Enabling Participatory Urbanism through Novel Use of Environmental Sensor Technologies

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CITI-SENSE

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Development of sensor-based Citizens' Observatory Community for improving quality of life in cities

Project website: www.citi-sense.eu

Starting date: 01/10/2012
Duration: 48 months
Budget: 12M€
Participants: 27 organizations (11 SMEs, 4 Universities, 12 Research institutes)
Call: FP7-ENV-2012.6.5-1 Developing community-based environmental monitoring and information systems using innovative and novel earth observation applications

CITI-SENSE project
Grant agreement nº: 308524

SEVENTH FRAMEWORK PROGRAMME

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CITI-SENSE Objective

To develop <u>Citizen's Observatories</u> to empower citizens to
- Contribute to and participate in environmental governance
- Support and influence community and policy priorities and associated decision making
- Contribute to Global Earth Observation System of Systems (GEOSS)

Citizen's observatories – *communities of users that will share technological solutions, information products and services, and community participatory methods, using approprite communication solutions, thus complementing established environmental data and information systems and improving local environmental decision making.*

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CITI-SENSE implementation
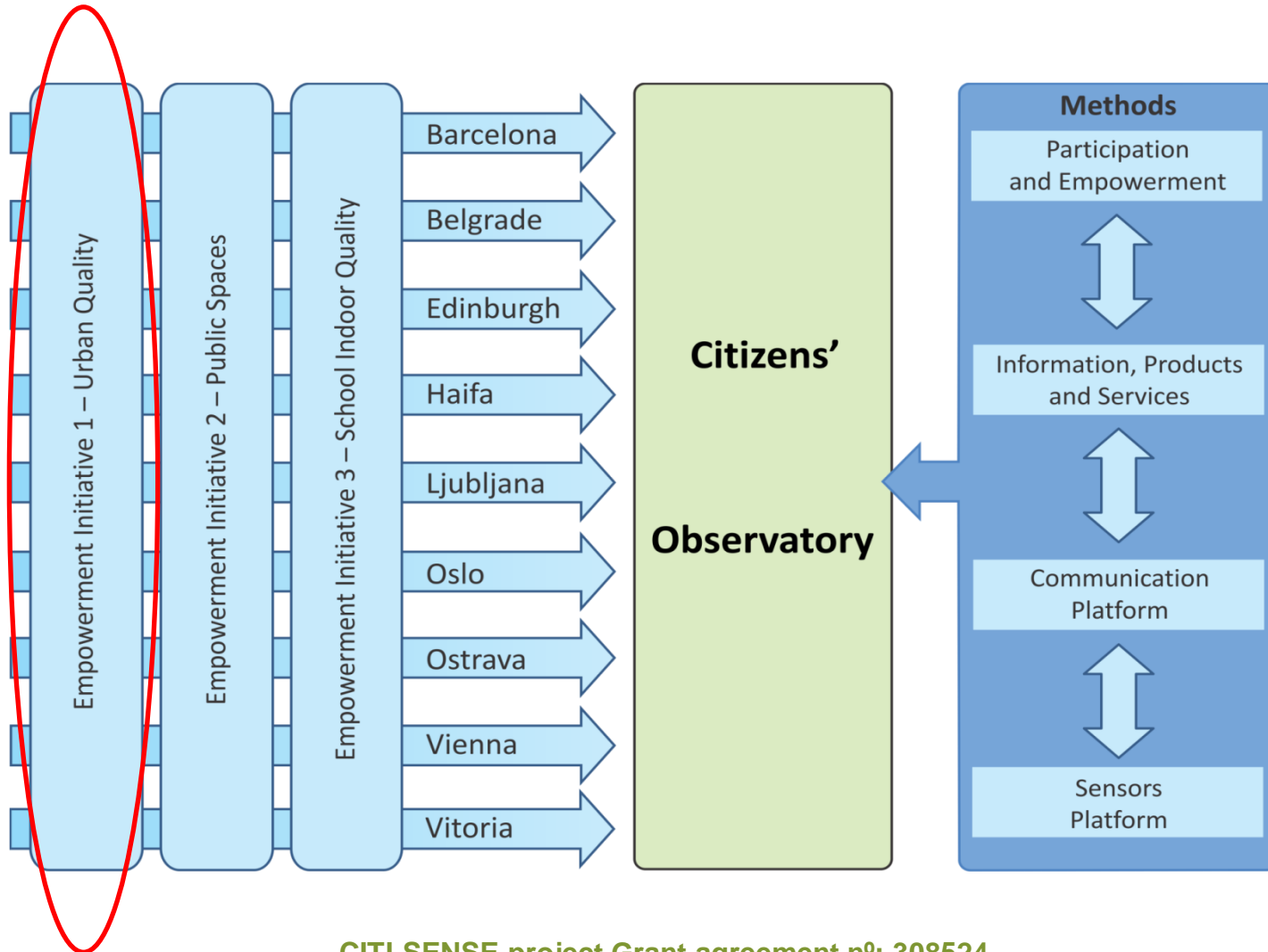
We know that…

Our _well-being_ is closely connected to the quality of the air.

