenges addressed by Action TD1105

- **Nanomaterials for AQC sensors**
- **Low-cost Gas Sensors**
- **Low-power Sensor-Systems**
- **Wireless Technology (*Environmental Sensors Network*)**
- **Air Quality Modelling**
- **Environmental Measurements**
- **Standards and Protocols**



COST Action EuNetAir: CHALLENGES

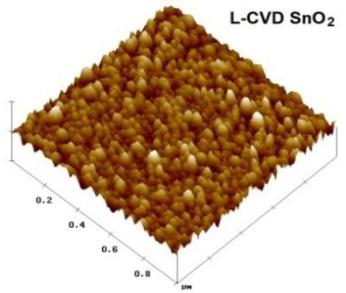
MATERIALS & GAS SENSORS	AQC SENSORS & SYSTEMS	AQ MODELLING	STANDARDS & PROTOCOLS
 MOX by UNIBS IREC UB SICCAS CNT by ENEA NASA URV CSIRO	 GasFET by EPFL, Switzerland	 CMAQ Calculations by NIMH, BG	 Dynamic Olfactometry (EN 13725/2003) by Univ. of Bari and Lenviros srl, IT
 Cantilever Sensor by DTU, DK	 ASIC Circuit: CMOS SOI by WARWICK & CCMOS Ltd, UK	 AQ Modelling dispersion in meteorological mesoscale by University of Ljubljana, SL	 Particle Surface Area Measurements by IUTA eV, DE
 Phtalocyanine Gas Sensors by CNRS UBP-LASMEA, FR	 WIRELESS SENSORS NETWORK by ISI, Greece	 Chemical Weather Forecasting and Information System by Hungarian Meteo Service	? **HARMONISATION:** Definition of protocols and standards for gas sensing measurements and gas sensors

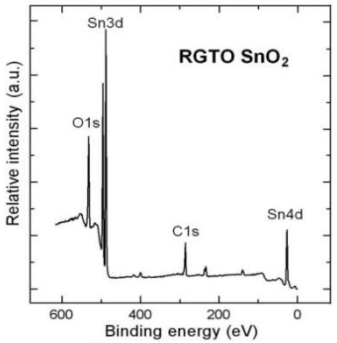
EuNetAir SOLUTIONS: NANOMATERIALS AND NANOTECHNOLOGIES

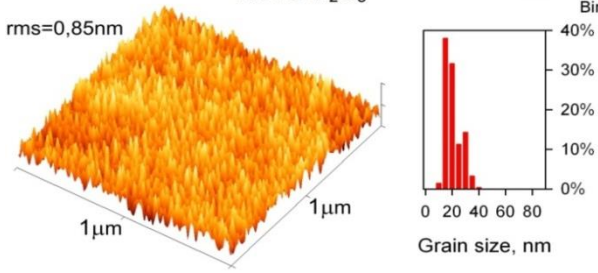
Metal Oxides Nanostructures by University of Brescia, Italy.

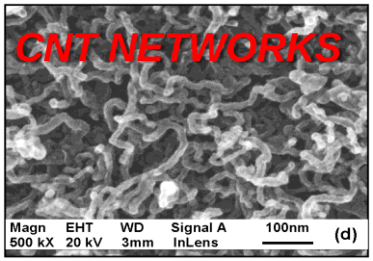
The increasing scientific interest in 1-D systems (nanowires, nanobelts, nanorods, nanotubes) and single-crystalline 1-D nanostructures (SnO_2, ZnO, WO_3, In_2O_3, MoO_3, TiO_2, etc.) are nowadays emerging as building blocks for a new generation of electronic, and optoelectronic nanometer-scaled devices with superior performances for gas sensing and energy applications.

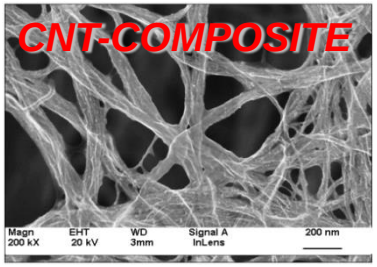
RGTO (RGVO) SnO_2 and In_2O_3 nanolayers by Silesian University of Technology, Poland











Carbon nanotubes (CNT) in the form of networks and composite as filler in an organic matrix by ENEA, Italy.

PROPERTY OF CNTs	VALUE
High surface area	100 - 1800 m^2/g
Hollow structure	1 - 5 nm diameter
Nanosized morphology	10 - 1000 Aspect ratio
High electron mobility	up to 10000 cm^2Vs^{-1}, at 300K
High structural/chemical reactivity	Bending at high angle (< 40°)
High thermal stability	1800 - 6000 $Wm^{-1}K^{-1}$ therm. cond.
Electrical Resistivity	1 - 100 kΩ (p-type Semiconductor)

EuNetAir SOLUTIONS: WIRELESS TECHNOLOGY

Production version of the mote technology from EPSRC MESSAGE.

