

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

COST Action TD1105

## INTERNATIONAL SEMINAR on

*New Sensing Technologies, Methods and Modelling for Air-Pollution Monitoring*

University of Lisbon, Faculty of Sciences, Centro de Biologia Ambiental  
Lisbon, Portugal, 17 October 2014

Action Start date: 01/07/2012 - Action End date: 30/06/2016 - Year 3: 2014-15 (*Ongoing Action*)

# *COST Action TD1105: Overview & Updating*

 **cost**  
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY



**Michele Penza**

Function in the Action: Action Chair  
ENEA - Brindisi, Italy



# A long history ..... with Cristina !

Simona Catino, ESR, Bari (Italy)  
STSM at Centro de Biologia Ambiental  
15 April - 15 May 2014



**COST**

**Annual Progress Conference  
Alexandropolis, 20-21 June 2012**

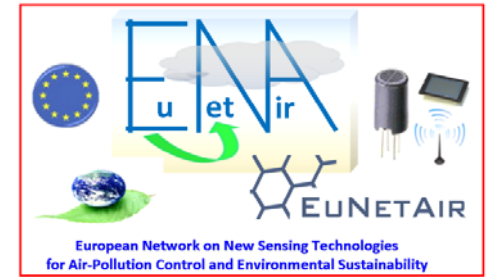


**COST Action TD1105  
Duisburg, 4-6 March 2013**



**COST Action TD1105  
Aveiro, 13-15 October 2014**

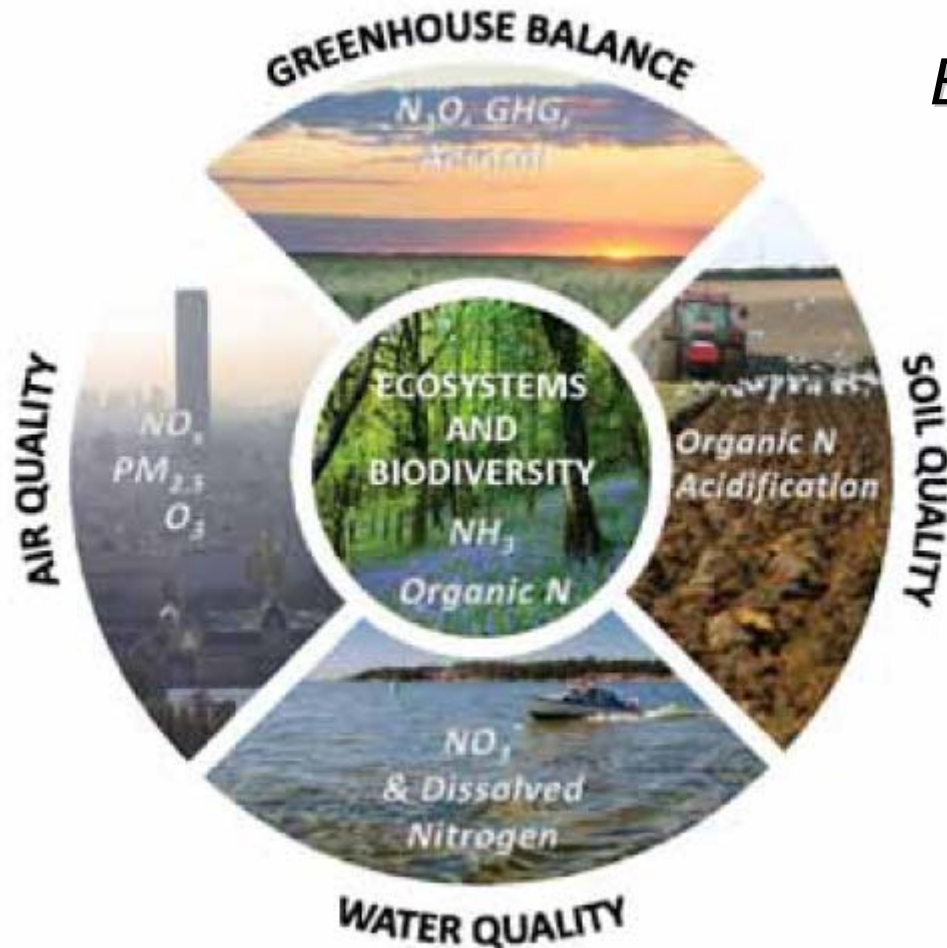
# Outline



- **Background / Problem Statement:**
  - ✓ *Scientific context*
  - ✓ *Challenges addressed by the Action*
- **MoU Action's Objectives: Main and Secondary**
- **Action Research Directions:**
  - ✓ *Methodology and Innovation*
- **Working Groups**
- **Results versus Objectives: Significant Highlights**
- **Future Plans and Challenges: Expected Impact**
- **Concluding Remarks**

## Nitrogen Pollution and the European Environment Implications for Air Quality Policy

EC In-Depth Report, September 2013



*Excess reactive nitrogen represents a major environmental threat that is only now beginning to be fully appreciated. At a global level, humans have more than doubled the production and cycling of reactive nitrogen, leading to a plethora of impacts that interact across all global spheres: atmosphere, biosphere, hydrosphere and geosphere.*

*Sutton et al., 2009*

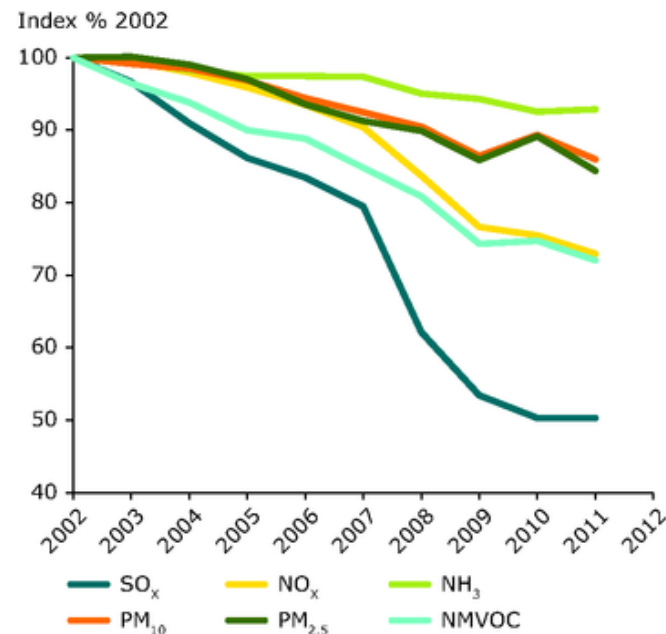
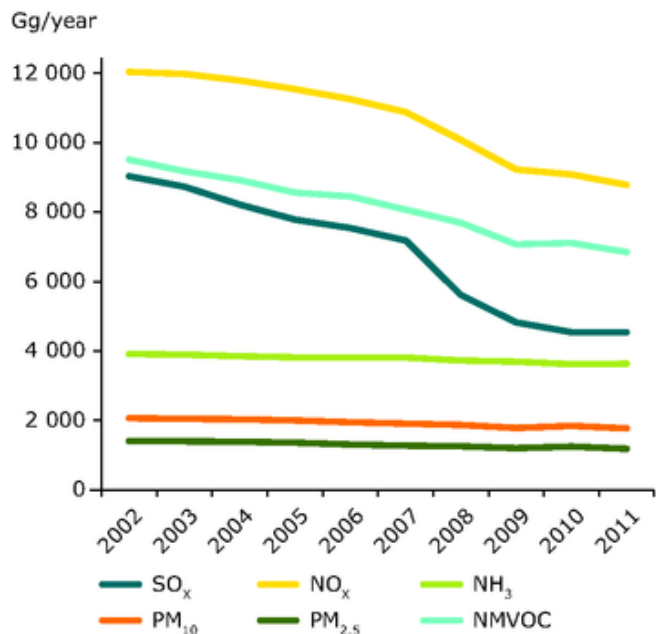
### Nitrogen Pollution:

**NO<sub>x</sub>, N<sub>2</sub>O, NH<sub>3</sub>, NH<sub>4</sub>, NO<sub>2</sub><sup>-</sup>, NO<sub>3</sub><sup>-</sup>, etc.**

Source: Sutton and Billen, 2010

# Scientific context: Air Quality Control (2/3)

European Environment Agency, EEA Report 9/2013

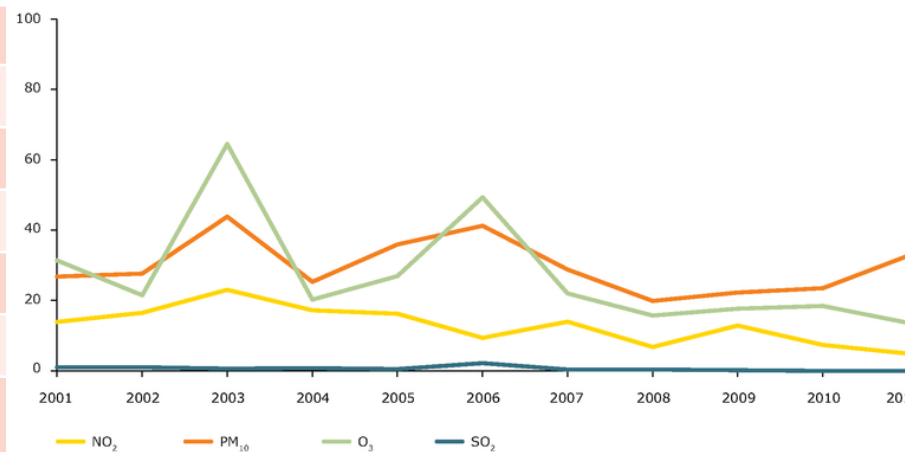


## Some Environmental Emergencies:

- 1930 - Meuse Valley (Belgium)
- 1952 - Great London Smog (UK)
- 1954 - Los Angeles (USA)
- 1984 - Bhopal (India)
- 2005 - Teheran (Iran)
- 2006 - Hong Kong (China)
- 2008 - Shanghai, Peking (China)
- 2012 - Taranto (Italy)

