EuroNanoForum 2015

The European Sensor-Systems Cluster (ESSC): High Impact EC Initiative on Sensor Technologies for Sustainable Applications

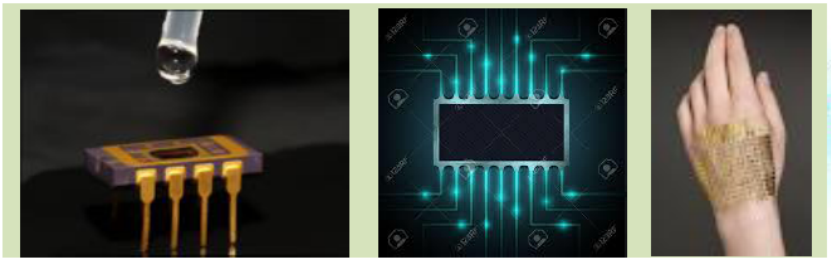
Michele Penza
Chairman of ESSC & Chair of COST Action TD1105
ENEA, Brindisi, Italy

Latvian Presidency of the Council of the European Union
EU2015.LV

HORIZON 2020
EUROPEAN UNION FUNDING
FOR RESEARCH & INNOVATION

Outline

- **The European Sensor Systems Cluster (ESSC):**
  - ✓ *Objectives, Vision, Position Paper*
- **COST Action TD1105:**
  - ✓ *European Network on New Sensing Technologies for Air-Pollution Control and Environmental Sustainability*
- **Future Plans and Challenges:** *Expected Impact*
- **Concluding Remarks**



The European Sensor Systems Cluster (ESSC)

European Sensor Systems Cluster - *ESSC*

Vision, Objectives, Strategies, Priorities and Challenges of EU Cluster

Cluster launched at Preparatory Workshop on 27 November 2014 in Brussels

sponsored and observed by EC DG Research and Innovation

SESSION 9: Smart Structures and Intelligent Materials

RADISSON BLU HOTEL LATVIJA, 10 June 2015 - Session Time: 16:15 - 17:45

Riga/Latvia, 10 June 2015

Vision, Objectives and Position Paper

Michele Penza - Chairman of the ESSC

michele.penza@enea.it

ENEA, Materials Technologies, Brindisi - Italy

KICK-OFF MEETING ESSC

The European Sensor-Systems Cluster (ESSC)