3 electrochemical gas sensors, temperature, humidity & noise.

IEEE 802.15.4 wireless mesh networking of up to 100 motes (up to 100 m between motes).

Custom network protocols for routing and power management.

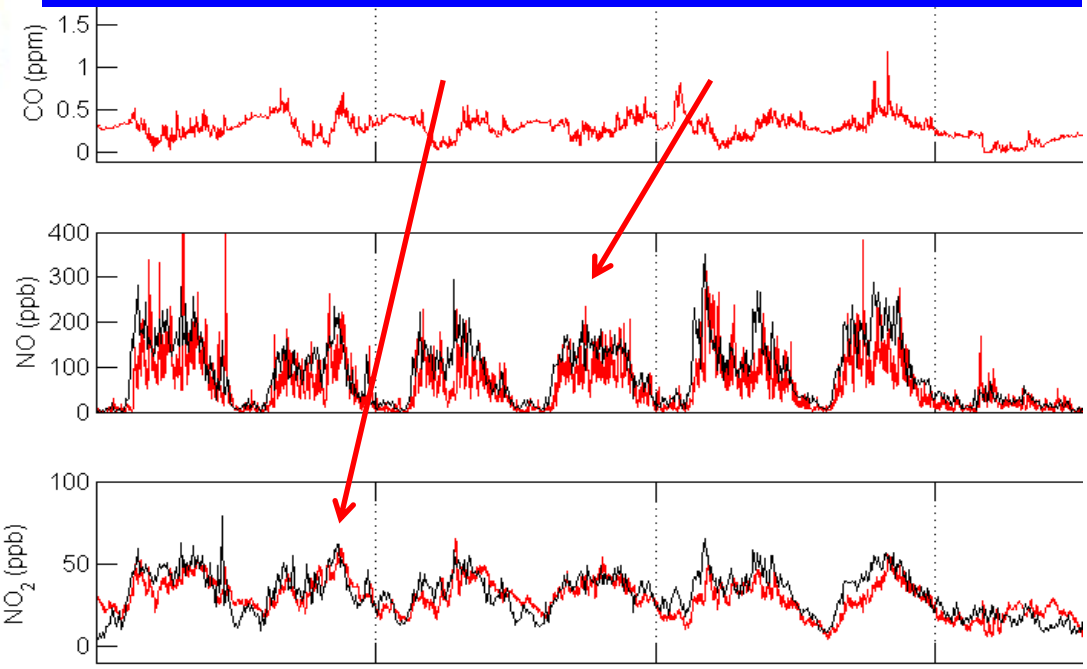
Solar rechargeable battery + Lithium D cell backup.

Designed for easy deployment on lighting columns etc.

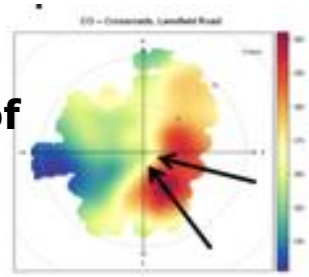
Low cost, rapid deployment and high spatial resolution.

The Envirowatch mote

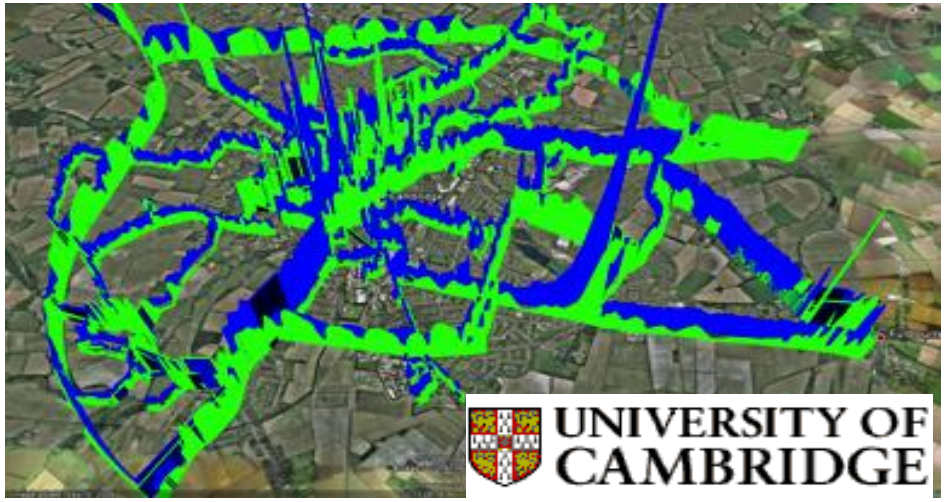
Automatically corrects mote electrochemical sensor data for temp and humidity (red) to achieve excellent agreement with precision instruments (black)



High granularity evaluation of air quality (e.g. NO_x, below), source attribution (right).