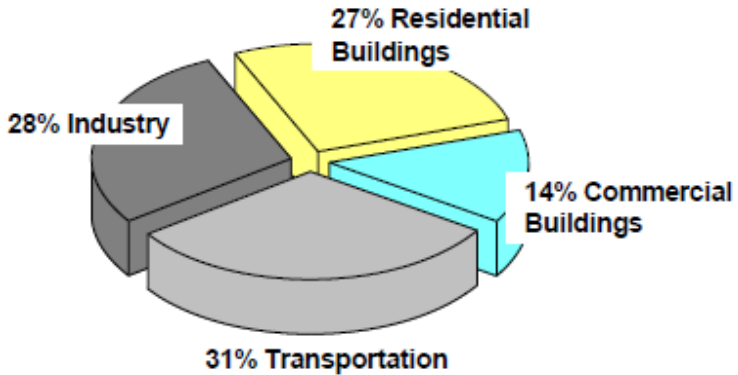
Pollutant	Limit Level
NO <sub>x</sub>	100, 200 ppb
CO	8 ppm
SO <sub>2</sub>	130, 190 ppb
O <sub>3</sub>	120 µg/m <sup>3</sup>
PM <sub>10</sub>	50 µg/m <sup>3</sup>
BTEX	6 µg/m <sup>3</sup>
PAH (BaP)	1 ng/m <sup>3</sup>
PM <sub>2.5</sub>	25 µg/m <sup>3</sup>

% of urban population exposed to air pollution exceeding acceptable EU air quality standard



**AMBIENT AIR QUALITY  
EU DIRECTIVE 2008/50/EC  
and Daughters**

# Scientific context: Indoor/Outdoor Energy Efficiency (3/3)



Primary energy consumption in the EU<sup>1</sup>

<sup>1</sup> O. Seppanen,

11<sup>th</sup> Conference on Indoor Air Quality  
2008, Copenhagen, Denmark

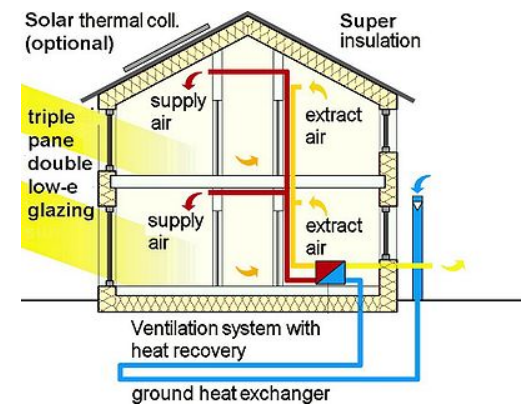
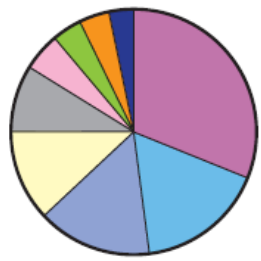
41% Primary Energy consumed in Buildings:

- 2/3 in Residential Buildings
- 1/3 in Commercial Buildings

Energy Performance of Buildings EU Directive  
EPBD 2010/31/EC

Figure 2 – Total Energy Consumption by End Use  
Adapted from E Source, 2006

- Ventilation 4%
- Refrigeration 3%
- Space Heating 31%
- Water Heating 17%
- Cooling 15%
- Lighting 12%
- Other 9%
- Cooking 5%
- Office Equipment 4%



Source: Environmental Protection Agency's National Action Plan for Energy Efficiency Sector Collaborative on Energy Efficiency Hotel Energy Use Profile

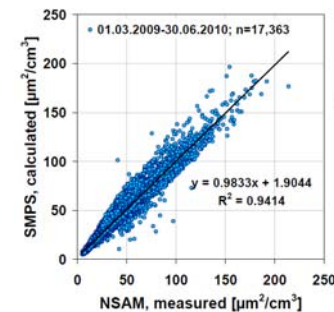
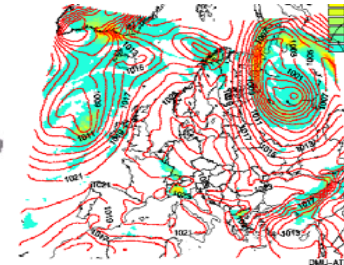
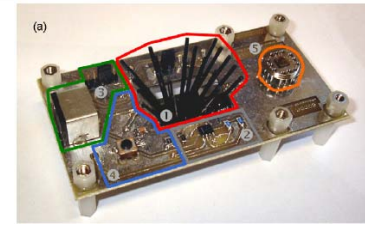
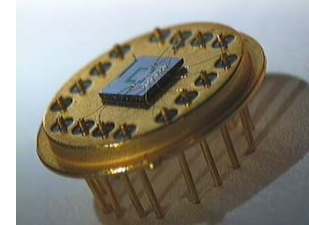
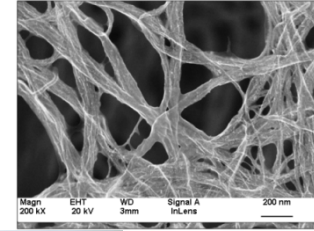
## IAQ by WORLD HEALTH ORGANIZATION

Indoor Air		Typical Substances		Cure
Contamination Source	Emission Source	VOCs	Others	
• Human Being	• Breath	Acetone, Ethanol, Isoprene	Humidity	demand controlled ventilation
		CO <sub>2</sub>		
	• Skin Respiration & Transpiration	Nonanal, Decanal, α-Pinene		
		Humidity		
	• Flatus	Methane, Hydrogen		
	• Cosmetics	Limonene, Eucalyptol		
	• Household Supplies	Alcohols, Esters, Limonene		
Unburnt Hydrocarbons				
CO				
• Building Material • Furniture • Office Equipment • Consumer Products	• Paints, Adhesives, Solvents, Carpets	Formaldehyde, Alkanes, Alcohols, Aldehydes, Ketones, Siloxanes	permanent 5-10% ventilation	
		• PVC		Toluene, Xylene, Decane
	• Printers, Copiers, Computers	Benzene, Styrene, Phenole		

Table 1 – Typical Indoor Air Contaminants (VOCs and others)

# Challenges addressed by Action TD1105 (1/1)

- **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**



# Action's Objectives (1/3)

## MoU Main Objectives of COST Action TD1105:

- To establish a **Pan-European multidisciplinary R&D platform** on new sensing paradigm for Air Quality Control (AQC) contributing to sustainable development, green-economy and social welfare.
- To create **collaborative research teams** in the **ERA** on the new sensing technologies for AQC in an integrated approach to avoid fragmentation of the research efforts.
- To train **Early Stage Researchers (ESRs)** and new young scientists in the field for supporting competitiveness of European industry by qualified human potential.
- To promote **gender balance** and involvement of ESRs in AQC.
- To disseminate **R&D results on AQC** towards **industry community** and policy makers as well as general public and high schools.



# Action's Objectives (2/3)

## MoU Secondary Objectives of COST Action TD1105:

- To provide a *platform between scientists* in the field of materials, nanotechnology and sensor-systems and other scientists such as environmental protection engineers, public agencies managers, stakeholders, decision-makers, aiming to improve best practices in AQC and explore the potential role of new generation of low-cost sensing devices.
- To investigate *sensing mechanisms* of functional nano-materials for gas measurement and identification of the best available nano-materials, providing concepts and harmonising pre-standardised methods; based on available datasets from partners.
- To assess *degradation rates and lifetime* of sensor elements in defined environmental conditions and evaluate interactions of sensitive materials with outdoor/indoor pollutants; based on datasets from ongoing and historical field deployments of low-cost sensors.
- To investigate *the best available technology* for sensor deployment, communication, power supply and data storage, analysis and display.

# Action's Objectives (3/3)

## MoU Secondary Objectives of COST Action TD1105:

- To monitor real-world environmental conditions with *experimental campaigns* to assess composition of *indoor air* (buildings: house and office) and *outdoor air* (urban areas and industrial sites) and to investigate how such data can be utilised in air pollution modelling.
- To approach *standardisation of methods* for air quality measurements, e.g. harmonisation of test procedures, chemical analysers, post processing, protocols, etc..
- To disseminate *knowledge* on functional materials and sensor-systems for AQC; to aid better focusing of Europe's resources by coordinated efforts in AQC and environmental sustainability to strengthen Europe's competitiveness and scientific excellence improving capacity building and networking to tackle global challenges in a big market in the mid-long term.

# Action Research Directions: *Methodology* (1/3)

## Cooperative Approach of COST Action TD1105:

The MoU Objectives will be successfully achieved by means of:

- The development of a **multidisciplinary network** of physicists, chemists, physico-chemists, electronics, nanotechnologists, specialists of materials, environment, metrology and management.
- The **relevance, expertise and international renown** of all involved partners.
- **Synergies** leading to work prospects and collective thought focused on the realization of *innovative sensitive materials* and *high-efficient sensing devices*. Such collective work will be *initiated during workshop* and strengthened by *early-stage researcher exchanges*.
- A **global approach** on sensing microsystems and their applications (*materials, transducers, technology, working conditions, methodologies, models, protocols*) leading to simultaneous and *synergic optimizations* of all the parameters to reach the *best performances*.

# Action Research Directions: *Methodology* (2/3)

## Partner Opportunities of COST Action TD1105:

MoU Objectives are accomplished to federate human and material resources:

- **To have access to at least 5 new European technological platforms:** *synthesis, characterization, design, development, experiments under gas.*
- To perform **measurement campaigns** in real conditions (indoor or outdoor, occupational and non-occupational context, industrial or urban environment) in various European towns thanks to the strong collaborations with national networks of air quality monitoring and environmental agencies (e.g., *AtMO* in France, *ARPA-PUGLIA* in Italy, *CSIC* in Spain, *NILU* in Norway, *Meteorological Services* in Hungary, etc.).
- **To contribute to a better modelling of pollutant dispersion** at the European scale (and more) by the achievements of a **large database on pollution** which will be available to environment protection engineers and researchers.
- **To react** quickly and more efficiently to **economic, social and medical needs related to air quality control**, the networking providing a wide range of technical solutions to suit to each requirement.
- To promote the pooling of scientific knowledge and skills by means of the **manpower mobility** (*Short Term Scientific Missions*) as encouraged by COST Action.