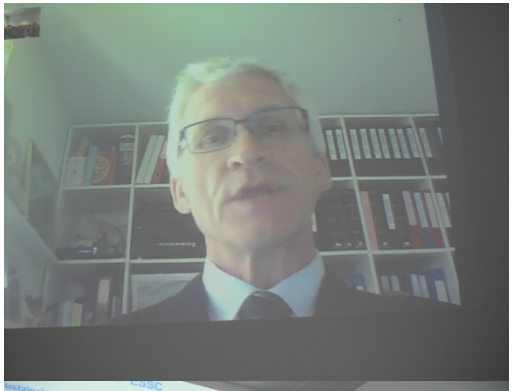
KICK-OFF MEETING ESSC

Tuesday 19 May 2015 - Session time: 12.00 - 13.30

Nuremberg Convention Center, NCC West - Room Tunis

SENSOR+TEST Trade Fair - AMA Conference 2015

Nuremberg (Germany), 19 - 21 May 2015

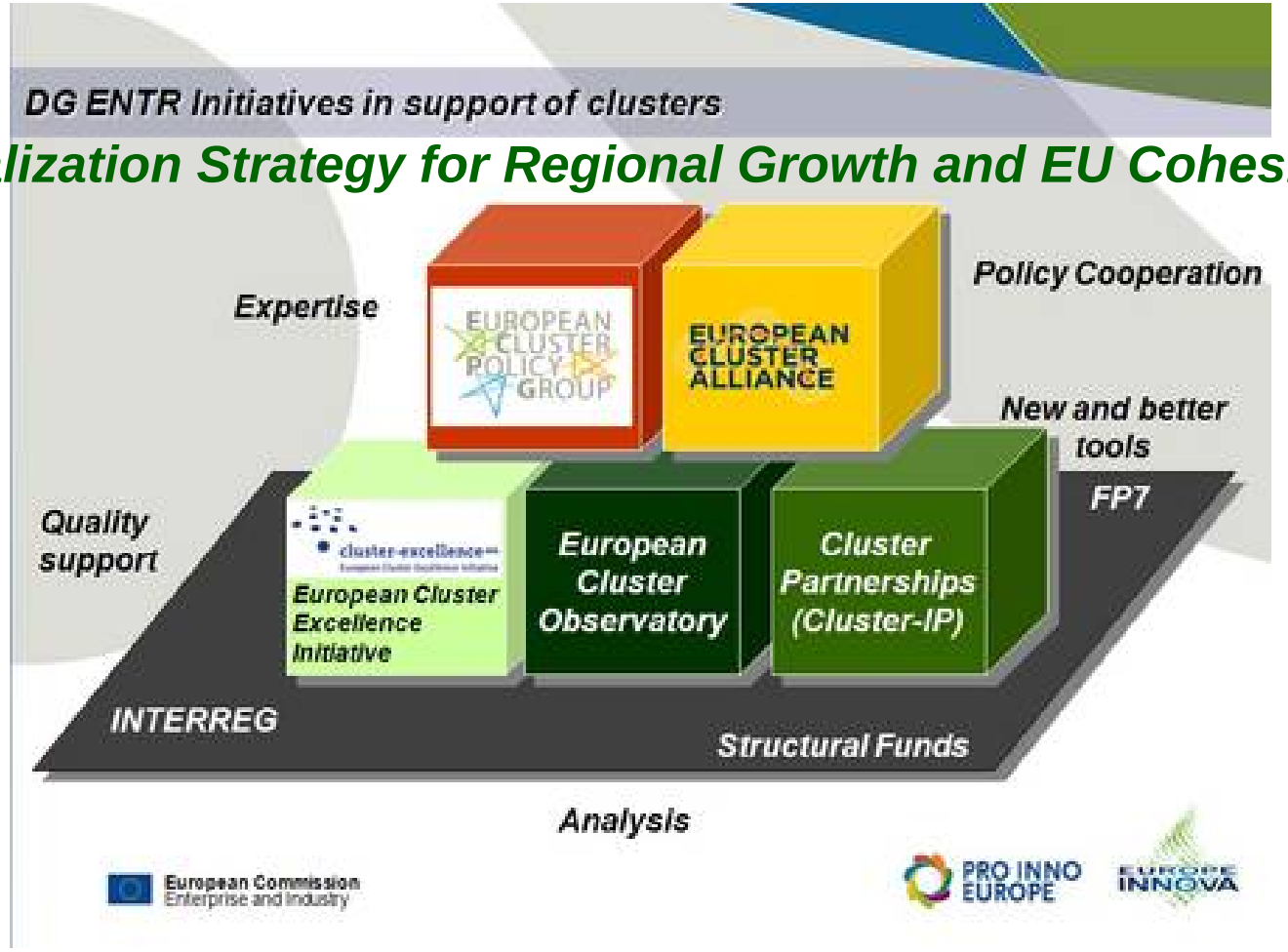
www.cluster-essc.eu

ESSC

The European Sensor Systems Cluster

40+ Participants

CONTEXT POLICY OF THE EU CLUSTERS



Smart Specialization Strategy for Regional Growth and EU Cohesion Policy

EC Report on *Innovation Clusters in Europe*:
A statistical analysis and overview of current policy support
by DG Enterprise and Industry

The European Sensor Systems Cluster (ESSC)

The EU CLUSTERs: *EC Expectations*

1. **Increase the Impact of Research funded under the NMBP Programme**
   - ✓ *Scientifically*
   - ✓ *Technically*
   - ✓ *Commercially*
2. **Facilitate Networking and help projects to benefit from Synergies**
3. **Obtain better Advice for future Policy and Call Preparations (Roadmaps, Inputs for Call Topics, long-term Research Goals)**
4. **Improve Impact, Exploitation and Knowledge Management**
5. **Raise Visibility of Public Funded Research activities and their Impact**

ESSC is one out of the 19 EU Clusters managed/observed by DG R&I - KET - Unit Advanced Materials & Nanotechnologies

VISION OF ESSC (1/2)

