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

COST Action TD1105

OPEN SESSION COST *EuNetAir* on

New Sensing Technologies for Air Pollution Detection: Trends & Challenges

CORE-GROUP MEETING at EUROSENSORS-2015 Conference

Concert Hall, Freiburg, Germany, 9 September 2015

COST Action TD1105: OVERVIEW & PLANS

Michele Penza

Action Chair

ENEA - Brindisi, Italy

michele.penza@enea.it

ENEA
AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE

COST is supported by the EU Framework Programme

ESF provides the COST Office through a European Commission contract

AGENDA

10:30 - 12:30 ***Open Session COST: New Sensing Technologies for Air Quality Monitoring***
Chairperson: Michele Penza, ENEA, Brindisi, Italy

10:30 - 10:50
COST Action TD1105: European Network on New Sensing Technologies for Air-Pollution Control and Environmental Sustainability. Overview and Plans
Michele Penza, Action Chair, ENEA, Brindisi, Italy

10:50 - 11:10
Performance Evaluation of Amperometric Sensors for the Monitoring of O_3 and NO_2 in Ambient Air at ppb Level
Laurent Spinelle, Manuel Aleixandre, Michel Gerboles, JRC, EC DG ENV, Institute for Environment and Sustainability, Ispra, Italy

11:10 - 11:30
LTCC, New Packaging Approach for Toxic Gas and Particle Detection
Anita Lloyd Spetz, M. Sobocinski, N. Halonen, D. Puglisi, J. Juuti, H. Jantunen, M. Andersson, Action Vice-Chair, Linkoping University, Linkoping, Sweden

11:30 - 11:50
Low-Cost Fabrication of Zero-Power Metal Oxide Nanowire Gas Sensors: Trends and Challenges
Jordi Samà[a], *Juan Daniel Prades*[a], *Olga Casals*[a], *Guillem Domènech-Gil*[a], *Sven Barth*[b], *Isabel Gracia*[c], *Carles Cané*[c], *Francisco Hernández-Ramírez*[a,d], *Albert Romano-Rodríguez*[a], Action MC Substitute, [a]Universitat de Barcelona, Barcelona, Spain; [b]Technical University Vienna (TUW), Institut for Material Chemistry, Vienna, Austria; [c]Consejo Superior de Investigaciones Científicas (CSIC), Institut de Microelectrònica de Barcelona (IMB-CNM), Bellaterra, Spain; [d]Catalonia Institute for Energy Research (IREC), Barcelona, Spain

11:50 - 12:10
Integrated Sensor Systems for Indoor Applications: Ubiquitous Monitoring for Improved Health, Comfort and Safety
Andreas Schuetze, WG2 Leader and MC Member, Saarland University, Saarbrucken, Germany

12:10 - 12:30
Towards Disposable Sensing Platforms and Analytical Instruments for Air Quality Monitoring
Danick Briand, Action MC Member, EPFL, Neuchatel, Switzerland

OUTLINE

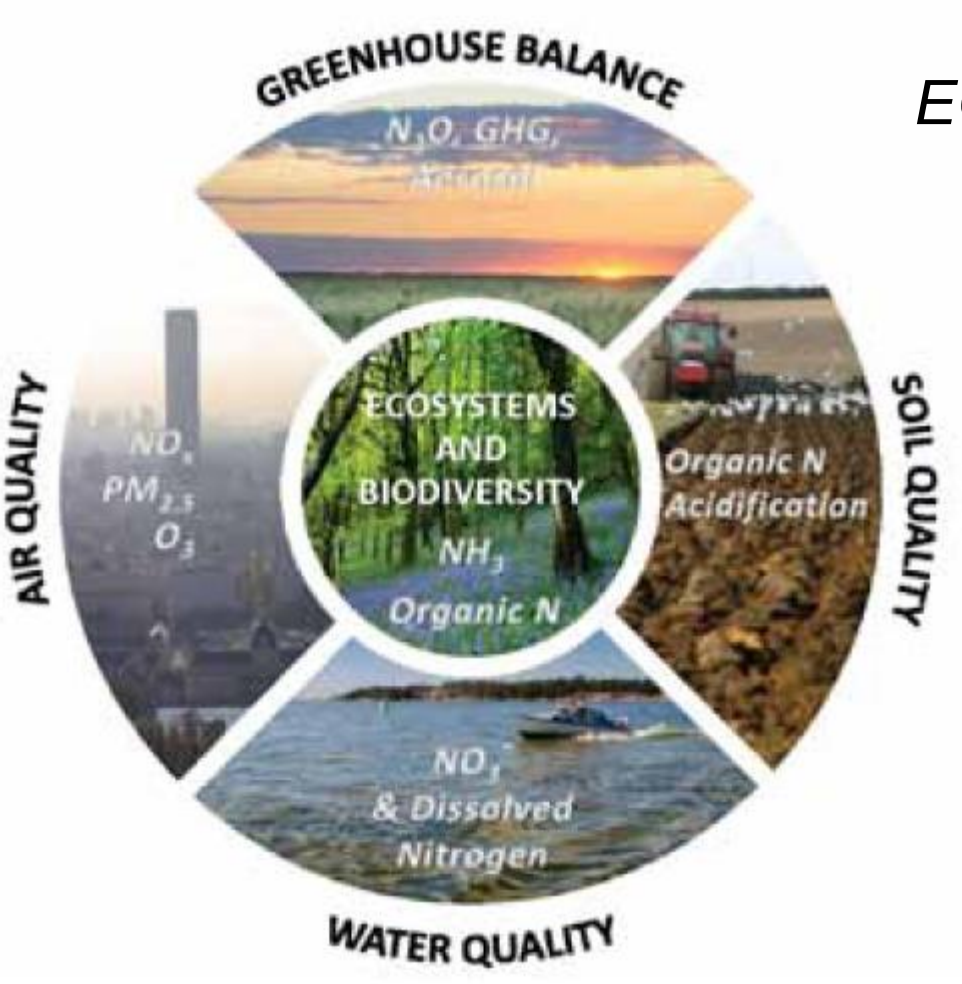
- **COST Action TD1105 *EuNetAir*: Some Features**
- **Examples of AQ Sensors Applications in the Real-World**
- **European Directive on *Ambient Air Quality* (2008/50/EC): the Role of the AQ Sensors and Related Activities**
- **Concluding Remarks**