# Action Research Directions: *Methodology* (3/3)

## **DELIVERABLES of COST Action TD1105.** MoU areas of S&T cooperation include:

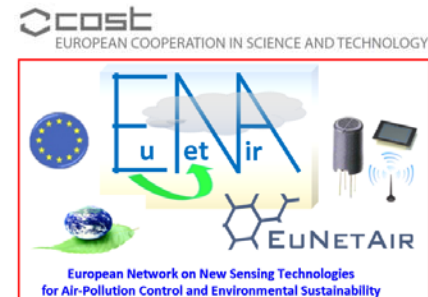
- **Workshops** on sensor materials and nanotechnologies, sensor-systems for AQC, environmental measurements, air-pollution modelling, chemical weather forecasting, distributed computing, wireless sensor networks, protocols and pre-standardisation; organization of open conferences to improve knowledge transfer and dissemination.
- **Training Schools** on sensor materials, technologies, processes, methods, modelling, forecasting, applications, environmental certification and validation, project management.
- **International ESRs exchange** and Scientists Mobility (STSMs) between partners involved in Action and Non-COST partnership at incoming/outcoming level.
- **New collaborative research actions** and research projects providing synergies between partners capabilities.
- **Participation** in Conferences, Short Courses, Mutual Publications, Reports, White Papers, Position Papers, etc.
- **Outreach** activities
- Enforcement of the **Gender Balance** agenda
- Coordinated **Dissemination** of the networking activities towards Academia, Industry and General Public.

# Action Research Directions: *Innovation* (1/1)

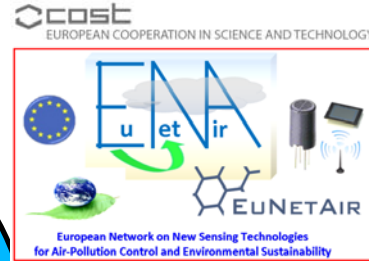
## Innovation Highlights of COST Action TD1105 *EuNetAir*:

The Working Program includes multidisciplinary Research at integrated approach and trans-domain multi-scale level:

- **Nanomaterials** for low-cost AQC sensors
- Improved **gas sensor systems** and low-power sensing microdevices
- **Wireless sensor networks** and distributed intelligence
- **Air-quality modelling** and chemical weather forecasting
- **New protocols**, standards and methods for AQC sensors
- **Harmonisation** of environmental measurements
- **Guidelines** for AQC systems and transducers
- **Environmental sustainability and energy efficiency**



# Action TD1105 *EuNetAir*: Working Groups (1/5)



**WG1:**  
**Sensor Materials  
&  
Nanotechnologies**

**WG2:**  
**Sensors, Devices  
& Systems for AQC**

**INTERDISCIPLINARY  
SPECIAL INTEREST GROUPS**

**WG4:**  
**Protocols &  
Standardisation  
Methods**

**WG3:**  
**Env. Measurements  
&  
Air Pollution Modelling**

## MANAGEMENT COMMITTEE:

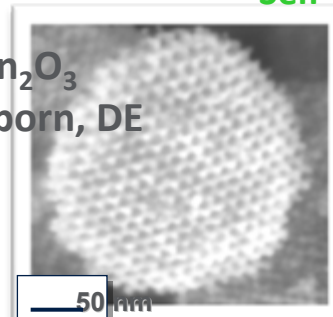
### CORE-GROUP & STEERING COMMITTEE

- **Editorial Board**
- **Dissemination**
- **Training Schools**
- **Gender Balance**
- **Early Stage Researchers (ESR)**
- **Short-Term Scientific Mission (STSM)**
- **Intellectual Property Rights (IPR)**
- **Local Organizing Committee (LOC)**

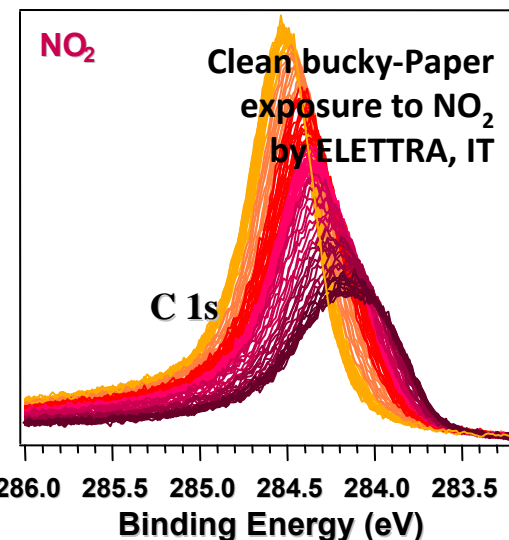
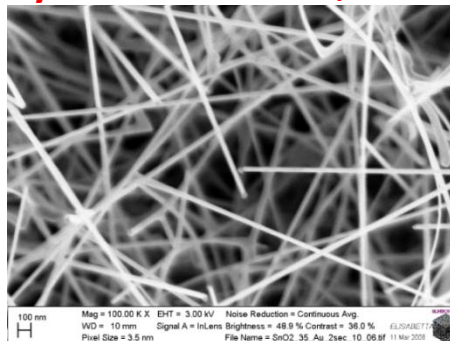
- **SIG 1: Network of Spin-offs**
- **SIG 2: Smart Sensors for Urban Air Monitoring in Cities**
- **SIG 3: Guidelines for Best Coupling Air Pollutant-Transducer**
- **SIG 4: Expert comments for the Revision of the Air Quality EU Directive**

- **Sub-Working Group 1.1:**  
Metal oxides nanostructures for AQC gas sensors.
- **Sub-Working Group 1.2:**  
Carbon nanomaterials for AQC gas sensors.
- **Sub-Working Group 1.3:**  
Emerging sensor materials (organic/inorganic, hybrid, nanocomposites, polymers, functional, etc.).

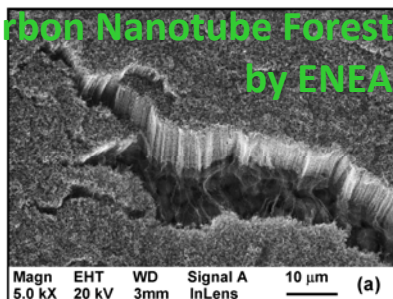
Mesoporous In<sub>2</sub>O<sub>3</sub>  
by Univ. of Paderborn, DE



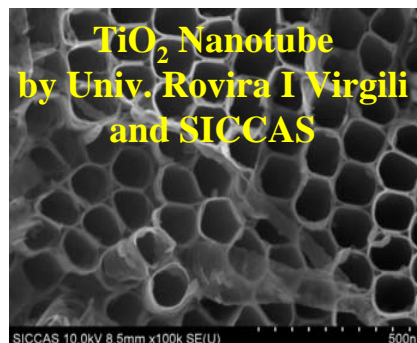
Metal oxide (SnO<sub>2</sub>)  
Nanowires nets  
by Univ. of Brescia, IT



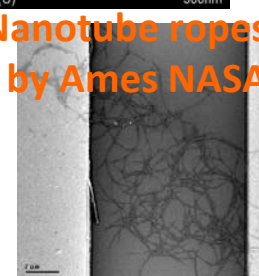
Carbon Nanotube Forest  
by ENEA



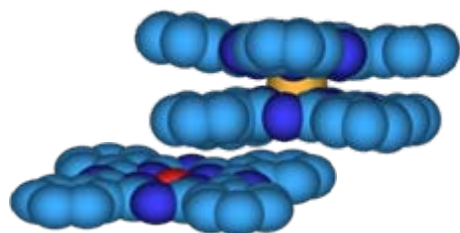
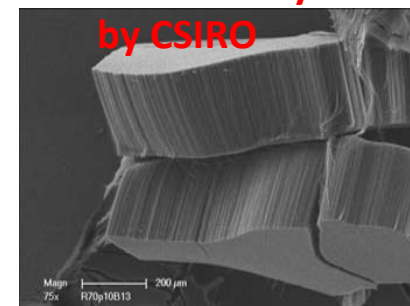
TiO<sub>2</sub> Nanotube  
by Univ. Rovira I Virgili  
and SICCAS



Carbon Nanotube ropes  
by Ames NASA



Carbon Nanotube yarns  
by CSIRO



New molecular materials of polymer-macrocycles as transducers for polluting gas sensing by University of Bourgogne

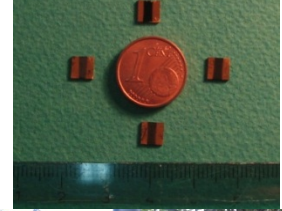


# TD1105 *EuNetAir* **WG2**: Sensors, Devices and Systems for AQC (3/5)

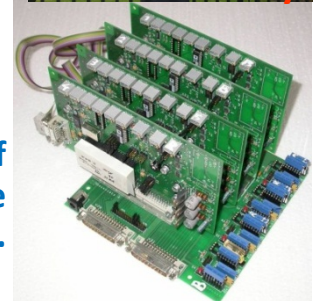
WG2 Chair: Prof. Andreas Schuetze, Saarland University, Germany

IT PATENT ENEA

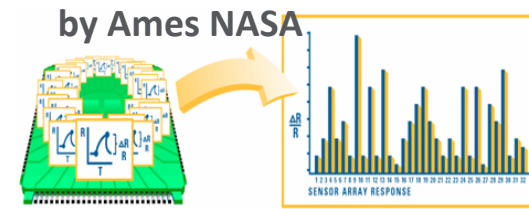
Carbon Nanotube Gas Sensors



EnviroWatch mote by Newcastle University



Warwick University in collaboration with Cambridge University, EPFL, PennState.