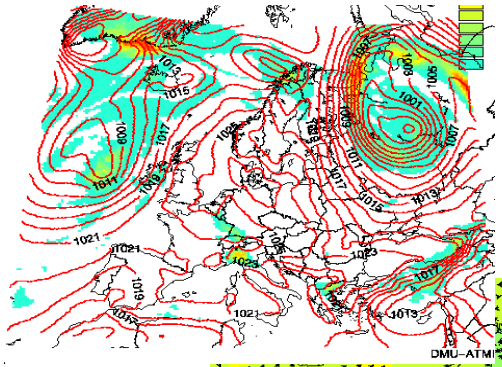


WIRELESS SENSORS NETWORK for AQC

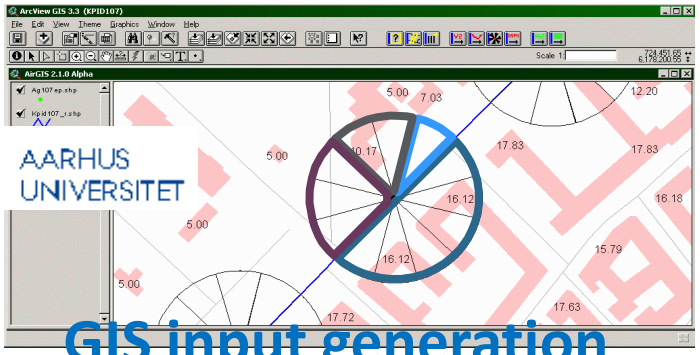


EuNetAir SOLUTIONS: AIR QUALITY MODELLING

Chemical weather

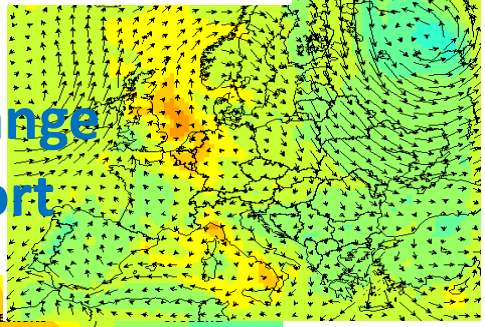


AARHUS UNIVERSITET

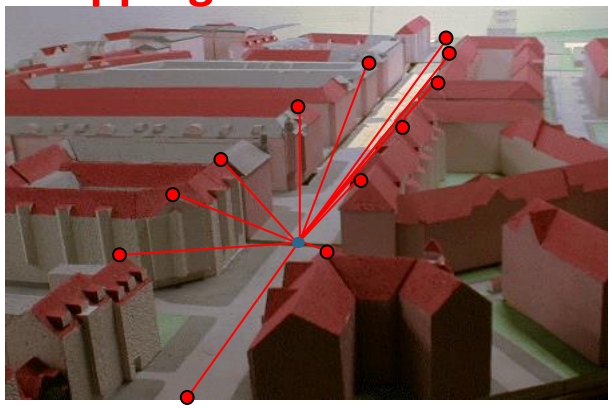


GIS input generation

Long-range transport

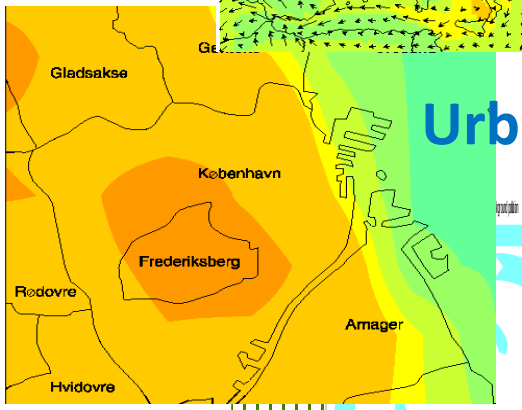


Mapping addresses

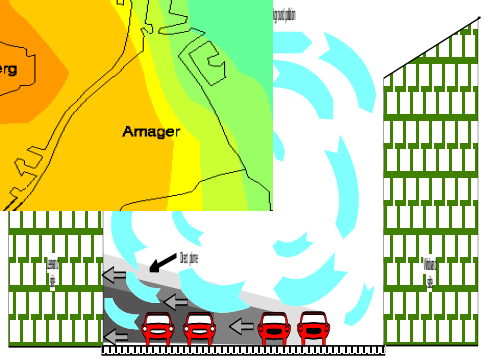


AirTHESS: operational AQ management and information system for Thessaloniki, Greece, employing Computational Intelligence for AQ forecasting and mobile phone technology for early warning messages.

***By Aristotle University, Greece*.**



Urban scale



Street scale

Open Questions:

Which Priorities for COST Action TD1105 EuNetAir

- **Which R&D Needs ????**
- **Which Strategies ????**
- **Which Roadmap for future joint-activities of Action TD1105 EuNetAir**
- **Please, Comments and Opinions from Action Partners and Stakeholders**

Thank you very much for your kind attention !