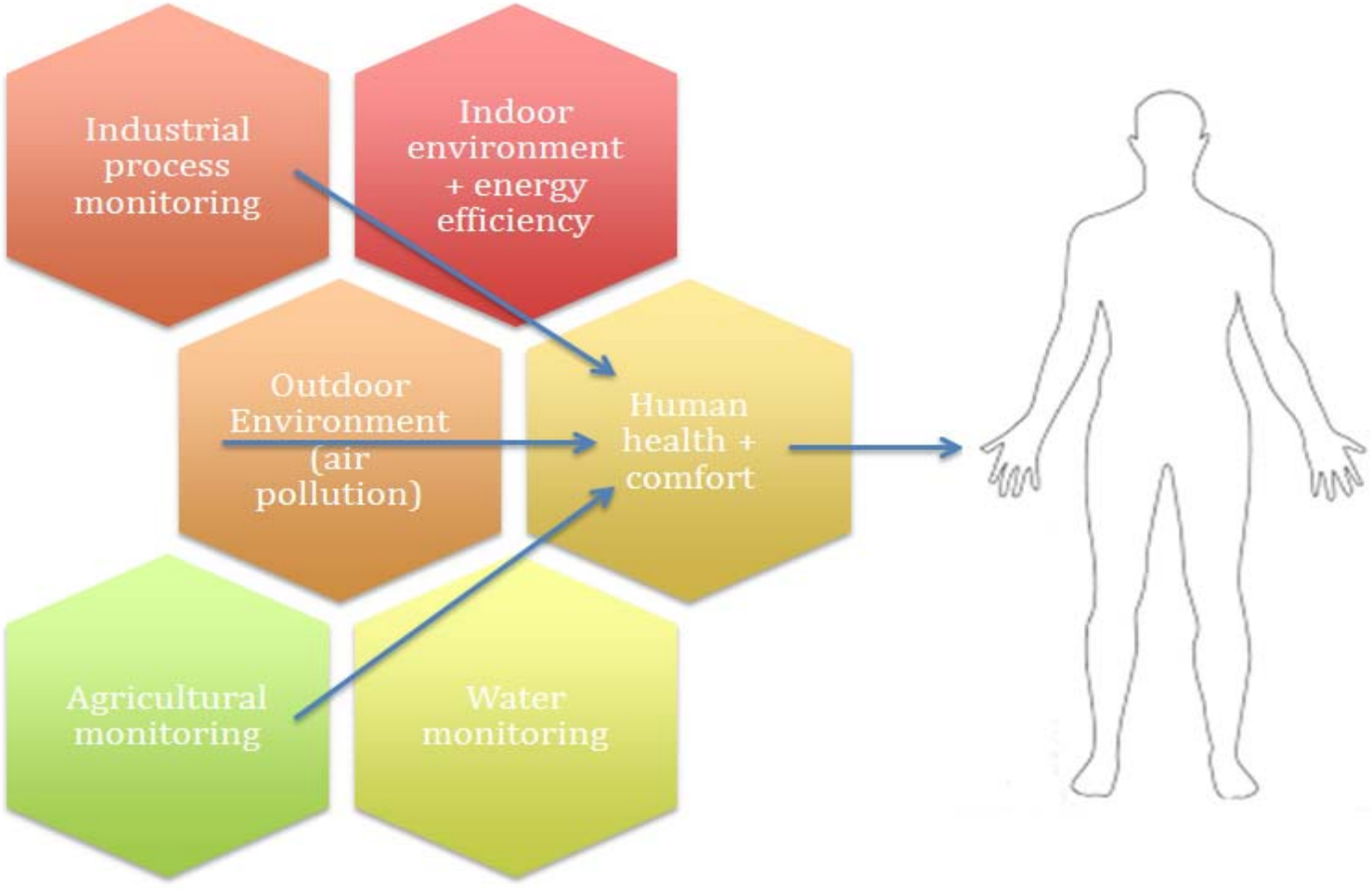
- The **European Sensor System Cluster (ESSC)** will identify the technical or non-technical challenges of (bio)chemical sensing and highlight opportunities resulting from **nanotechnology**, **microsystems integration**, **advanced data evaluation**, their **manufacturing**, **commercialization** and **systemic integration**.

- **ESSC** will mobilize a *pan-European network*, ready to advise, assist and execute the national or international measures leading to **strengthened position of European Research and Innovation** in the field **(bio)chemical sensing** (e.g. analysis, measures proposition, evaluation, reviews).

VISION OF ESSC (2/2)

ESSC Key Areas:

- Environmental Sustainability
- Energy Efficiency
- Health Monitoring
- Comfort
- Industrial Applications



OBJECTIVES OF ESSC

The ESSC is committed to execute objectives, which are defined as follows:

1. Maximize the **cooperation between projects** (avoid duplicating work and improve efficiency)
2. Identify **common interests in on-going research and development** (e.g. open calls, training)
3. Provide a **forum** for discussion, problem solving and analytical planning R&D activities in Europe
4. Establish the **EU-wide meeting platform** for researchers and mainly for involved industries and end-users
5. **Remove commercialization barriers** to ensure the EU leadership in Sensor Technologies
6. **Integrate inputs** and Recommendations from other existing clusters or groups
7. Promote the **connection with external bodies** (EC-RTD, Connect, standardization and regulatory bodies, journals and scientific boards, advisory boards)
8. Disseminate the **sensor-related issues/findings** to informed public (e.g. stimulate awareness for the invisible environmental problems and support *citizen science*)

TECHNOLOGICAL CHALLENGES OF ESSC (1/5)

Preliminary List:

(*to be completed and prioritized in the further* ***Roadmap*** *activities*)

(Final Roadmap on September 2015 !)