Sensitivity to airborne pollutants is very _different from one person to another_.

The exposure to air pollutant depends also of the _activity level_.

Levels of air quality are _not homogeneous_ over the city.

Current AQ information is _not personalized_ and _not always_ _easily accessible_.

Most of the cities in Europe have _exceedances of AQ thresholds_ for human health protection.

But…

Why are citizens not concerned about air quality?

? They don't know how polluted is the air that they breathe

? They don't know the health consequences of air pollution

? Effects of air pollution are not easily sensed in the body in most situations

What will happen if citizens can measure, sense and be aware of consequences of living in a polluted city?

Will they become more proactive and avoid polluted areas?

Will they ask for changes to the local authorities?

What has been demonstrated to have a positive effect on citizen participation?

WP5: Participatory governance and empowerment

Some thoughts

- *People are the body of observatories*; sensors are the motor to drive them. Technology and smart systems are useless if people do not use them in the appropriate way.

- The best tool is the most *simple to use and understand*, not the most complete or complex.

- Online participation cannot replace the *present practices* for citizen involvement, but should complement this.

- Need to *identify the actors involved*, as well as their motivations and expectations. *Tolerance to diversity* (of wants, needs, opinions).

- *Power of the crowd*. Address not only individuals but associations. Individuals respond to subtle social and group behavioral cues.

- A sound understanding of the project location, cultural and geographic *context*.

- Need to monitor *positive and negative indicators*.

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El Urban Quality

Barcelona (Spain)

Belgrade (Serbia)

Edinburgh (UK)

Haifa (Israel)

Ljubljana (Slovenia)

Oslo (Norway)

Ostrava (Czech Republic)

Vienna (Austria)

Vitoria (Spain)

'Nice to have' vs 'Can be done'

- Need to agree in commonalities and be open for diversity
  - Static sensors: PM, O_3, NO_2, CO, temperature and relative humidity.
  - Personal sensors: O_3, NO_2, CO, temperature and relative humidity.
  - The number of personal and static sensors will not be homogenous over the cities
  - Some cities will include other parameters: noise, health.
  - Some cities will conduct extended studies: biomarkers.

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'Nice to have' vs 'Can be done'

- Limitations in the current technology available
  - Sensitivity vs size (portability) of sensors
    - What can be measured?
      - PM10 and PM2.5
      - VOCs, PAHs
      - Pollen
    - How good are the measurements?
      - Sensitivity
      - Noise data

- Limitations in the budget
  - Some low-cost sensors are not that low-cost

EI Urban Quality

Understanding the urban environment

|	Aims	Users	Physical Sensors	Social Sensors	Measurements
CITI-SENSE EI Urban Quality	Improving quality of life in cities Identifying indicators Evaluating sensors Facilitating stakeholder interaction	Citizens •Activists •Sports •Health compromised Authorities	Low-cost sensors Static sensors Mobile sensors	Volunteer Information	Pollution Meteorology Noise Health parameters Biomarkers UV exposure

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Objectives of the EI

Provide **quantified** environmental data products on air pollution & meteorological conditions to **participants**

Validate the sensors and estimate **uncertainty** to ensure data with enough quality is given to users

Receive the **feedback** from participants about usefulness of data and new awareness about air pollution

Intercompare **good practices** in different European cities with different backgrounds