Wednesday, 9 September 2015
Concert Hall, Freiburg, Germany

Scientific context: Environmental Sustainability

Nitrogen Pollution and the European Environment
Implications for Air Quality Policy

EC In-Depth Report, September 2013



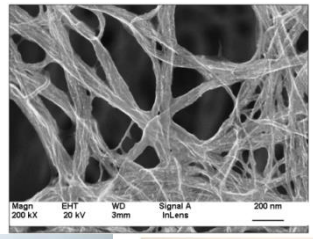
Source: Sutton and Billen, 2010

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.

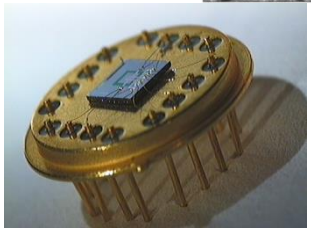
Sutton et al., 2009

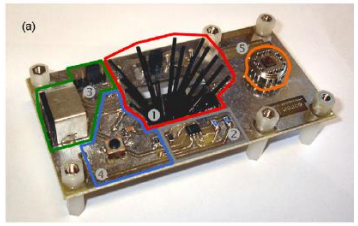
Nitrogen Pollution:
NO_x, N_2O, NH_3, NH_4, NO_2^-, NO_3^-, etc.

Challenges addressed by Action TD1105

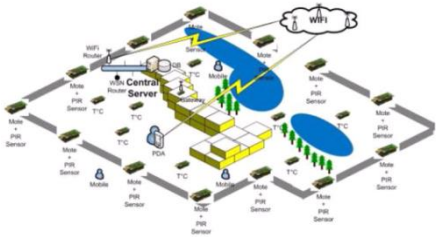


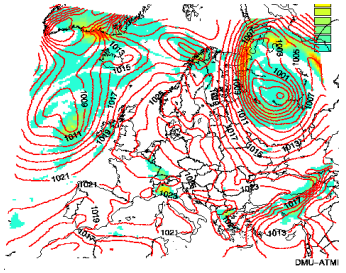
- **Nanomaterials for AQC sensors**
- **Low-cost Gas Sensors**



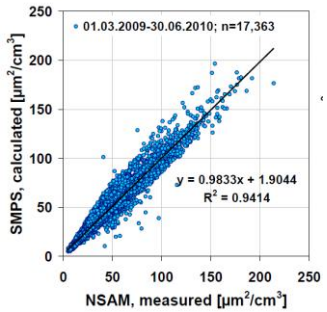


- **Low-power Sensor-Systems**
- **Wireless Technology (*Environmental Sensors Network*)**





- **Air Quality Modelling**
- **Environmental Measurements**



- **Standards and Protocols**

cost
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

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

COST Action TD1105 *EuNetAir*: Working Groups

www.cost.eunetair.it

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EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

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

WG1:
Sensor Materials & Nanotechnologie

WG2:
Sensors, Devices & Systems for AQC

WG3:
Env. Measurements & Air Pollution Modelling

WG4:
Protocols & Standardisation Methods

INTERDISCIPLINARY SPECIAL INTEREST GROUPS

Action Size (July 2012 - May 2016):
200 Experts from 120 Teams - 31 Countries

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*

Country	MC Members (58): *Male (69%) - Female (31%)*
Austria	Dr. Anton KOCK
Belgium	Dr Jan THEUNIS; Dr Anne-Claude ROMAIN
Bulgaria	Dr Dimiter SYRAKOV; Dr Ivan NEDKOV
Croatia	Dr. Irena CIGLENECKI-JUSIC; Prof. Vedran BILAS
Czech Republic	Dr. Vera KURKOVA; Dr. Zdenek ZELINGER
Denmark	Prof. Ole HERTEL
Estonia	Prof. Raivo Jaaniso
Finland	Prof. Kaarle HAMERI; Prof. Jyrki LAPPALAINEN
France	Prof. Marcel BOUVET; Prof. Jerome BRUNET
Germany	Prof. Andreas SCHUETZE; Dr Corinna HAHN
Greece	Prof. George PAPADOPOULOS; Prof. Kostas KARATZAS
Hungary	Ms Krisztina LABANCZ; Dr Zita FERENCZI
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
Luxembourg	Dr. Arno GUTLEB
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 PITICESCU
Serbia	Dr. Anka CVETKOVIC; Dr. Milena JOVASEVIC-STOJANOVIC
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

Kick-off Meeting
Brussels
16 May 2012

MANAGEMENT COMMITTEE

MC Chair:	Michele Penza, ENEA, IT
MC Vice Chair:	Anita Lloyd Spetz, Linkoping University, SE
Grant Holder:	Eurice GmbH, Saarbrucken, DE

Country	MC Substitutes (33)
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 KUHLBUSCH Dr. Juliane ROSSBACH
Greece	Prof. George KIRIKIADIS Dr. Christos KOULAMAS
Hungary	Prof. Zoltan HORVATH
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 Dr. Ana Margarida COSTA
Romania	Dr. Cristina RUSTI; Dr. Marcel Adrian IONICA
Slovenia	Prof. 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