- **Indoor Sensing**
- **Environmental Sensing**
- **Biosensors**
- **Chemo/bio Sensors for Liquids**
- **Modelling and Simulation**
- **Analytical Tools and Metrology**
- **Standardization and Regulation**
- **Business Models and Spin-offs**

TECHNOLOGICAL CHALLENGES OF ESSC (2/5)

- **Improved 3S of sensor materials and More 3S**:
  - ❑ Sensitivity, Selectivity, Stability
  - ❑ Response/Recovery Time, Repeatability, Resolution
- **Miniaturization and integration**:
  - ✓ Low-powered Sensors
  - ✓ Chemical Filters
  - ✓ Catalysts
  - ✓ Pre-concentrators
  - ✓ Low-cost Modules
  - ✓ Sub-systems
- **Integration to systems**:
  - ➢ Energy Consumption/Harvesting
  - ➢ Data acquisition and Filtering
  - ➢ Data Fusion
  - ➢ User Interaction

TECHNOLOGICAL CHALLENGES OF ESSC (3/5)

The particular challenges are identified, where R&D efforts should be invested:

- **Indoor Sensing**
  - Cross-sensitivity with *specific gases (fatty acids)*
  - Accurate VOC *quantification*
  - *Long term exposure* quantification
  - *Stability and life* expectancy
  - Miniaturization, low consumption, controlling and data processing
  - Integration to air treatment systems and HVAC (incl. occupancy)
  - Human machine interface for comfort
- **Environmental Sensing**
  - Scalable sensing models for building Sensor Networks to track key air/water quality parameters
  - Sensors complementary to existing tools (larger devices)
  - Integration to *mobile devices*
  - Low cost, wireless sensors to form *networks (e.g. sensing cities*)
  - Targeted *information to habitants* and mitigation
  - *Nanoparticle detection* for dust and aerosols

TECHNOLOGICAL CHALLENGES OF ESSC (4/5)

The particular challenges are identified, where R&D efforts should be invested:

- **Biosensors**
  - Disposables vs. *continuous/automatic* monitoring
  - High throughput
  - *Regulatory framework* not fully adapted to personalization
  - Towards *point of care* diagnostics, incl. Telemonitoring
  - Data integrate-ability in *health system*
- **Chemo/bio Sensors for Liquids**
  - High potential, *but low progress*
  - *Multiparametric approach should be investigated*
- **Modeling and Simulation**
- *Multi-physics model*: analyte flow, material layer, transduction, data processing, integration
- **Industrial Process Monitoring**
  - Better control of processes by increasing the number chemical parameters to be determined continuously *(robust sensors needed)*

TECHNOLOGICAL CHALLENGES OF ESSC (5/5)

The particular challenges are identified, where R&D efforts should be invested:

- **Analytical Tools and Metrology**
  - Validation
  - Joint-exercises *sensors-versus-analyzers* in real scenario measurements
  - Measurement protocols for benchmarking
- **Standardization and Regulation**
  - Standards and data protocols for Data Benchmarking (open access)
  - Validation and standardization of measurement procedures
  - Advanced study of VOC impact on health/productivity
  - Harmonization/Regulation/Public information of measured sites/households
  - Regulation/Public info on industrial products - e.g., real time styrene monitoring
- **Business Models and Spin-offs**
  - Total cost of ownership vs. savings in comfort environment
  - Food quality monitoring and price adaptation (realtime S/D)
  - Health system rewarding for early testing and monitoring

GOVERNANCE: Steering Committee of ESSC (1/2)

- **Chairman of ESSC:** **Michele Penza, ENEA, Italy**
- **Coach of ESSC:** **Rudolf Frycek, Amires, Switzerland**
- **EC Observer:** **Hans Hartmann Pedersen** *(EC Officer),* **DG R&I, Belgium**

Environmental Sensors	• D. Diamond
Indoor Air Quality	• A. Schütze (O. Martimort)
Health Monitoring and Comfort Sensors	• P. Galvin (A. Prina Mello)
Monitoring of Industrial Processes	• T. Mayr
Sensor Integration and Commercialization	• O. Martimort
Dissemination and Outreach	• T. Simmons (Eurice)

GOVERNANCE OF ESSC (2/2)

- **Chairman of ESSC:** **Michele Penza, ENEA, Italy - michele.penza@enea.it**
- **Coach of ESSC:** **Rudolf Frycek, Amires, Switzerland - frycek@amires.eu**
- **EC Observer:** **Hans Hartmann Pedersen** *(EC Officer)* **hans-hartmann.pedersen@ec.europa.eu**

Application WG	Leader	Institution	Email
Environmental Sensors	D. Diamond	Dublin City Uni (Ireland)	dermot.diamond@dcu.ie
Indoor Air Quality	A. Schütze	Saarland Univ. (Germany)	schuetze@lmt.uni-saarland.de
Health Monitoring and Comfort Sensors	P. Galvin	Tyndall (Ireland)	paul.galvin@tyndall.ie
Monitoring of Industrial Processes	T. Mayr	TU Graz (Austria)	torsten.mayr@tugraz.at
Sensor System Integration and Commercialization	O. Martimort	Nanosense (France)	martimort@nano-sense.com
Dissemination and Outreach	T. Simmons	AMA Sensorik (Germany)	simmons@ama-sensorik.de