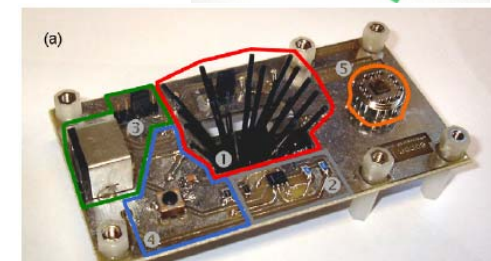


Using pattern matching algorithms, the data is converted into a unique response pattern

A versatile platform for the efficient development of gas detection systems based on automatic device adaptation by University of Saarland.



Low-ppb sensitivity for NO<sub>2</sub> GaN-based sensor concept



Autonomous Gas Sensor System by IREC and Univ. of Barcelona

## Sub-Working Group 2.1:

Gas sensors and new transducers.

## Sub-Working Group 2.2:

Portable gas sensor-systems.

## Sub-Working Group 2.3:

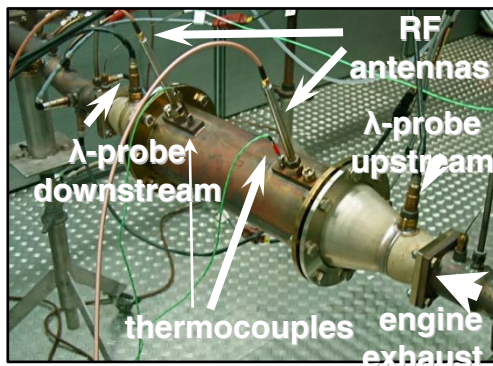
Wireless technology and AQC sensors network.

## Sub-Working Group 2.4:

Intelligence algorithms and distributed computing for networked AQC gas sensors.

Direct status measurement of automotive catalysts by radio-frequency technique by University of Bayreuth, DE.

ERATION IN SCIENCE AND TECHNOLOGY



## Chemical Weather Forecasting by NIMH, Bulgaria

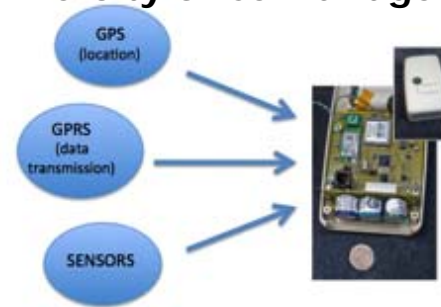


by Aristotle University, EL

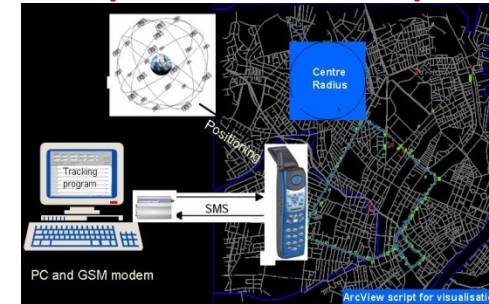


## AirMerge system for Chemical Weather Models

Mobile and static sensor  
network configurations  
by University of Cambridge.



## AQ Modeling: Tracking routes by Aarhus University, DK



## Sub-Working Group 3.1:

Environmental measurements at laboratory and in field air-quality stations.

## Sub-Working Group 3.2:

Air-quality modelling and chemical weather forecasting.

## Sub-Working Group 3.3:

Harmonisation of environmental measurements.



Environmental measurements of PM and air pollution by CSIC, ES



AQ monitoring station by ARPA-PUGLIA, IT

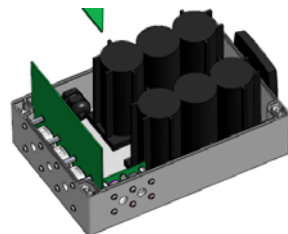


AQ monitoring station by Aarhus University, DK



AQ monitoring station by Lithuanian EPA

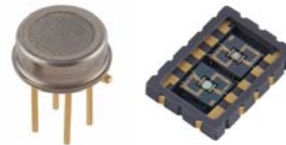
- **Sub-Working Group 4.1**:  
Protocols, standards and methods for AQC by analyzers/instruments (no-sensors) technologies.
- **Sub-Working Group 4.2**:  
Protocols, standards and methods for AQC by sensors (no-analyzers) technologies.
- **Sub-Working Group 4.3**:  
Benchmarking of new products and market of commercial AQC sensors.



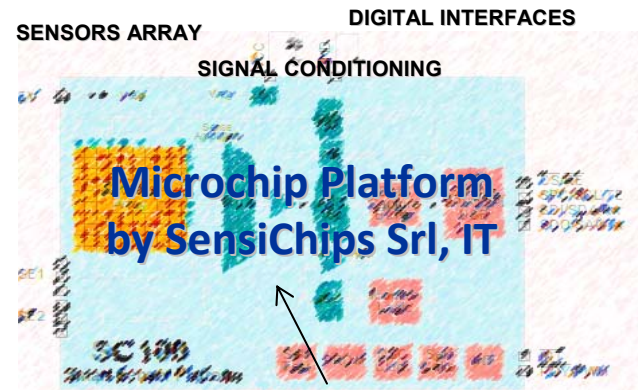
**Battery-Powered Sensors by Alphasense Ltd, UK**

European Directive 2008/50/EC: Ambient Air Quality  
EU standard EN 13725/2003: Dynamic Olfactometry  
Protocols and Standardised Methods for Gas Sensors  
Guidelines of Best Transducers applied to specific gases

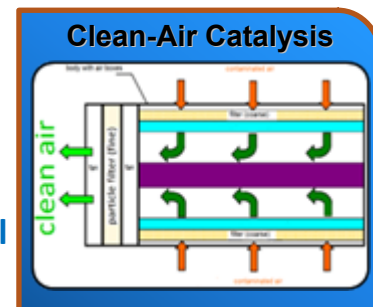
Dynamic olfactometry EN13725  
by Univ. of Liege, Odometric SA,  
Univ. of Bari, Lenviros srl.



**Packaged Sensors  
by E2V, CH**



**New precision multi-parametric analytical tool**



**Becker Gruppe, DE**



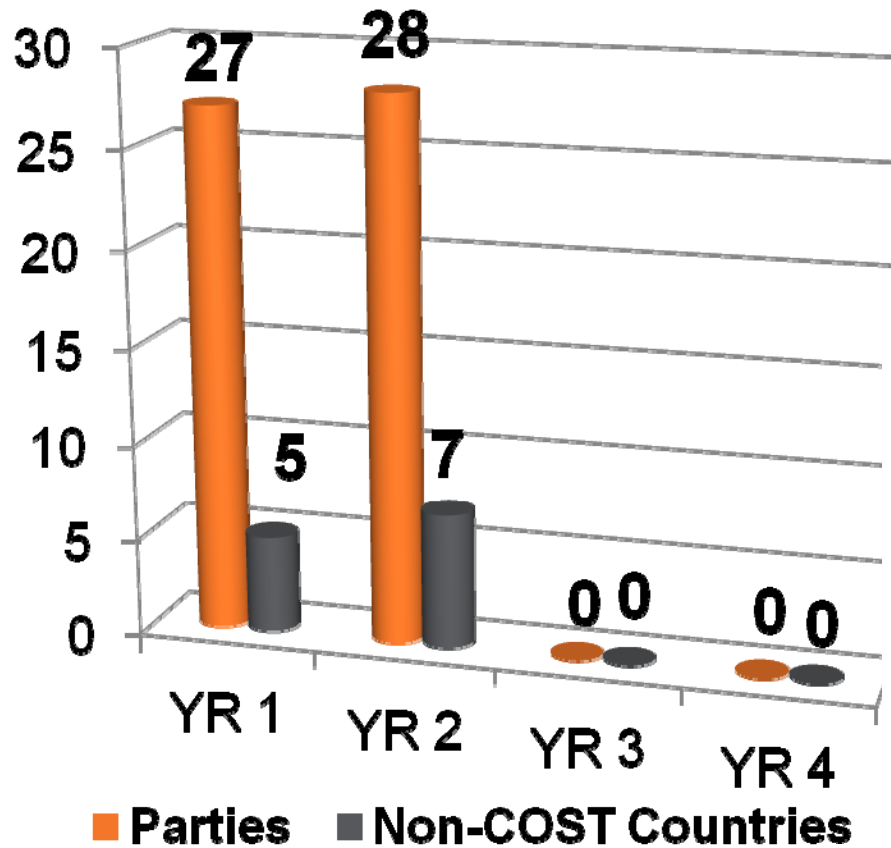
**CO<sub>2</sub> IR sensor for alarm  
System by SenseAir AB, Sweden**