COST Action TD1105 *EuNetAir*

31 COST Countries (Parties) have already signed Memorandum of Understanding (MoU)

PARTIES: 31

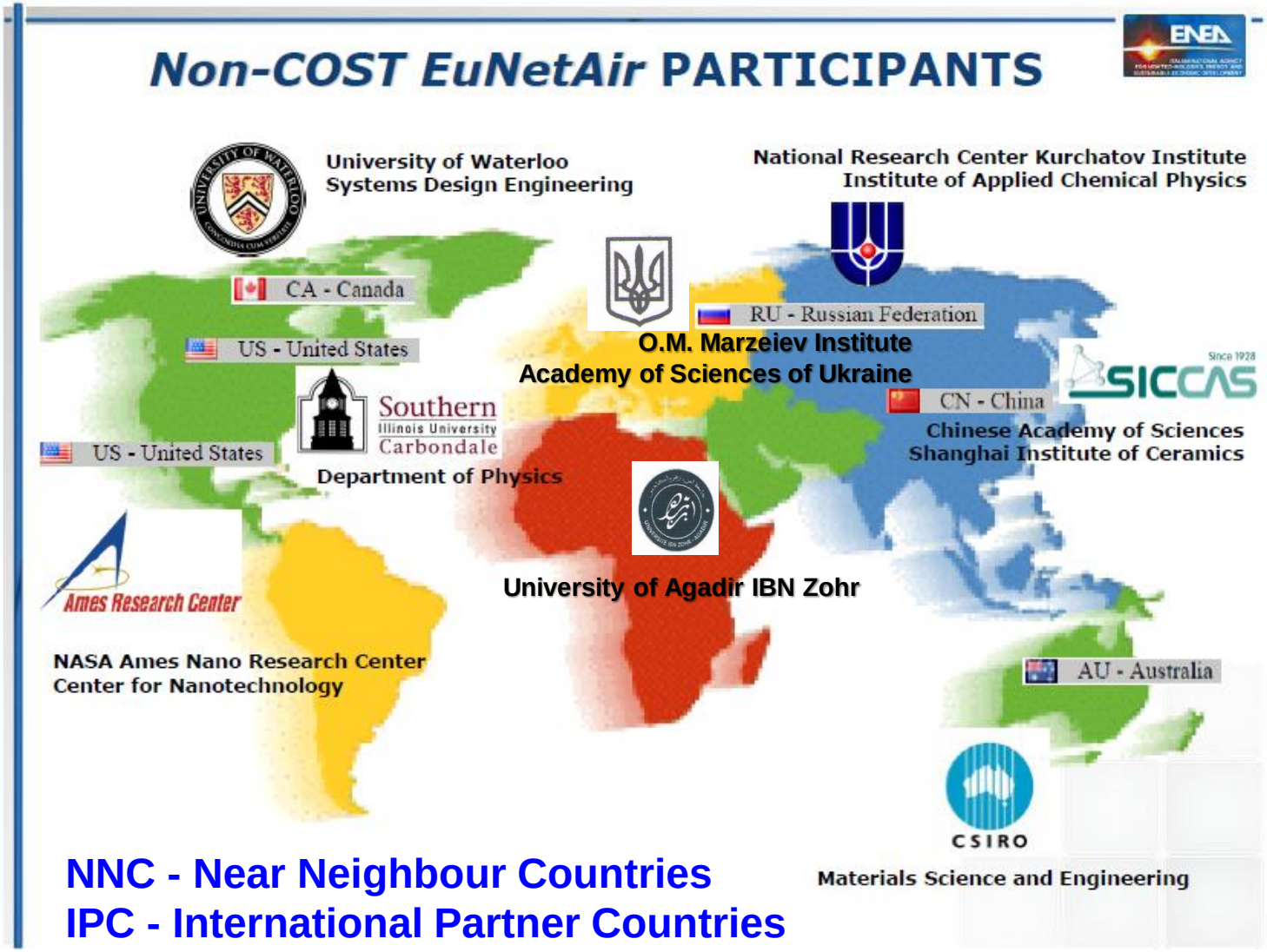
already accepted MoU

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

COST Action TD1105 *EuNetAir*: 7 Non-COST Countries and 8 Non-COST Institutions

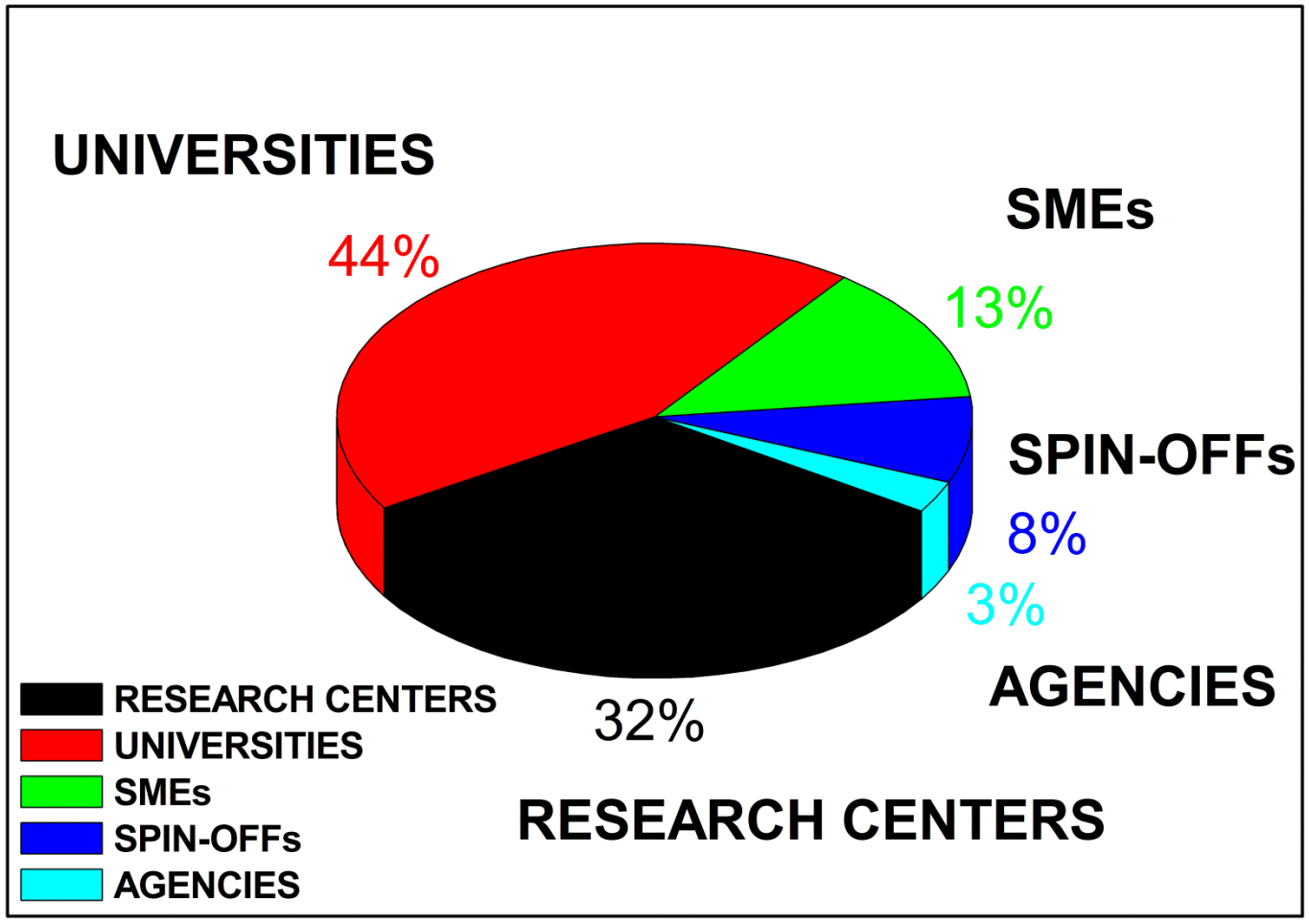
Non-COST Countries:
Australia, Canada, China, Morocco, Russia, Ukraine, USA