PARTNERS supporting ESSC

FP7/H2020 PROJECTS & Actions supporting ESSC

FUNDING and NETWORKING of ESSC

- **No specific funding yet**
- Use resources within *running EU projects*
- Use resources of your environment (e.g. associations, institutions)
- Continue **defining which specific funding** is urgently in need and use Cluster to build **critical mass and to communicate it**
- **Any Interlink with the other European Societies, Bodies, Associations, Platforms and ESSC ??? *For instance*: EMRS, IMCS, ISOCS, EuroSensors, ……**

ESSC CONTACT PERSONS:

- **Chairman of the ESSC: Dr. Michele Penza (ENEA, Brindisi, Italy) - michele.penza@enea.it**
- **Coach of the ESSC: Dr. Rudolf Frycek (Amires, Neuchatel, Switzerland) - frycek@amires.eu**
- **EC Observer of ESSC: Dr. Hans Hartmann Pedersen (DG R&I) - hans-hartmann.pedersen@ec.europa.eu**

REGISTRATION AS ESSC MEMBER at:

www.cluster-essc.eu

European Commission - DG Research & Innovation
Directorate Key Enabling Technologies
Unit Advanced Materials and Nanotechnologies

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

www.cost.eunetair.it

WG1:
Sensor Materials & Nanotechnologie

WG2:
Sensors, Devices & Systems for AQC

WG4:
Protocols & Standardisation Methods

WG3:
Env. Measurements & Air Pollution Modelling

INTERDISCIPLINARY SPECIAL INTEREST GROUPS

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*

COST Action TD1105 Size (2012-2016):
200 Experts from 120 Teams - 31 Countries

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

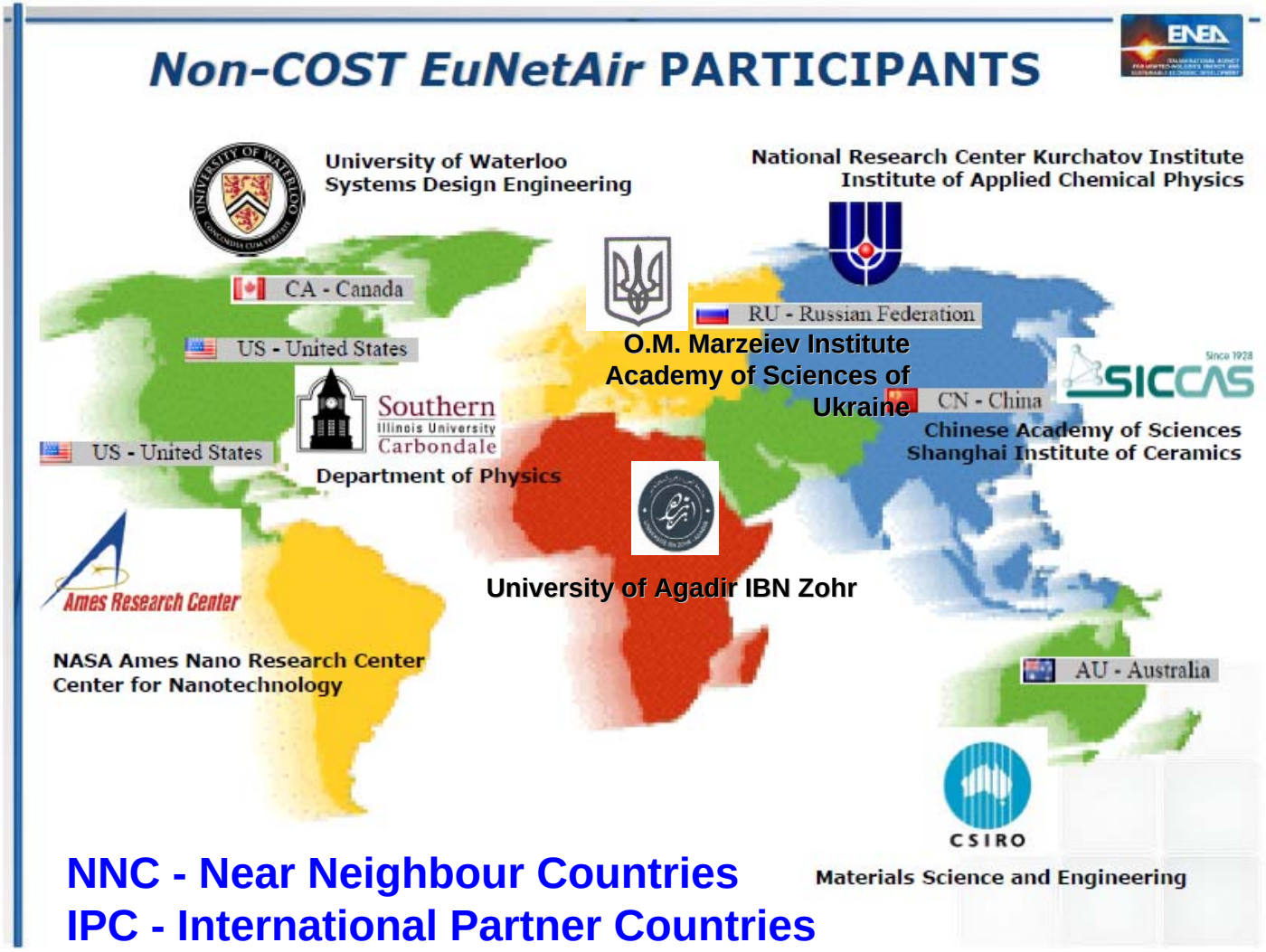
European Commission

The European Sensor Systems Cluster (ESSC)

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).