# COST Action TD1105 ROADMAP (2012-2016)

YEAR	Quarter 1	Quarter 2	Quarter 3	Quarter 4
1	<p><b><u>M</u></b>: Kick-Off Meeting. <b>MC Meeting 1.</b></p> <p><b><u>D</u></b>: MC setup and Action Workplan established</p>	<p><b><u>M</u></b>: Editorial Board for Leaflet, Brochure, Newsletter. Action website setup.</p> <p><b><u>D</u></b>: Definition of WGs and WGs Workplans</p>	<p><b><u>M</u></b>: <b>MC Meeting 2.</b> WGs Meeting 1.</p> <p><b><u>D</u></b>: Scientific activities, ESR/STSM program, Dissemination</p>	<p><b><u>M</u></b>: <b>Workshop 1.</b> <b>Training School 1.</b></p> <p>State-of-Art on AQC.</p> <p><b><u>D</u></b>: Evaluation and Activity Report. Scientific strategies</p>
2	<p><b><u>M</u></b>: <b>MC Meeting 3.</b> WGs Meeting 2. Update Action website.</p> <p><b><u>D</u></b>: Scientific activities. Liason with EU Programs</p>	<p><b><u>M</u></b>: Editorial Board meeting. ESR/STSM.</p> <p><b><u>D</u></b>: Dissemination. Newsletter. Reporting</p>	<p><b><u>M</u></b>: <b>MC Meeting 4.</b> WGs Meeting 3. <b>Workshop 2. Training School 2.</b></p> <p><b><u>D</u></b>: S&amp;T strategies</p>	<p><b><u>M</u></b>: <b>International Conference 1.</b> Edit. Board. ESR/STSM.</p> <p><b><u>D</u></b>: Dissemination. Reporting</p>
3	<p><b><u>M</u></b>: <b>MC Meeting 5.</b> WGs Meeting 4.</p> <p><b><u>D</u></b>: Dissemination. Strategies &amp; Activities</p>	<p><b><u>M</u></b>: Edit. Board: State-of-art AQC. ESR/STSM</p> <p><b><u>D</u></b>: Dissemination. Strategies. Reporting</p>	<p><b><u>M</u></b>: <b>MC Meeting 6.</b> WGs Meeting 5. <b>Workshop 3. Training School 3.</b></p> <p><b><u>D</u></b>: S&amp;T strategies</p>	<p><b><u>M</u></b>: Edit. Board: Newsletter. ESR/STSM</p> <p><b><u>D</u></b>: Dissemination. Reporting</p>
4	<p><b><u>M</u></b>: <b>MC Meeting 7.</b> WGs Meeting 6.</p> <p><b><u>D</u></b>: S&amp;T strategies. Link to</p>	<p><b><u>M</u></b>: <b>Workshop 4.</b> <b>Training School 4.</b></p> <p><b><u>D</u></b>: Dissemination. ESR/STSM. S&amp;T</p>	<p><b><u>M</u></b>: WGs Meeting 7.</p> <p><b><u>D</u></b>: S&amp;T strategies and activities. ESR/STSM. Dissemination</p>	<p><b><u>M</u></b>: <b>International Conference 2.</b> <b>MC Meeting 8.</b></p> <p><b><u>D</u></b>: Final Evaluation.</p>



# COST Action TD1105 EuNetAir: **Action Parties (28)**



**Non-COST Countries: NNC + IPC**

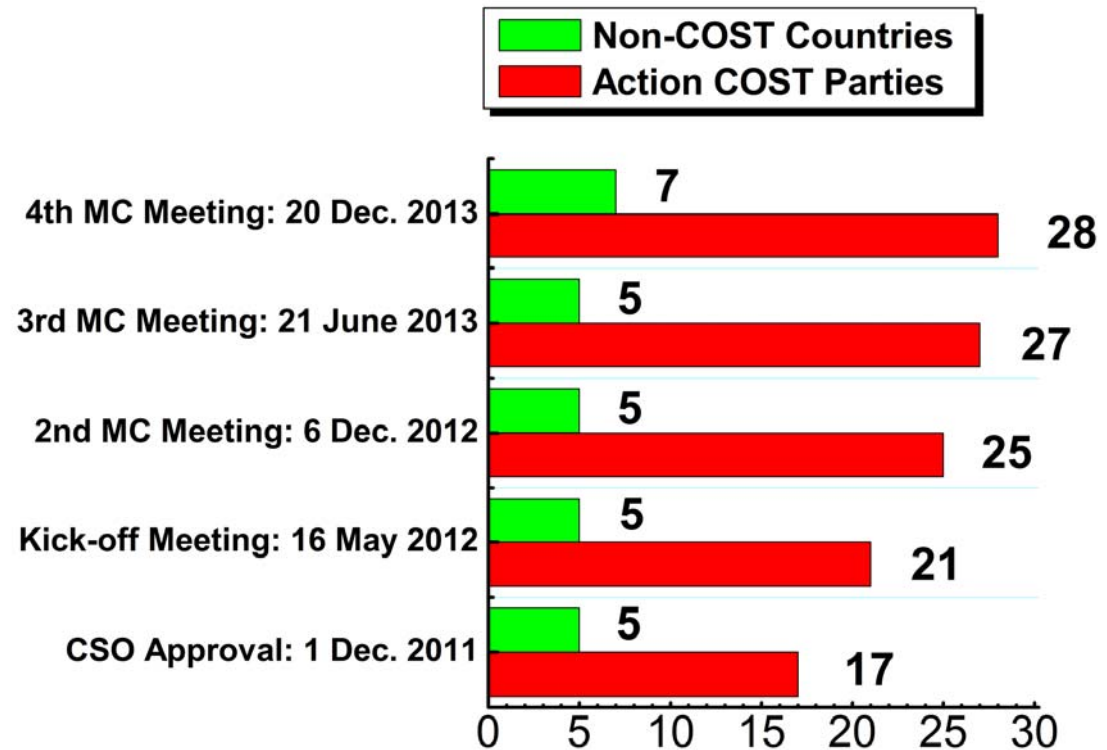
## Grant Holder:

Eurice GmbH, Saarbrücken, Germany

## *GH Scientific Representatives:*

Corinna Hahn, MC Member

Juliane Rossbach, MC Substitute



# COST Action TD1105 *EuNetAir*: 28 COST Countries (Parties) have already signed Memorandum of Understanding (MoU)

## PARTIES:

already accepted  
MoU: 28 Countries

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

**COST Action *EuNetAir* PARTICIPANTS**

Logos of participating institutions and organizations include:

- vito (vision on technology)
- UNIVERSITÉ DE LIÈGE
- Arlon campus
- ODOMETRIC
- ICICJR
- CAMBRIDGE CMOS SENSORS
- TRINITY COLLEGE DUBLIN
- MPI-BGC
- ENEA
- EPFL (ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE)
- e2v
- ENVEVE
- EMPA (Materials Science & Technology)
- UNIVERSITÄT DES SAARLANDES
- FM (FUNCTIONAL MATERIALS)
- ETHERA
- UNIVERSITÄT PADERBORN (Die Universität der Informationsgesellschaft)
- UST (UMWELT SENSOR TECHNIK)
- BECKER GRUPPE
- 3S (Gas sensing solutions)
- AARHUS UNIVERSITET
- DTU
- Aristotle University Thessaloniki
- FORTH (Foundation for Research & Technology - Hellas)
- I.S.I. (Industrial Systems Institute)
- IREC (Institut de Recerca en Energia de Catalunya)
- MINISTERIO DE CIENCIA E INNOVACION
- CSIC (CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS)
- UNIVERSITAT DE BARCELONA
- UNIVERSITÄT ROMA I VIRGILI
- world sensing
- UNIVERSITY OF OULU (OULUN YLIOPISTO)
- UB (UNIVERSITÄT BUDAPEST)
- BP (UNIVERSITÉ BLAISE PASCAL)
- HMS
- imec
- ENEA
- elettra
- UNIVERSITÀ DEGLI STUDI DI TRIESTE (Dipartimento di Scienze Chimiche e Farmaceutiche)
- UNIVERSITÄT STUDIUM CUIUS BONAERAE
- lenviros
- sensichips
- CHALMERS
- SenseAir
- SENSIC (Clean air sensors)
- Aerosol
- Linköpings universitet
- Imperial College London
- Newcastle University
- UNIVERSITY OF CAMBRIDGE
- WARWICK
- MANCHESTER 1824
- Univerza v Ljubljani

# COST Action TD1105 *EuNetAir*:

## 7 Non-COST Countries and 8 Non-COST Institutions

**Non-COST Countries:**  
Australia, Canada, China,  
Morocco, Russia, Ukraine,  
USA

**Non-COST Institutions:**

CSIRO (Australia);  
University of Waterloo  
(Canada); Chinese  
Academy of Sciences,  
Shanghai Institute of  
Ceramics (China);  
University of Agadir IBN  
Zohr (Morocco); National  
Research Center Kurchatov  
Institute (Russia); O.M.  
Marzeiev Institute for  
Hygiene and Medical  
Ecology of Academy of  
Science of Ukraine  
(Ukraine); Southern Illinois  
University Carbondale,  
NASA Ames Research  
Center (USA).