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).



Action Participation Statistics

EuNetAir COST PARTNERSHIP June 2015



COST Parties: 31
COST Organizations: 123
UNIVERSITIES: 55
RESEARCH CENTERS: 39
SMEs: 16
SPIN-OFFs: 9
AGENCIES: 4

EXAMPLES OF APPLICATIONS FOR AQ SENSORS AND AQ SENSOR-SYSTEMS

- **Wireless Sensor Network** around Heathrow airport for AQ Monitoring

  by University of Cambridge and Alphasense (UK)
- **Mobile Sensors on Public Transportation** (e.g., bus, tram) for *near real-time pollution detection* in the city

  by EMPA, EPFL, ETHZ, Switzerland
- **Stationary Sensors Node and Portable Sensors** for AQ Monitoring

  by ENEA (Italy) and JRC-IES (EC)
- **Joint-Exercise *Sensors-versus-Analyzers*** in Aveiro (Portugal)

  by IDAD (Portugal) and 15 EuNetAir partners

WIRELESS SENSORS NETWORK AROUND HEATHROW

London: Heathrow Airport

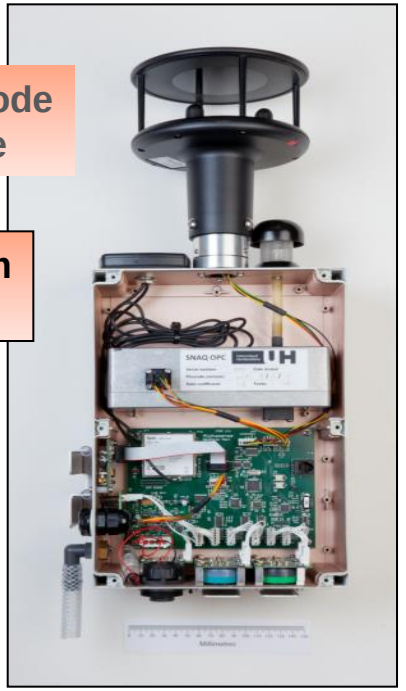
SNAQ-Heathrow project: Wireless Sensors Network

Courtesy by Rod Jones and Alphasense Ltd

- **~ 50 sensor nodes located in and around the airport**
- **Web: http://www.snaq.org/**

SNAQ sensor node by Cambridge

~49 x 22 x 16 cm
~2.8 kg



UNIVERSITY OF CAMBRIDGE

University of Hertfordshire UH

Alphasense THE SENSOR TECHNOLOGY COMPANY

MANCHESTER 1824

Heathrow

BRITISH AIRWAYS

NPL National Physical Laboratory

Imperial College London

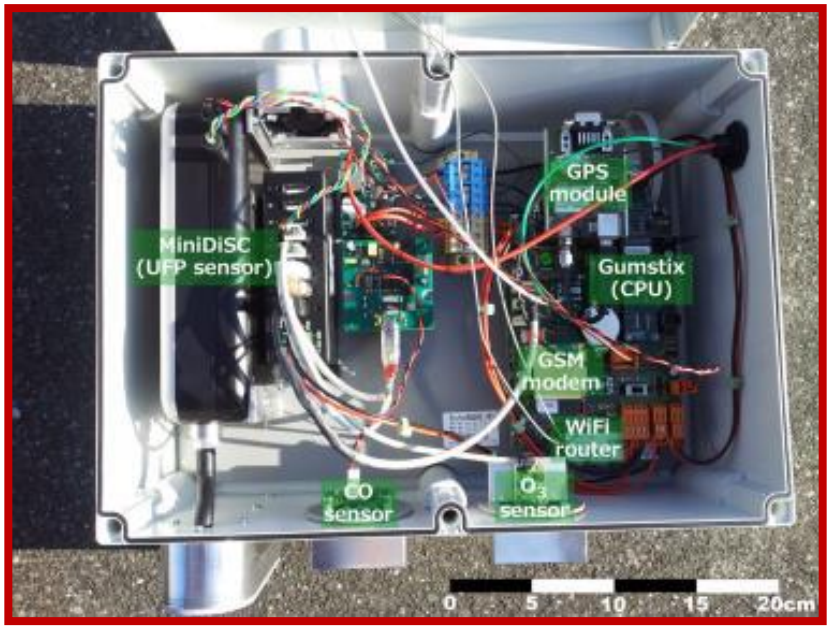
Cambridge Environmental Research Consultants Environmental Software and Services