EI-UQ Architecture
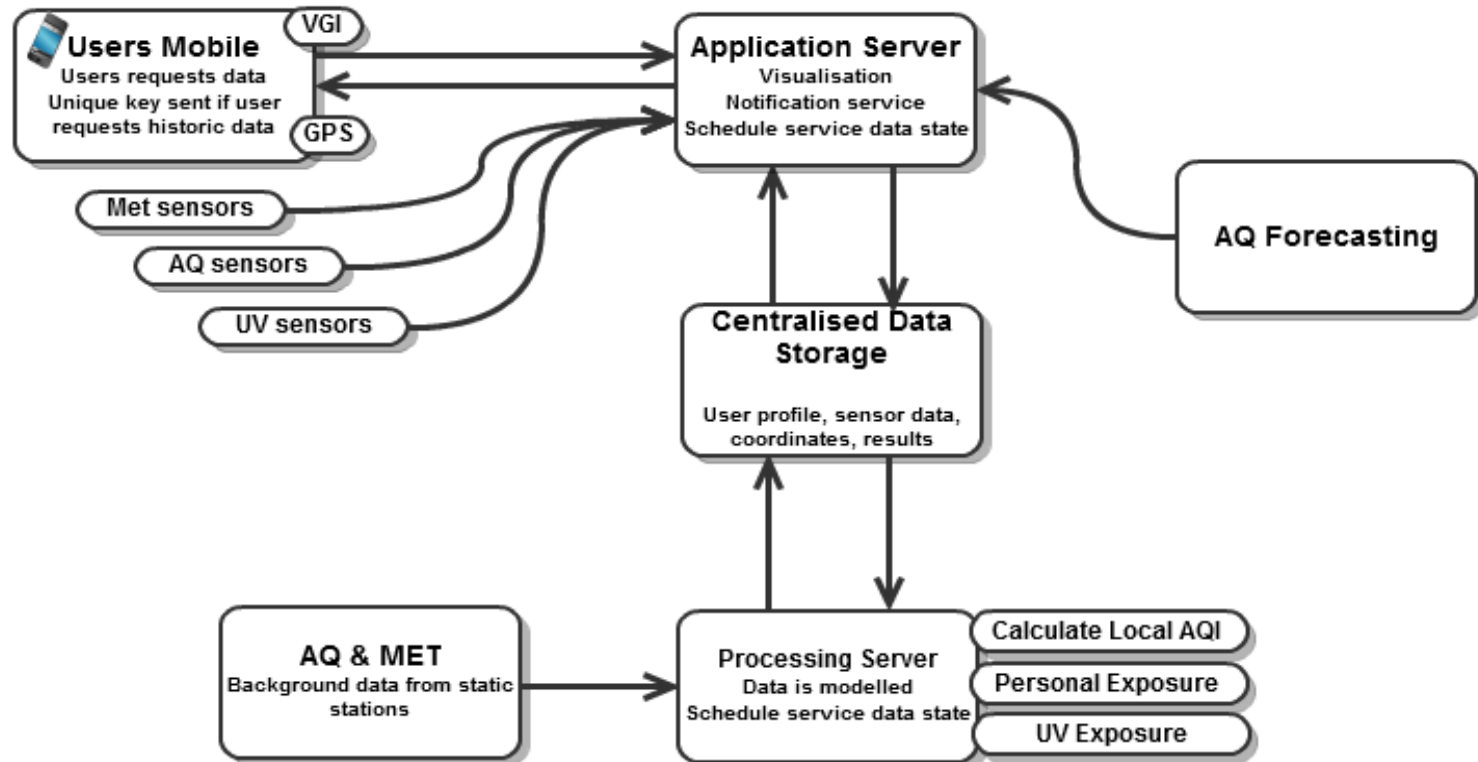
Step 1: Mobile sensor data transmitted to Application server.
Step 2: User requests service, Coordinates provided. ID Yes/No
Step 3: Processing server fetches relevant data from DB.
Step 4: Process server models data and stores results in DB. If Unique ID supplied, this data is related to the user. If not, the data is stored only as Temp and is flushed after it has been sent.
Step 5: Application Server retrieves results and returns response to mobile phone.

In order to adapt effectively to environmental challenges, citizens need "to engage actively in proving their own environment, using new observation techniques and innovative economic ideas"

European Environmental Agency

WP8: Air pollution and environmental sensors

Sensor platform

Examples of static platforms

Geotech

AirBase

Examples of portable platforms

Alphasense

Ability to use a *range of micro-sensors* (pollution, meteorology…)

Enough *sensitivity* and *selectivity*

Connectivity via GSM/3G mobile network, Wi-Fi network, Local Area Network (LAN)/Ethernet, etc

Person's *activity level* via accelerometers (human exposure)

Static can be mounted on different places: street lights, house windows, etc.

Mobile can be carried by persons or mounted on bikes, cars, etc.

Challenge to integrate different types of data (geo- and environmental data including data from sensors and data from citizens and other relevant stakeholders), and to present these in a way that makes sense to citizens without competence in interpreting big data.