**Non-COST EuNetAir PARTICIPANTS**

**University of Waterloo**  
Systems Design Engineering

**National Research Center Kurchatov Institute**  
Institute of Applied Chemical Physics

**CA - Canada**

**RU - Russian Federation**

**O.M. Marzeiev Institute**  
Academy of Sciences of Ukraine

**US - United States**

**US - United States**

**Southern Illinois University**  
Carbondale  
Department of Physics

**CN - China**

**Chinese Academy of Sciences**  
Shanghai Institute of Ceramics

**Ames Research Center**

**University of Agadir IBN Zohr**

**AU - Australia**

**CSIRO**  
Materials Science and Engineering

**ENEA**

**SICCAS** Since 1928

**IPC - International Partner Countries**



# ***EuNetAir: List of Experts from NNC and IPC***



**180** EXPERTS from **28** COST Countries and **7** Non-COST Countries



**AU - Australia**

Dr. Phil MARTIN



**CA - Canada**

Prof. John YEOW



**CN - China**

Dr. Yongxiang LI  
Dr. Zhifu LIU



**RU - Russian Federation**

Dr. Alexey VASILIEV



**US - United States**

Prof. Andrei KOLMAKOV  
Dr. Meyya MEYYAPPAN



**MA - Morocco**

Dr. Radouane LEGHRIB  
Dr. Houda LAHLOU



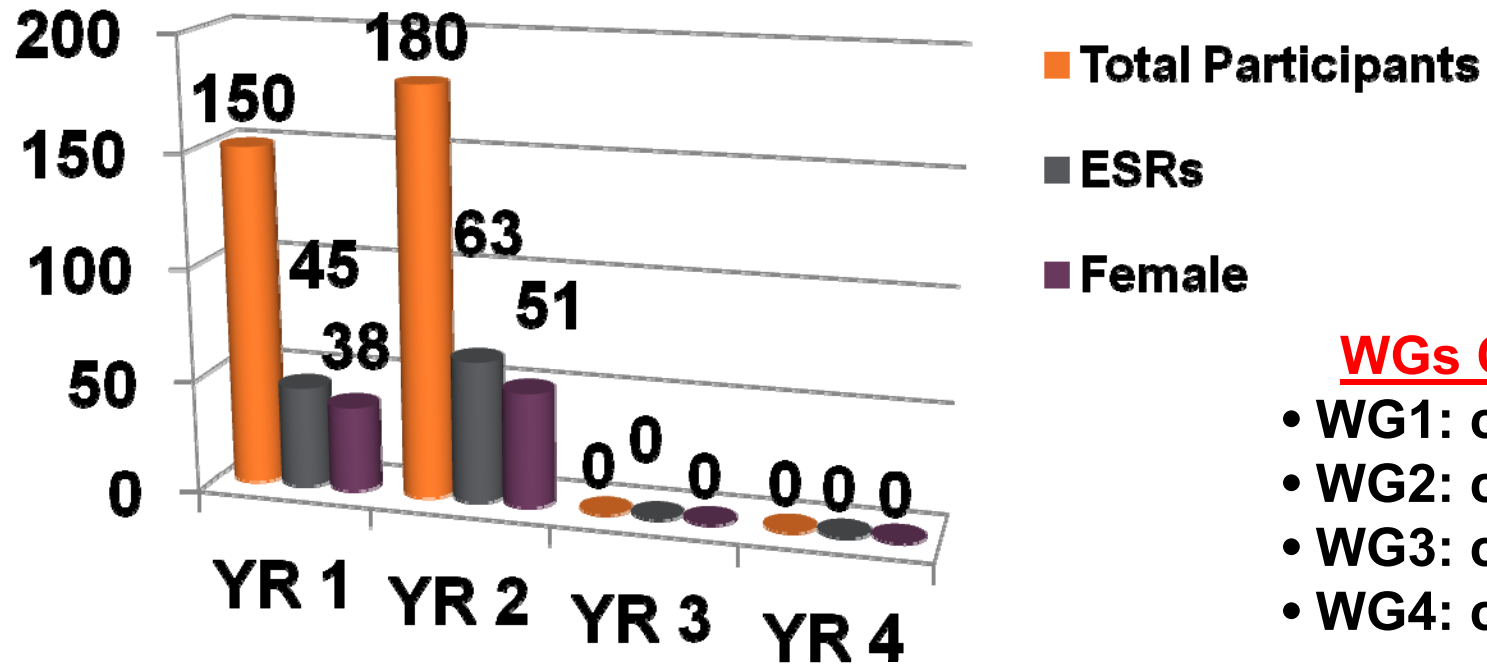
**UA - Ukraine**

Dr. Olena TUROS  
Dr. Arina PETROSIAN  
Dr. Oksana ANANYEVA  
Dr. Liudmyla MYKHINA  
Dr. Liliia PETRUK  
Dr. Tetiana MAREMUKHA

**NNC - Near Neighbour Countries**

**IPC - International Partner Countries**

# COST Action TD1105 EuNetAir: **Action participants**




## WGs Composition:

- WG1: ca. 30 participants
- WG2: ca. 45 participants
- WG3: ca. 40 participants
- WG4: ca. 25 participants


## Summary YEAR 2: 1 July 2013 - 30 June 2014

- Total Number of Participants: 180 (80% active)
- Early Stage Researchers (ESRs): 63 (35%)
- Females: 51 (28%)
- MC Members: 52 - Male: 38 (73%); Female: 14 (27%)
- MC Substitutes: 29 - Male: 24 (83%); Female: 5 (17%)


 <b>AT - Austria</b>	Materials Center Leoben Forschung GmbH	
 <b>BE - Belgium</b>	VITO, Université de Liège, Odometric S.A.	
 <b>BG - Bulgaria</b>	National Institute of Meteorology and Hydrology - BAS; Institute of Electronics - BAS	
 <b>CH - Switzerland</b>	Ecole Polytechnique Fédérale de Lausanne; e2v Microsensors S.A.; EnvEve S.A.; EMPA	
 <b>CZ - Czech Republic</b>	Academy of Sciences of the Czech Republic	
 <b>DE - Germany</b>	Institute of Energy and Environmental Technology; Saarland University; MPI for Biogeochemistry Univ. of Bayreuth; Univ. of Paderborn; Univ. Applied Sci. Ostwestfalen-Lippe; UST; Alfred Becker; 3S	
 <b>DK - Denmark</b>	Aarhus University; Technical University of Denmark - DTU	
 <b>EL - Greece</b>	Aristotle University; FORTH; Athena/ISI; University of Piraeus	
 <b>ES - Spain</b>	Catalonia Institute for Energy Research - IREC; Spanish National Research Council - CSIC; University Rovira i Virgili; University of Barcelona, Worldsensing S.L.	
 <b>FI - Finland</b>	University of Oulu; University of Helsinki; Tampere University of Technology	
 <b>FR - France</b>	University of Bourgogne; University Blaise Pascal; Ecole des Mines de Douai; CEA-CNRS; ETHERA	
 <b>HU - Hungary</b>	Hungarian Meteorological Service	
 <b>IS - Iceland</b>	Agricultural University of Iceland	 <b>MK - Republic of Macedonia</b> Ministry of Environment and Physical Planning
 <b>IE - Ireland</b>	Trinity College Dublin; University College Cork	
 <b>IL - Israel</b>	AirBase Systems; TECHNION	 <b>RS- Serbia</b> Institute of Public Health of Belgrade; VINCA
 <b>IT - Italy</b>	ENEA; ELETTRA; Univ. of Bari; Univ. of Brescia; Univ. of Trieste; Lenviros; Sensichips, ARPA-Puglia	
 <b>LV - Latvia</b>	University of Latvia	
 <b>NL - Netherlands</b>	IMEC - Holst Centre; ECN	
 <b>NO - Norway</b>	NILU - Norwegian Institute for Air Research	
 <b>PL - Poland</b>	Silesian University of Technology; Warsaw University of Life Science	
 <b>PT - Portugal</b>	Univ of Coimbra; Instit. of Environment & Development; National Health Institute; Univ of Lisbon	
 <b>RO - Romania</b>	National R&D Institute for Nonferrous and Rare Metals; SC IPA SA - Research & Development	
 <b>SE - Sweden</b>	Linköping University; Chalmers University of Technology; SenSiC AB; SenseAir AB	
 <b>SI - Slovenia</b>	University of Ljubljana; Aerosol d.o.o.	
 <b>UK - United Kingdom</b>	Imperial College London; Newcastle University; University of Manchester; Cambridge; University of Warwick; University of Edinburgh; Cambridge CMOS Sensors; Alphasense	
 <b>TR - Turkey</b>	GEBZE Institute of Technology; Middle East Technical University of Ankara	

 AT - Austria


Dr. Anton KOCK  
Dr. Stefan DEFREGGER

 BE - Belgium


Prof. Anne-Claude ROMAIN  
Dr. Jan THEUNIS  
Dr. Julien DELVA

 BG - Bulgaria


Dr. Dimiter SYRAKOV  
Dr. Ivan NEDKOV

 CH - Switzerland

Dr. Danick BRIAND  
Dr. Marco BRINI  
Dr. Christine ALEPEE  
Dr. Nicolas MOSER  
Dr. Christoph HUEGLIN

 CZ - Czech Republic


Dr. Vera KURKOVA  
Dr. Roman NERUDA  
Dr. Zdenek ZELINGER

 DE - Germany


Dr. Thomas A. J. KULHUSCH  
Dr. Ulrich QUASS  
Prof. Andreas SCHUETZE  
Dr. Tilman SAUERWALD  
Prof. Ralf MOOS  
Dr. Daniela SCHONAUER-KAMIN  
Dr. Thorsten WAGNER  
Dr. Olaf KIESEWETTER  
Dr. Thorsten CONRAD  
Dr. Thomas BECKER  
Prof. Wrenger Burkhard  
Dr. Jost Valentin Lavric  
Dr. Corinna HAHN

 DK - Denmark


Prof. Ole HERTEL  
Dr. Lise Lotte SORENSEN  
Prof. Anja BOISEN  
Dr. Silvan SCHMID

 EL - Greece


Prof. Kostas KARATZAS  
Prof. George KIRIAKIDIS  
Dr. Christos KOULAMAS  
Prof. George PAPAPOPOULOS  
Prof. Tatiana TAMBOURATZIS

 ES - Spain


Prof. Juan Ramon MORANTE  
Dr. Francisco HERNANDEZ  
Dr. Xavier QUEROL  
Dr. Mar VIANA  
Prof. Eduard LLOBET  
Dr. Radu IONESCU  
Prof. Albert ROMANO  
Dr. Juan Daniel PRADES  
Dr. Jordi LLOSA

 FI - Finland


Prof. Heli JANTUNEN  
Prof. Jyrki LAPPALAINEN  
Dr. Jari JUUTI  
Prof. Kaarle HAMERI  
Prof. Jorma KESKINEN

 FR - France


Prof. Marcel BOUVET  
Prof. Jerome BRUNET  
Prof. Alain PAULY  
Dr. Jean SUISSE  
Dr. Amadou NDYAE  
Dr. Thu-Hoa THRAN-THI  
Dr. Philippe KARPE  
Prof. Jerome ROSSIGNOL  
Prof. Nadine LOCOGE

 HU - Hungary


Dr. Zita FERENCZI  
Dr. Krisztina LABANCZ

 IS - Iceland


Dr. Arngrimir THORLACIUS

 IE - Ireland


Dr. Francesco PILLA  
Prof. John WENGER

 IT - Italy


Dr. Michele PENZA  
Dr. Marco ALVISI  
Dr. Saverio DE VITO  
Dr. Andrea GOLDONI  
Dr. Magda BRATTOLI  
Dr. Annamaria DEMARINIS  
Dr. Gianluigi DE GENNARO  
Dr. Luigi BARBIERI  
Prof. Giorgio ASSENNATO  
Dr. Roberto SIMMARANO  
Prof. Giorgio SBERVEGLIERI