AQ MOBILE SENSORS DEMONSTRATION IN EU CITIES

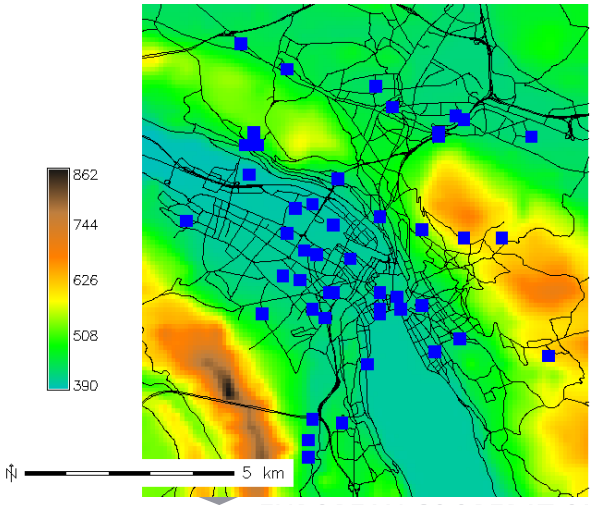
Lausanne and Zurich: City

OpenSense project: Wireless Fixed/Mobile Sensors Network

Courtesy by Karl Aberer and OpenSense Consortium



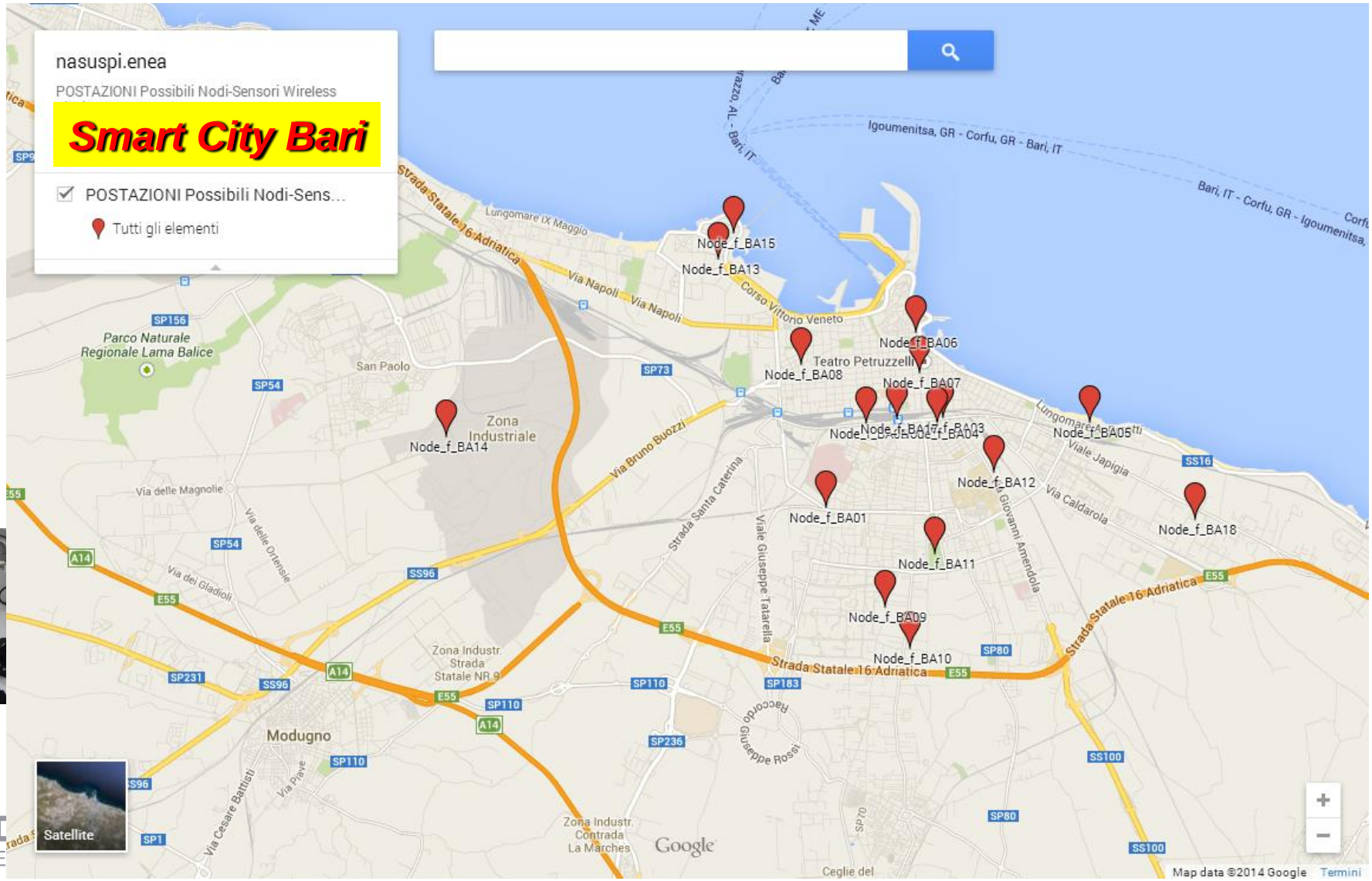
Sensor Node for Air Quality Monitoring: CO, NO_x, O_3, UFP, etc.



Mobile AQ sensors complement stationary sensors network

IT NATIONAL PROJECT *RES-NOVAE*: OUTDOOR APPLICATIONS

AQ ENEA Sensors Fixed Nodes Network distributed in Bari (Italy)
Urban Control Center (UCC) collects data from City.