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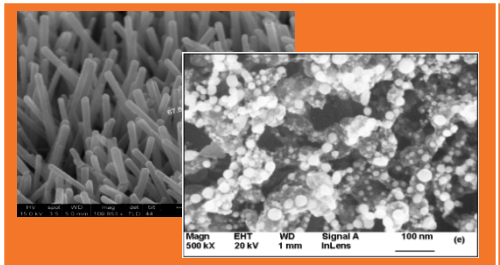
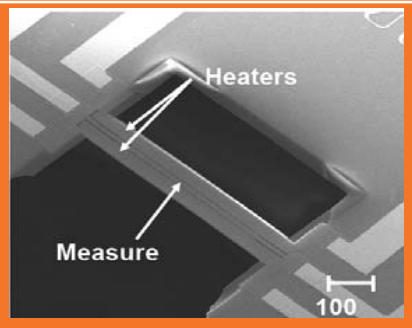
COST Action EuNetAir: CHALLENGES

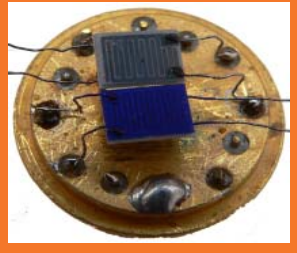
MATERIALS & GAS SENSORS



MOX by UNIBS IREC UB SICCAS
CNT by ENEA NASA URV CSIRO

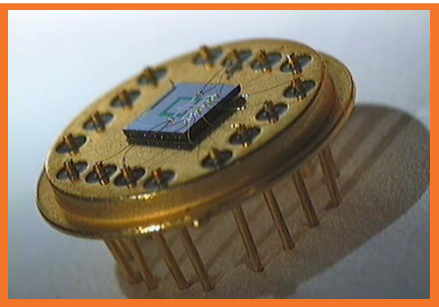


Cantilever Sensor by DTU, DK

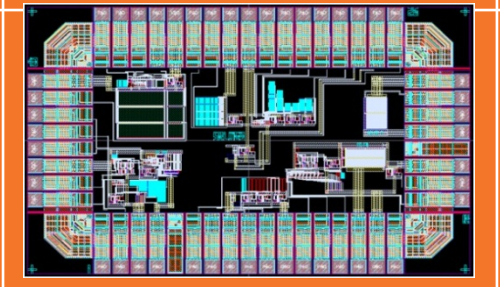


Phtalocyanine Gas Sensors
by CNRS UBP-LASMEA, FR

AQC SENSORS & SYSTEMS



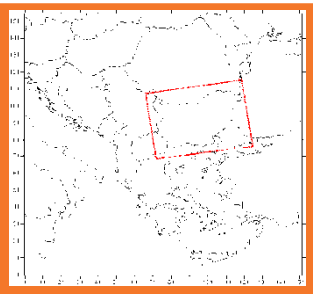
GasFET by EPFL, Switzerland



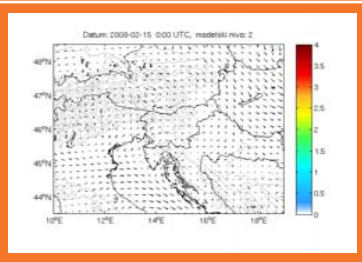
ASIC Circuit: CMOS SOI
by WARWICK & CCMOS Ltd, UK

WIRELESS SENSORS NETWORK
by ISI, Greece

AQ MODELLING



CMAQ Calculations
by NIMH, BG

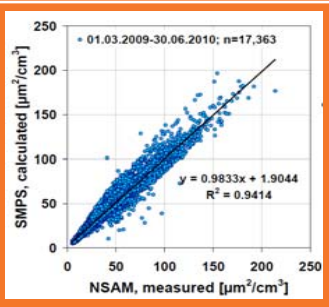


AQ Modelling dispersion in
meteorological mesoscale by
University of Ljubljana, SL

Chemical Weather Forecasting
and Information System
by Hungarian Meteo Service

STANDARDS & PROTOCOLS

Dynamic Olfactometry (EN
13725/2003) by Univ. of Bari and
Lenviros srl, IT

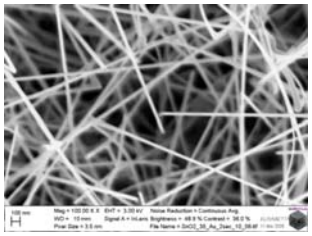


Particle Surface Area
Measurements by IUTA eV, DE

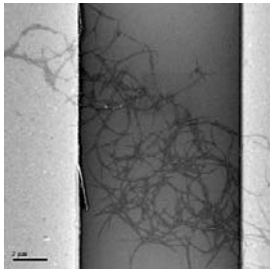
?