 MK - Rep. of Macedonia


Dr. Igor ATANASOV  
Dr. Ljupcho GROZDANOSVKI

 NL - Netherlands


Dr. Sywert BRONGERSMA  
Dr. Ernie WEIJERS  
Dr. Rene OTJES

 PL - Poland


Dr. Monika KWOKA  
Prof. Stanislaw GAWRONSKI  
Prof. Jacek SZUBER

 PT - Portugal


Prof. Bernadete RIBEIRO  
Prof. Carlos BORREGO  
Dr. Joao Paulo TEIXEIRA  
Prof. Cristina MAGUAS  
Dr. Miguel COUTINHO  
Dr. Ana Margarida COSTA

 SE - Sweden


Prof. Anita LLOYD SPETZ  
Dr. Marina VOINOVA  
Dr. Mike ANDERSSON  
Dr. Donatella PUGLISI  
Dr. Ulf THOLE  
Prof. Ingrid BRYNTSE

 IL - Israel


Dr. Liad ORTAR  
Prof. Hossam HAICK

 UK - United Kingdom


Prof. Julian GARDNER  
Prof. Roderic JONES  
Prof. Krishna PERSAUD  
Prof. John POLAK  
Dr. Robin NORTH  
Dr. Jeff NEASHAM  
Dr. Fabio GALATIOTO  
Prof. Florin UDREA  
Dr. John SAFFELL  
Prof. John LEE

 NO - Norway


Dr. Nuria Castell-BALAGUER  
Dr. Philippe SCHNEIDER

 RO - Romania


Dr. Roxana Mioara PITICESCU  
Dr. Marcel IONICA  
Dr. Cristina RUSTI  
Dr. Radu Adrian IONICA

 TR - Turkey


Prof. Zafer Ziya OZTURK  
Prof. Mehmet Fatih DANISMAN

 RS - Serbia

Anka CVETKOVIC  
Milena JOVASEVIC-STOJANOVIC

 SI - Slovenia

Rahela ZABKAR  
Grisa MOCNIK  
Branko STER

 LV - Latvia

Prof. Iveta STEINBERGA

## Country

## MC Members (54): Male (70%) - Female (30%)

Austria	Dr. Anton KOCK
Belgium	Dr Jan THEUNIS; Dr Anne-Claude ROMAIN
Bulgaria	Dr Dimiter SYRAKOV; Dr Ivan NEDKOV
Croatia (NEW Party)	Dr. Irena CIGLENECKI-JUSIC
Czech Republic	Dr. Vera KURKOVA; Dr. Zdenek ZELINGER
Denmark	Prof. Ole HERTEL
Finland	Prof. Kaarle HAMERI; Prof. Jyrki LAPPALAINEN
France	Prof. Marcel BOUVET; Prof. Jerome BRUNET
Germany	Prof. Andreas SCHUETZE; Dr Corinna HAHN
Greece	Prof. George PAPAPOULOS; Prof. Kostas KARATZAS
Hungary	Ms Krisztina LABANCZ; Dr Zoltan ENYEDI
Iceland	Dr Arngrimur THORLACIUS
Ireland	Dr. Francesco PILLA; Prof. John WENGER
Israel	Dr. Liad ORTAR; Prof. Hossam HAICK
Italy	Dr Michele PENZA; Prof. G. SBERVEGLIERI; Dr. G. DE GENNARO
Latvia	Dr Iveta STEINBERGA; Dr. Gita SAKALE
Macedonia Rep.	Dr. Igor ATASANOV; Dr. Ljupcho GROZDANOVSKI
Netherlands	Dr Sywert BRONGERSMA; Dr. Ernie WEIJERS
Norway	Dr Nuria CASTELL BALAGUER; Dr. Philipp SCHENEIDER
Poland	Dr Monika KWOKA; Prof. Janislaw GAWRONSKI
Portugal	Prof. Bernadete RIBEIRO; Prof. Carlos BORREGO
Romania	Dr Marcel IONICA; Dr Roxana Mioara PITUCESCU
Serbia	Dr. Anka CVETKOVIC
Slovenia	Dr Grisa MOCNIK; Dr Rahela ZABKAR
Spain	Prof. Juan Ramon MORANTE; Prof. Eduard LLOBET VALERO
Sweden	Prof. Anita LLOYD SPETZ; Prof. Ingrid BRYNTSE
Switzerland	Dr Danick BRIAND; Dr. Nicolas MOSER
United Kingdom	Dr John SAFFELL; Prof. Roderic JONES
Turkey	Prof. Zafer ZIYA OZTURK; Prof. Mehmet Fatih DANISMAN

**MC Chair:** Michele Penza, ENEA, IT

**MC Vice Chair:** Anita Lloyd Spetz, Linkoping University, SE

**Grant Holder:** Eurice GmbH, Saarbrucken, DE

## Country

## MC Substitutes (31)

Austria	Dr Stefan DEFREGGER
Belgium	Dr Julien DELVA
Czech Republic	Dr. Roman NERUDA
Denmark	Dr. Lise Lotte SORENSEN
Finland	Prof. Jorma KESKINEN
France	Dr Jean SUISSE; Prof. Alain PAULY
Germany	Dr Daniela SCHONAUER-KAMIN Dr. Thomas KUHMBUSCH Dr. Juliane ROSSBACH
Greece	Prof. George KIRIKIADIS Dr. Christos KOULAMAS
Italy	Dr. Roberto SIMMARANO Dr. Marco ALVISI; Dr. Saverio DE VITO
Macedonia Rep.	Dr. Beti ANGELEVSKA
Netherlands	Dr. Rene OTJES
Poland	Prof. Jacek SZUBER
Portugal	Dr. Joao Paulo TEIXEIRA
Romania	Dr. Cristina RUSTI; Dr. Marcel Adrian IONICA
Slovenia	Dr. Andrej DOBNIKAR
Spain	Prof. Albert ROMANO-RODRIGUEZ Dr. Jordi LLOSA
Sweden	Dr Ulf THOLE; Dr. Marina VOINOVA
Switzerland	Dr Christoph HUEGLIN
Turkey	Prof. Necmettin KILINC
UK	Prof. Julian GARDNER Dr Robin NORTH; Prof. Florin UDREA

*Kick-off Meeting at Brussels on 16 May 2012*

# Year 3: Scientific Planning of *EuNetAir* (1/2)

Meetings/Workshops/Training Schools planned for upcoming year  
([Year 3: 1 July 2014 - 30 June 2015](#)):

- **WG1-WG4 Meeting** on *New Sensing Technologies for Air-Pollution Monitoring and Start of the Air Quality Joint-Exercise Intercomparison* at IDAD - University of Aveiro, Aveiro (Portugal), 13 - 15 Oct. 2014.
- The **3<sup>rd</sup> International Workshop of the COST Action TD1105** on *New Trends and Challenges on Air Quality Control* at University of Latvia, Riga (Latvia), 26 - 27 March 2015.
- The **Action 3<sup>rd</sup> International Training School** on *Atmospheric Aerosol Physics, Measurements and Sampling* at Hyytiala Station of the University of Helsinki, Helsinki (Finland), 2 - 8 May 2015.

MC/WG Meetings planned for the upcoming year

(Year 3: 1 July 2014 - 30 June 2015):

- **3<sup>rd</sup> SCIENTIFIC MEETING: WGs Meeting and 6<sup>th</sup> MC Meeting** at Bahcesehir University and GEBZE Institute of Technology, Istanbul (Turkey), 3 - 5 Dec. 2014.
- **4<sup>th</sup> SCIENTIFIC MEETING: WGs Meeting and 7<sup>th</sup> MC Meeting** at Linkoping University, Linkoping (Sweden), 3 - 5 June 2015.
- **Special Session EuNetAir / Core-Group Meeting** to EUROSENSORS 2014, Brescia (Italy), 7 - 10 September 2014.
- **Special Session EuNetAir / Smart Cities Sensors** to IEEE SENSORS 2014, Valencia (Spain), 2 - 5 November 2014.

# Aveiro Joint-Exercise Intercomparison & WG Meeting

13 October 2014: Starting Joint-Exercise (2 weeks duration)

14 - 15 October 2014: EuNetAir WG1-WG4 Meeting

EuNetAir Air Quality Joint-Exercise Intercomparison 2014

Local Organizers: Prof. Carlos Borrego and Dr. Ana Margarida Costa (IDAD)

**Air quality campaign at Aveiro (Portugal) city centre 2014**



Continuous measurements: CO, benzene, NO<sub>x</sub>, SO<sub>2</sub>, PM<sub>10</sub>, VOC  
Temperature, humidity, wind velocity, wind direction, solar radiation, precipitation

**COST partners (at least 8 teams joined) are invited to install their microsensors side-by-side to compare performance with referenced equipment in the Air-Quality Mobile Laboratory**



# THIRD SCIENTIFIC MEETING: WG & 6<sup>th</sup> MC Meeting

## *New Sensing Technologies for Indoor Air-Pollution*

Bahcesehir University, **Istanbul** (Turkey), 3 - 5 December 2014

### **PLENARY SESSION:**

***EU Projects Cluster on  
Indoor Environments  
Quality and Applications***

### **Multidisciplinary Meeting:**

*International Experts and Coordinators  
of FP7 and H2020 research projects  
related to the IEQ Cluster  
are highly expected to participate*



### **Local Organizers:**

**Prof. Zafer Ziya Ozturk,  
GEBZE, Istanbul (Turkey)**

**Prof. Ali Gungor,  
Bahcesehir University,  
Istanbul (Turkey)**

# 3<sup>rd</sup> International WORKSHOP *EuNetAir*

## *New Trends and Challenges for Air Quality Control*

hosted by University of Latvia, **Riga** (Latvia), 26 - 27 March 2015

### Local Organizer:

Prof. Iveta Steinberga,  
University of Latvia,  
Riga (Latvia)