AirBOX Sensor-Node

AIR-SENSOR BOX: *Proof-of-Concept by ENEA*

MicroSensors for Urban Air Quality Monitoring

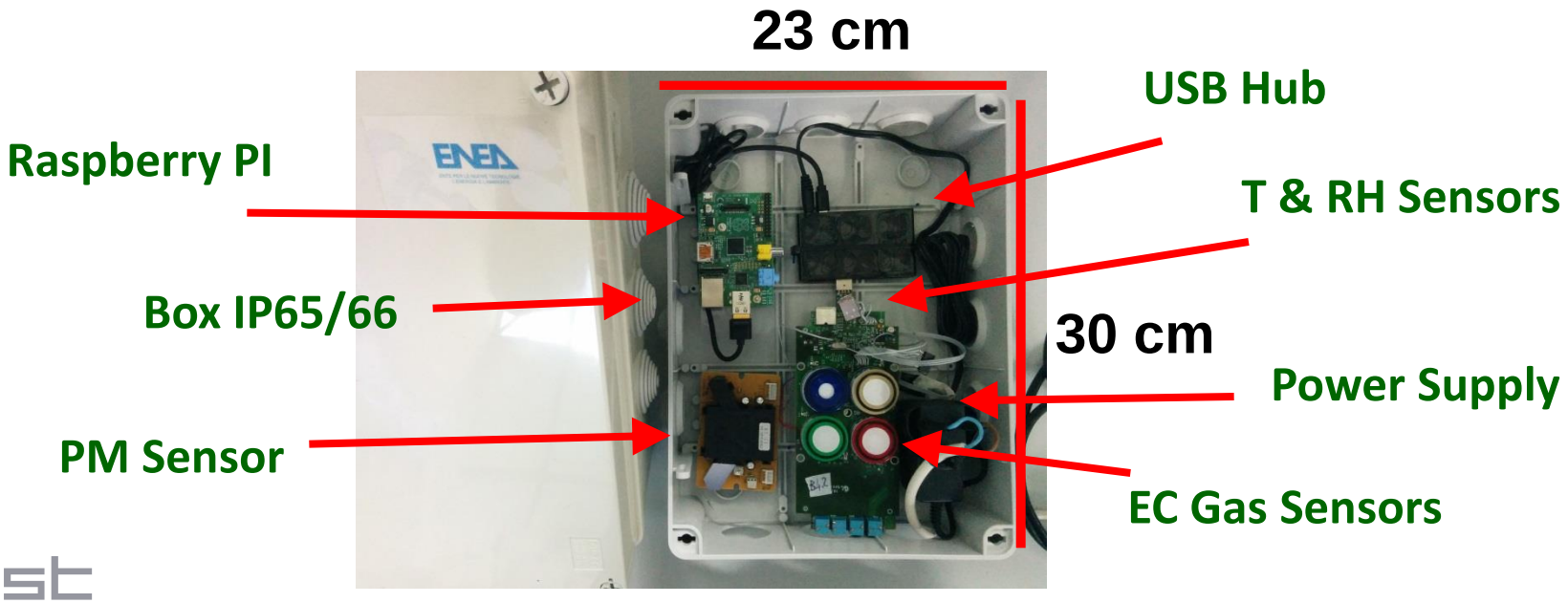
Wireless Sensor-Node Network for Air Quality Monitoring

- ***Hardware***:

  A. AQ Multiparametric Sensor Node: NO_2, O_3, CO, SO_2, PM_{10}, T, RH

  B. Electronics: Raspberry PI, Modem GSM, SIM Card, Wi-Fi

  C. Database: saving data in real-time on a server (***IBM Italia collaboration***)



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SENSOR TECHNOLOGIES: *Proofs-of-Concept*

NASUS GAS SENSOR BOX

M. Penza et al., COST Brescia Meeting at EUROSENSORS 2014, 7 - 10 Sept. 2014

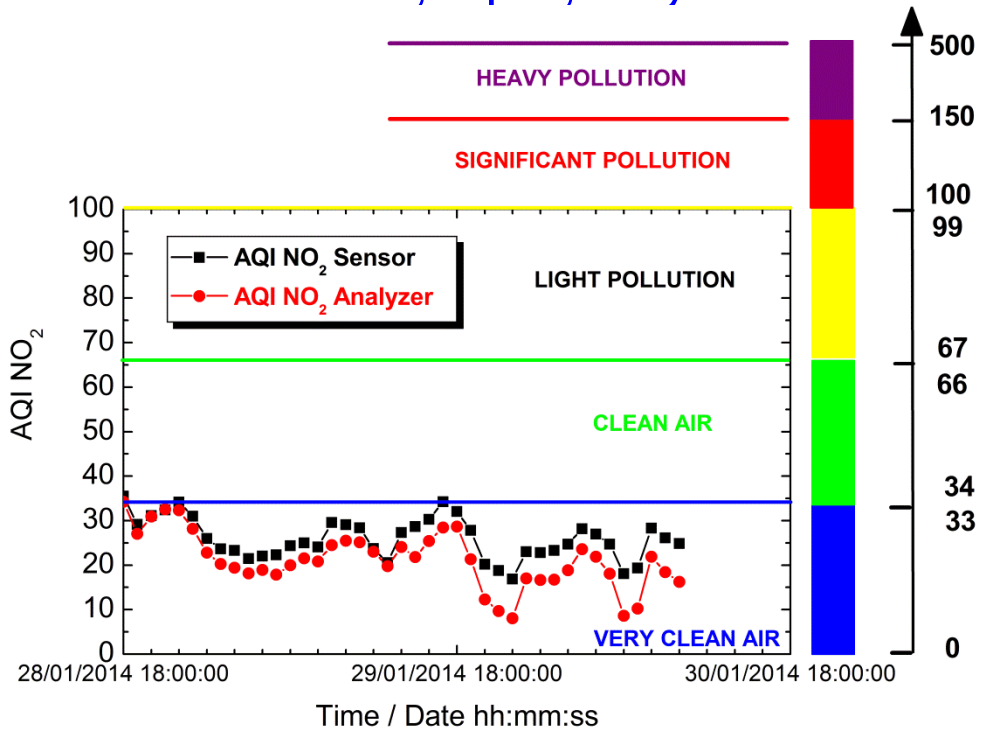
M. Penza et al., Special Session Smart Cities Sensors at IEEE SENSORS 2014, 2 - 5 Nov. 2014