HARMONISATION:
Definition of protocols and
standards for gas sensing
measurements and gas sensors

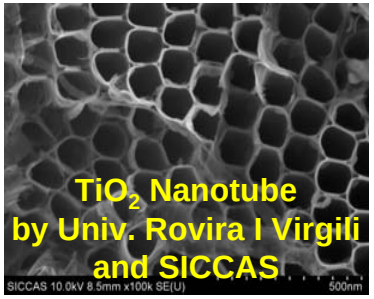
Selected Examples of Gas Sensors and Sensor Systems

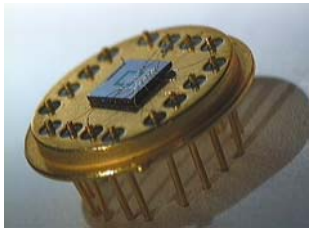


Metal oxide (SnO_2) Nanowires nets by Univ. of Brescia



Carbon Nanotubes by Ames NASA

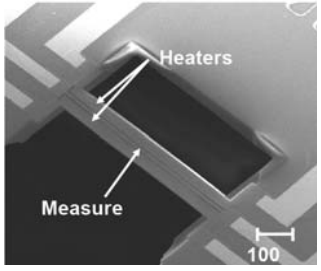




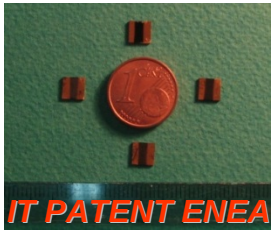
GasFET by EPFL, CH

UNITEC srl, ETL3000
multi-component outdoor air quality monitor

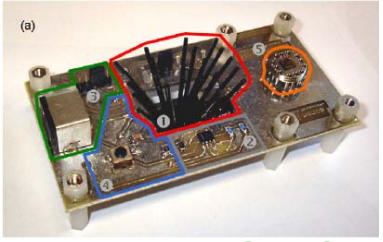
AEROQUAL, AQM 60
Air Quality Sensors Station



Cantilever Sensor by DTU, DK

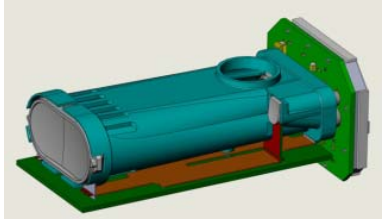


Carbon Nanotube Gas Sensors

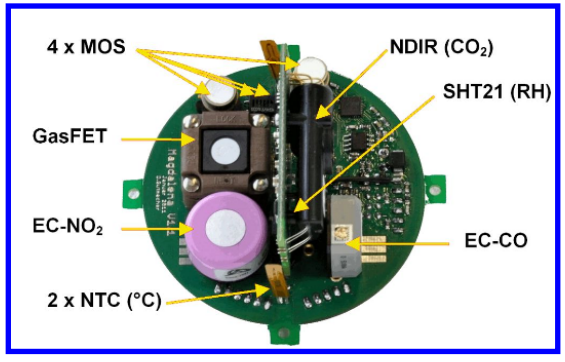


Autonomous Gas Sensor System by IREC and Univ. of Barcelona

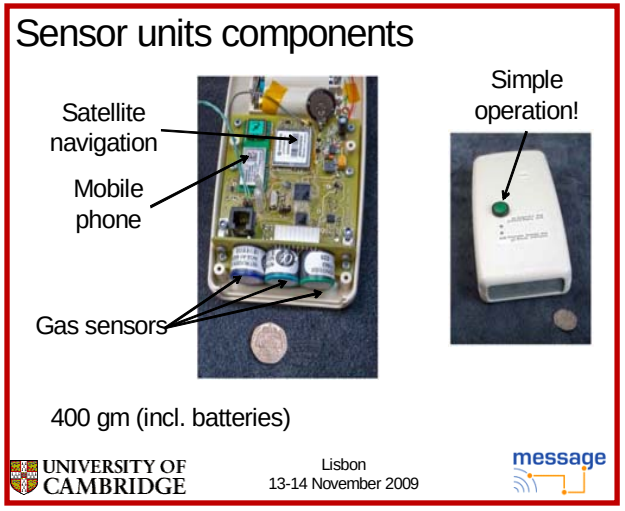
Octocopter - the first platform by *Max Planck Institute for Biogeochemistry, Jena, Germany* tested a measurement sensor package for air quality