# 3<sup>rd</sup> TRAINING SCHOOL *EuNetAir* at Hyytiala Forestry Field Station

## *Atmospheric Aerosol Physics, Measurements and Sampling*

hosted by University of Helsinki, **Hyytiala** (Helsinki), 2 - 8 May 2015

### Local Organizer:

Prof. Kaarle Hameri,  
University of Helsinki,  
Helsinki (Finland)



**Call for Participation: 15 Trainees and 3 Trainers will be funded.**  
**Deadline for Application: March-April 2015 (to be launched !)**

# FOURTH SCIENTIFIC MEETING: WG & 7<sup>th</sup> MC Meeting

hosted by Linköping University, **Linköping** (Sweden), 3 - 5 June 2015

## Local Organizer:

Prof. Anita Lloyd Spetz,  
Linköping University,  
Linköping (Sweden)



## FOCUS ON:

*Outdoor Applications*

# OUTREACH ACTIVITIES from Action TD1105

## COST Action TD1105 - EuNetAir

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

Action website:

[www.cost.eunetair.it](http://www.cost.eunetair.it)

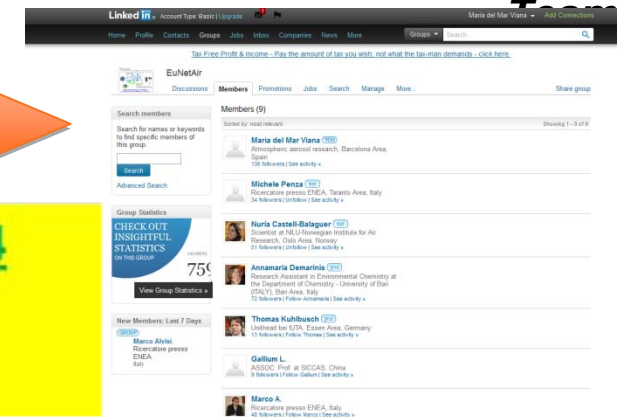
hosted by ENEA

Dr. Marco Alvisi, Webmaster Coordinator

Sebastiano Dipinto, Valerio Pfister, Gianfranco Zingarelli, Webmaster

Social Scientific ESRs Network (SSEN) by LinkedIn

Moderator(s): Mar Viana, Mariacruz Minguillon



3<sup>o</sup> CALL for Short Exchange Visits launched on June 2014  
(STSM - Short Term Scientific Mission)

Dr. Jan Theunis, STSM Coordinator EuNetAir



EuNetAir Newsletter

COST Action TD1105 Iss. 1/Dec 2012

Opening Editorial

- Issue 1: published on Dec. 2012 ✓
- Issue 2: published on June 2013 ✓
- Issue 3: published on Dec. 2013 ✓
- Issue 4: published on June 2014 ✓
- Issue 5: planned on Dec. 2014 ✎

Prof. Ralf Moos, Editor-in-Chief

Dr. Daniela Schonauer-Kamin, Editorial Board Manager

## Video/Interview at Action Webpages:

[www.cost.eunetair.it](http://www.cost.eunetair.it) - **Section VIDEO**

- **Thu-Hoa Tran-Thi**

Research Director on Indoor Sensors Applications, CEA-CNRS, France

- **Tim Watkins**

Deputy Director US EPA Air, Climate and Energy Programme, USA

- **Andrea C. Ferrari**

Chairman of Executive Board of Graphene Flagship, UK

- **Cristina Guerreiro**

Coordinator of EEA AQ Report 2012 and 2013, Norway

- **Meyya Meyyappan**

Chief Scientist at NASA Ames Nano Research Center, USA

- **Michele Penza**

Action Chair at RAI3 Italian TV Show *GeO&GeO*, Italy

# Editorial Activities: WGs MEETING at EEA

*New Sensing Technologies for Air-Pollution Control and Environmental Sustainability*

- **Special Issue Urban Climate (Elsevier)**

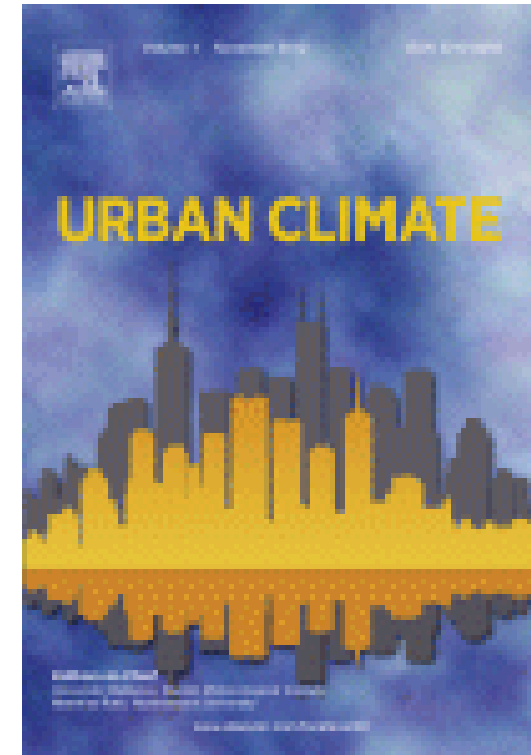
*New Sensing Technologies and Methods for Air-Pollution Monitoring*

*Proceedings of the Action EEA Meeting open to external contributors.*

*Peer-review process (<http://ees.elsevier.com/uclim/>)*

- **Guest Editors:**

- ✓ Michele Penza, ENEA, Italy
- ✓ Anita Lloyd Spetz, Linkoping University, Sweden
- ✓ Ole Hertel, Aarhus University, Denmark
- ✓ Ulrich Quass, IUTA eV, Germany
- Deadline for submission: 28 February 2014 (**Close**)
- Number of Submissions: **22 Manuscripts**
- Expected Publication: **Fall 2014 (Nov-Dec 2014)**



# Editorial Activities: **Symposium at EMRS**

*New Sensing Technologies for Air-Pollution Control and Environmental Sustainability*

- **Special Issue Journal of Sensors and Sensor Systems (Copernicus Publications)**

*Advanced Functional Materials for Environmental Monitoring and Applications*

*Proceedings of Symposium-B EMRS Spring Meeting 2014, 26-30 May 2014, Lille (FR)*

*Peer-review process ([www.journal-of-sensors-and-sensor-systems.net](http://www.journal-of-sensors-and-sensor-systems.net))*

- **Guest Editors:**

- ✓ Michele Penza, ENEA, Italy
- ✓ Anita Lloyd Spetz, Linköping University, Sweden
- ✓ Albert Romano-Rodriguez, Barcelona University, Spain
- ✓ Yongxiang Li, Chinese Academy of Sciences, China
- ✓ Meyya Meyyappan, NASA Ames Research Center, USA

- Deadline for submission: **31 July 2014**

- Expected Publication: **Fall 2014 (Nov-Dec 2014)**







# *Expected Impact by Action TD1105*

- **European Leadership on AQC Science & Technology**
- **Development of Green-Economy**
- **Support to Sustainable Development**
- **Support to Monitoring System of Clean Air for Europe**
- **Fostering Research & Innovation on New Sensing Technologies for Environmental Monitoring**

# CONCLUSIONS

**The COST Action TD1105 *EuNetAir* is proposed to solve problems in the area of:**

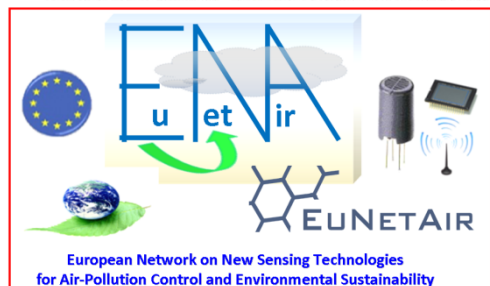
- Air Quality Control
- Environmental Sustainability
- Indoor/Outdoor Energy Efficiency
- Climate Change Monitoring
- Health Effects of Air-Pollution

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



# Contact Details

 **cost**  
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY



**CSO Approval: 01 Dec. 2011**

**Kick-off Meeting: 16 May 2012**

**Start of Grant: 01 July 2012**

**End of Grant: 30 June 2016**

[www.cost.eunetair.it](http://www.cost.eunetair.it)

**MC Chair:**

Dr. Michele Penza, ENEA, IT  
[michele.penza@enea.it](mailto:michele.penza@enea.it)

**MC Vice Chair:**

Prof. Anita Lloyd Spetz  
Linköping University, SE  
[spetz@ifm.liu.se](mailto:spetz@ifm.liu.se)

**Grant Holder:**

Dr. Corinna Hahn, Dr. Juliane Rossbach  
Eurice GmbH, DE  
[c.hahn@eurice.eu](mailto:c.hahn@eurice.eu); [j.rossbach@eurice.eu](mailto:j.rossbach@eurice.eu)

**Scientific Secretary:**

Dr. Annamaria Demarinis Loiotile  
[annamaria.demarinis@uniba.it](mailto:annamaria.demarinis@uniba.it)

**Science Officer:**

Dr. Deniz Karaca  
[deniz.karaca@cost.eu](mailto:deniz.karaca@cost.eu)

**Administrative Officer:**

Dr. Andrea Tortajada  
[andrea.tortajada@cost.eu](mailto:andrea.tortajada@cost.eu)

**Rapporteur ESSEM:**

Prof. Kostantinos Kourtidis (GR)  
[kourtidi@env.duth.gr](mailto:kourtidi@env.duth.gr)

**Rapporteur MPNS:**

Prof. Joaquim Manuel Vieira (PT)  
[vieira@cv.ua.pt](mailto:vieira@cv.ua.pt)

**Rapporteur CMST:**

Prof. Antonio Lagana (IT)  
[lagana05@gmail.com](mailto:lagana05@gmail.com)

[http://www.cost.eu/domains\\_actions/essem/Actions/TD1105](http://www.cost.eu/domains_actions/essem/Actions/TD1105)

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Lisbon, Portugal, 17 October 2014



**THANK YOU VERY MUCH FOR YOUR KIND ATTENTION !**



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