Courtesy from ENEA

COCX_A3_Alphasense
NO2A1_A3_Alphasense
SO2AF_A3_Alphasense
H2SA1_A3_Alphasense

4 sensors (Electrochemical) to detect air-pollutants (e.g., CO, NO_2, SO_2) H_2S, T and RH

Real Measurements in collaboration with JRC-IES, Ispra, Italy



Air Quality Index (AQI) by NO_2 Sensor and NO_x Chemiluminescence Analyzer

Aveiro Joint-Exercise Intercomparison & WG Meeting

13 - 27 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 Monitoring campaign at Aveiro (Portugal) city centre 2014

Continuous measurements: CO, benzene, NOx, SO_2, PM_{10}, VOC

Temperature, humidity, wind velocity, wind direction, solar radiation, precipitation

COST partners (15 teams joined from 12 COST Countries) installed their microsensors side-by-side to compare performance with referenced equipment in the Air-Quality Mobile Laboratory

1ST EuNetAir Air Quality Joint-Exercise Intercomparison

- **Micro-sensors typologies and monitored pollutants:**
  - Electrochemical sensors:
    - NO, NO_2, CO, O_3, SO_2
  - Optical sensors:
    - PM1, PM2.5, PM10
  - Metal Oxide Semiconductor based sensors (MOS):
    - NO_2, COV, CO, O_3, SO_2
  - Non dispersive infrared technology sensors (NDIR):
    - CO_2
  - Photoionization detection sensors (PID):
    - COV_t

Carlos Borrego, IDAD, Aveiro, Portugal

CURRENT STATUS in AIR QUALITY SENSORS

European Commission

AQD: Data Quality Objectives (DQO)

	SO_2, NO_2/NO /NOx, CO	Benzene	O_3
Uncertainty for **fixed measurements**	15 %	25 %	15 %
Uncertainty for **indicative measurements**	**25 %**	**30 %**	**30 %**
	diffusive samplers, ***micro-sensors***		

Michel Gerboles, JRC-Ispra, IES

FUTURE TRENDS in AIR QUALITY SENSORS

European Policy for the use of sensors

- **Micro-sensors**:
- - **for now**: not mentioned, not foreseen in European legislation for regulatory purposes
- - **European Members States** shall demonstrate that the Data Quality Objective for Indicative Methods is met (***national projects***).

- **For now**, the European Commission mainly observes the results of some Research projects related to micro-sensors: *MACPoll*, *AIRMONTECH*, *FP7- ENV.2012.6.5-1* (air quality monitoring in a "Smart City" context with community involvement, *S3-EURUSSIA*, KEY-VOCs, CITI-SENSE, ***COST Action TD1105 EuNetAir***, etc. …)

Open Questions of the Air Quality Sensors

- Lower Accuracy compared to Reference Methods
- Cross-sensitivity and low Selectivity
- Low Stability and Drift to be corrected periodically
- Calibration needs periodically (e.g., at least 1 calibration/month)
- Regular Maintenance of the in-field AQ sensor nodes
- Data Quality Objective (European Directive 2008/50/EC) to be addressed for ***Indicative Measurements*** by demonstration of the equivalence to use microsensors for AQ monitoring

Advantages and Benefits of the Air Quality Sensors

- Low-cost for deployment in Cities at high spatial-temporal resolution
- Suitability for personal exposure studies
- Suitability for emission source information
- Outdoor monitoring of gases (NO2/NO, O3, CO, SO2, H2S, tVOCs, CO2, NH3, etc.)
- Outdoor monitoring of particulate matter (PM10, PM2.5, PM1.0, UFP)
- Indoor monitoring of gases (CO, VOCs, benzene, formaldehyde, naphthalene, toluene, etc.) and PM (PM10, PM2.5, PM1.0)
- Combination of sensors with modelling for micro-scale analysis (1-2 mt resolution)

Focus Group Meeting *EuNetAir*

Innovation on Environmental Sensor Technologies

hosted by Siemens, Munich (Germany), 29 April 2015

SIEMENS

Local Organizer:

Dr. Olivier von Sicard
Siemens AG
Munich (Germany)

Participation:

- **15 Participants**
- **10 COST Countries**

Output:

Planned Report on
Innovation on Environmental Sensor Technologies

FOURTH SCIENTIFIC MEETING: WG & 7th MC Meeting

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

Local Organizer:

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

FOCUS ON:

Outdoor Applications

- **4 June 2015: Roundtable on the *European Sensor-Systems Cluster (ESSC)***
- **5 June 2015: *World Environment Day 2015, 5 June* - Global Day by UNEP**
- **22 June 2015: *AMA Science Proceedings* (max 4 pages Templated) with DOI**
- **Spring 2016: *Special Issue JSSS* (Copernicus) - Peer Review Process**

Year 4: Scientific Planning of *EuNetAir* (1/2)

Meetings/Workshops/Training Schools planned **for upcoming year** (**Year 4: 1 July 2015 - 15 May 2016**): ***EXTENSION: 15 Nov. 2016 - tbc!***

- **WG1-WG4 Meeting** on *Air Quality Monitoring and Calibration: Horizons in Sensing Technologies, Methods and Modelling - Start of the 2nd EuNetAir Air Quality Joint-Exercise Intercomparison* organized by the VINCA Institute, Belgrade (**Serbia**), 13 - 14 Oct. 2015. *Local organizer*: Dr. Milena Jovasevic-Stojanovic, VINCA

- The **4th International Workshop of the COST Action TD1105** on *Innovations and Challenges for Air Quality Control Sensors* at FFG (National AT COST Office), Wien (**Austria**), 25 - 26 February 2016. *Local organizer*: Dr. Anton Kock, MCL

- The **Action 4th International Training School** on *Modelling, Methods and Technologies for Air Quality Control* at Emdrup Campus in Copenhagen, by Aarhus University (**Denmark**), 19 - 22 April 2016. *Local organizer*: Prof. Ole Hertel, Aarhus University. Trainees: 13-15 expected. Trainers: 3-4 expected.