SenseAir SA,
Low-Cost NDIR Sensor Platform for sub-ppm Gas Detection



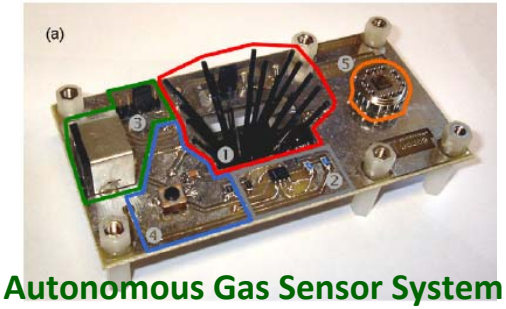
Research Platform for Fire Gas Detection by Siemens AG



European Commission

The European Sensor Systems Cluster

EuNetAir INNOVATION on AIR QUALITY MONITORING



Autonomous Gas Sensor System
by IREC and Univ. of Barcelona

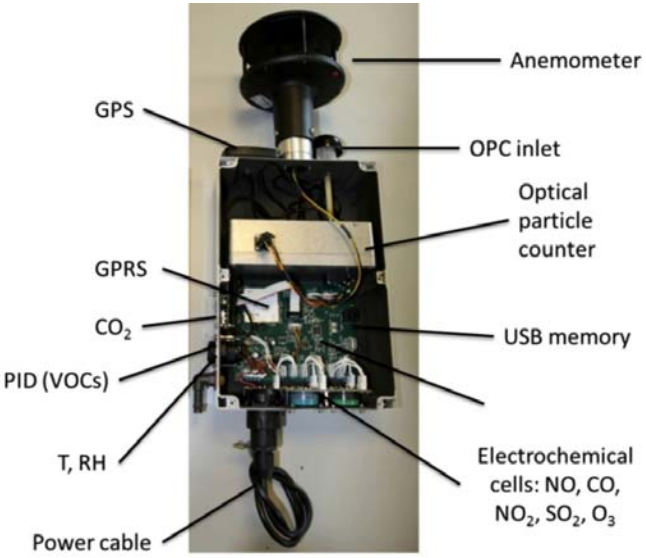
23 cm

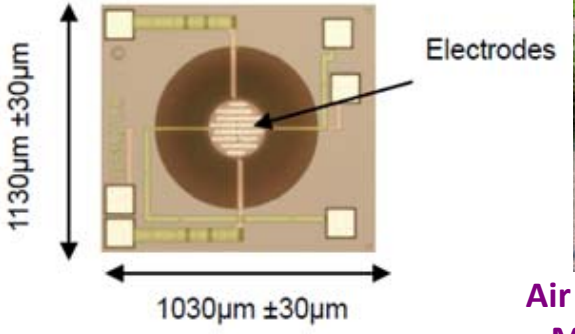
30 cm

AIRBOX Sensor System
by ENEA, Italy

Wireless sensor network for air-quality monitoring
around Heathrow airport
by University of Cambridge and Alphasense Ltd, UK

AQC Gas Sensor
by CCS, UK



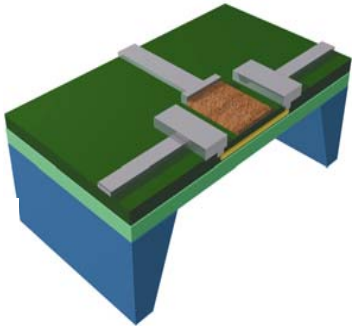


Miniaturized CMOS Sensor
by CCMOS Sensors Ltd and Warwick University

Air Quality Bike (Aeroflex) for
Mobile AQ Measurements
by VITO, Belgium

Smoke Detector
SIEMENS, Germany

E5000 IAQ
Probe/Controller,
NanoSense, France



SGX-Sensortech MOX Gas Sensors
for Automotive AQ Measurements
by SGX-Sensortech, Switzerland

A low-cost modular sensor platform
combining IR spectrometry and
MOX gas sensors for IAQ
monitoring (CO_2, VOC) and medical
applications
by 3S GmbH and Saarland
University, Germany

NDIR Gas Sensors (CO_2)
by SenseAir, Sweden

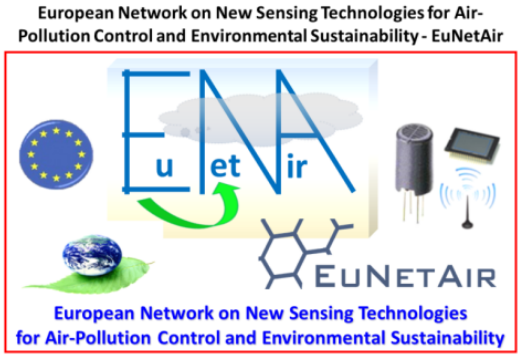
European Commission

The European Sensor Systems Cluste

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



EuroNanoForum 2015
COST Workshop

COST Highlights on Nanotechnology and Advanced Materials

12 June 2015, Friday 10:30am - 12:00
Meeting room Beta 1

www.cost.eu/events/COST-ENF2015

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ACKNOWLEDGEMENTS

Riga, Latvia, 10 - 12 June 2015

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