Year 4: Scientific Planning of *EuNetAir* (2/2)

MC/WG Meetings planned **for the upcoming year**

(**Year 4: 1 July 2015 - 15 May 2016**): ***EXTENSION: 15 Nov. 2016 - tbc!***

- **5th SCIENTIFIC MEETING: WGs Meeting and 8th MC Meeting on New Sensing Technologies for Indoor Air Quality Monitoring: Trends & Challenges** at Bulgarian Academy of Sciences, Sofia (**Bulgaria**), 16 - 18 Dec. 2015. *Local organizers*: Prof. Ivan Nedkov and Prof. Dimiter Syrakov, BAS

- **6th SCIENTIFIC MEETING: WGs Meeting and 9th MC Meeting on New Sensing Technologies for Outdoor Air Quality Monitoring** at Czech Academy of Sciences, Prague (**Czech Republic**), 5 - 7 October 2016. *Local Organizers*: Prof. Zdenek Zelinger, Dr. Vera Kurkova, Dr. Roman Neruda, CAS

- **Special Session EuNetAir / Core-Group Meeting** to **EUROSENSORS 2015**, Freiburg (**Germany**), 6 - 10 September 2015

OUTREACH ACTIVITIES from Action TD1105

Action website:

www.cost.eunetair.it

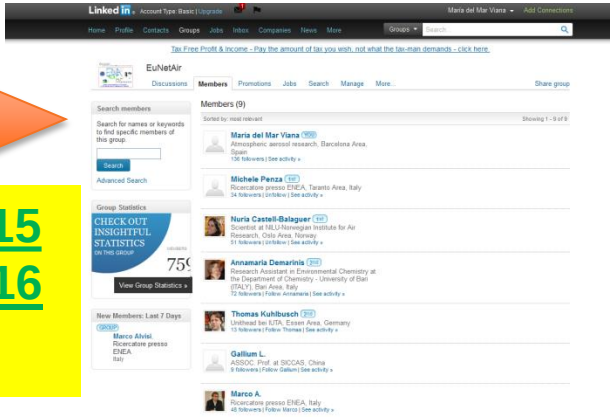
hosted by ENEA

Dr. Marco Alvisi, *Webmaster Coordinator*

Sebastiano Dipinto, Valerio Pfister, Gianfranco Zingarelli, *Webmaster Team*

Social Scientific ESRs Network (SSEN) by LinkedIn

Members: >50 - Moderators: M. Viana, M. Minguillon



4° CALL for Short Exchange Visits launched on September 2015

Short Term Scientific Mission: 9 TO BE FUNDED by 15 May 2016

Dr. Jan Theunis, STSM Coordinator EuNetAir

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: published on Dec. 2014 ✓
Issue 6: published on June 2015 ✓

Prof. Ralf Moos, *Editor-in-Chief*

Dr. Daniela Schonauer-Kamin, *Editorial Board Manager*

Symposium planned at EMRS Spring Meeting 2016

Lille (France), 2-6 May 2016

Advanced Functional Materials for Environmental Monitoring Sensors and Energy Systems Applications

Proceedings of Symposium EMRS Spring Meeting 2016 to be published under peer-review process in ***Beilstein Journal of Nanotechnologies*** *(IF 2014: 2.3)*

- *Peer-review process* Open Access journal without publication fee (http://www.beilstein-journals.org/bjnano).

- ***Symposium Organizers***:

✓Michele Penza, ENEA, Italy

✓Anita Lloyd Spetz, Linkoping University, Sweden

✓Albert Romano-Rodriguez, Barcelona University, Spain

✓Meyya Meyyappan, NASA Ames Research Center, USA

- **Deadline for abstract submission**: **15 January 2016**

http://www.emrs-strasbourg.com

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

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**

Contact Details

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

CSO Approval: 01 Dec. 2011
Kick-off Meeting: 16 May 2012
Start of Grant: 01 July 2012
End of Grant: 15 May 2016

www.cost.eunetair.it

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http://www.cost.eu/domains_actions/essem/Actions/TD1105

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Taking charge of air quality control in Europe's smart, green cities

A COST funded network of European spin-offs, SMEs, agencies, research centres and universities is working on developing cheaper and energy efficient sensors for air quality control in Europe's future smart cities.

full story

Some CONCLUSIONS and Future Activities

- **Low-cost Micro-sensors should not substitute but supplement routine monitoring devices, at the moment**.
- Use of **portable systems** based on ***low-cost solid-state gas sensors*** to supplement high-cost standard chemical analyzers should be possible for some pollutant gases.
- Further **long-term investigations** in order to extend the range of air-pollutants detectable by ***low-cost solid-state gas sensors*** at higher accuracy.
- Further **sensor-system miniaturization and integration** with commercial electronics (e.g., smartphones, tablets, etc.) for **community participatory environmental sensing**.
- **Air Quality Control Fixed/Mobile Sensors Network for Smart Cities Applications**
- **Air Quality Index (AQI) to inform general public**.

ACKNOWLEDGEMENTS

Freiburg, Germany, 6 - 9 September 2015

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European Network on New Sensing Technologies
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THANK YOU VERY MUCH FOR YOUR KIND ATTENTION !

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EUROSENSORS XXIX 2015 Germany Freiburg

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