Visualizations might be helpful
for making sense of data.
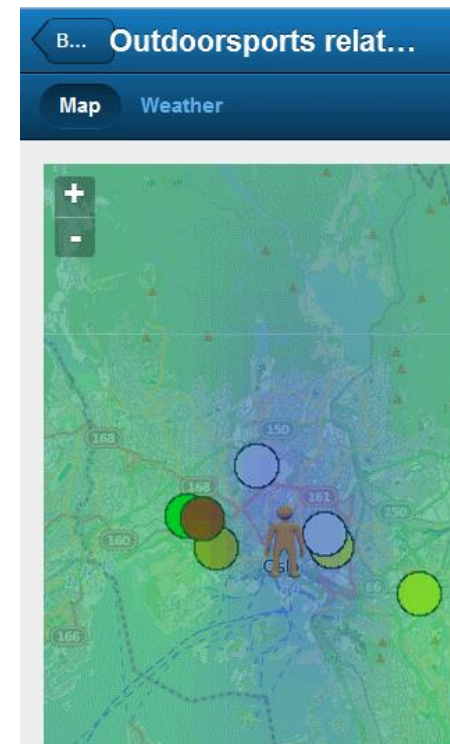
WP7: Environmental Data and Services Platform

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Information displays

Examples of web platform
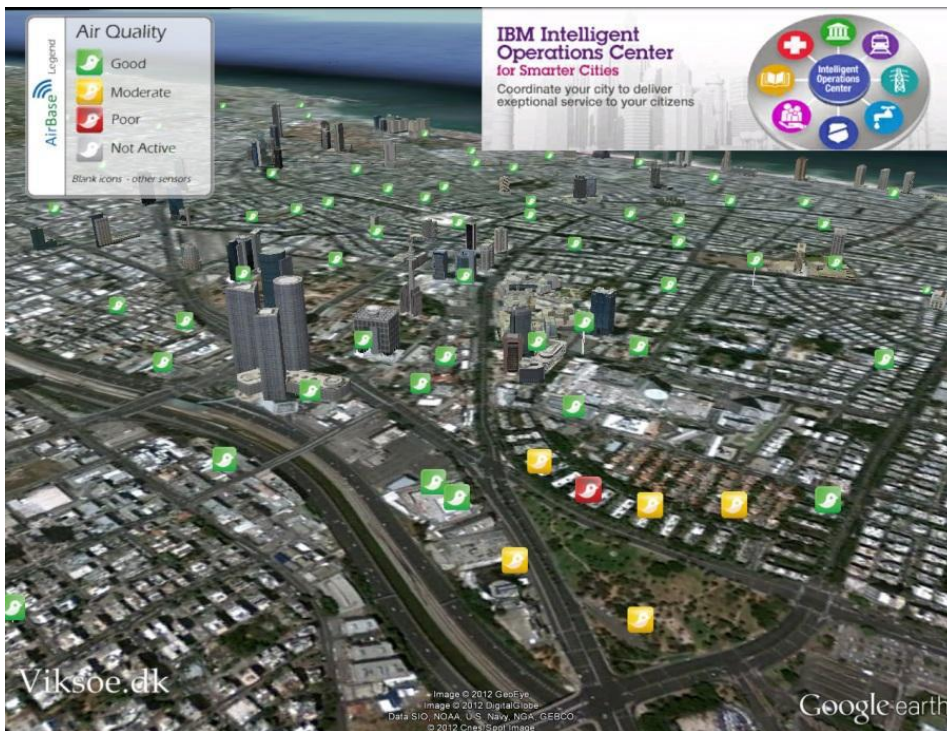
Example of App

AirBase

Envirofi

EI Timeline

Year 1: Development of site specific study protocols
Validation/calibration of separate parts

Year 2: Pilot study in convenience sample (10 sensors)
Evaluation of the performance in different cities.
The EIs cities are very different, and "good practices" cannot be transferred without considering the specific context of each city

Year 3: Implementation of full Empowerment Initiative (100? sensors)
Evaluation of user experience with the technology
Analysis of the collected data

"Cities have the capability of providing something for everybody, only because, and only when, they are created by everybody."

Jane Jacobs, journalist, author, urban theorist.

El Urban Quality: Barcelona

- High levels of air pollution and noise

- AQ information not easy to obtain by citizens

- Participants: Normal citizens, active transport users and COPD patients

- Pollutants & noise

- LUR - mapping

1.620.943 hab.
16.146,46 hab/km²

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EI UQ: Belgrade & Pancevo

- High levels of air pollution
- Pancevo: 15 km of Belgrade, big industrial area.
- Urban and industrial pollution.
- Participants: normal citizens exposed to air pollution and COPD patients
- Pollutants (+PAH) & health parameters (+biomarkers)
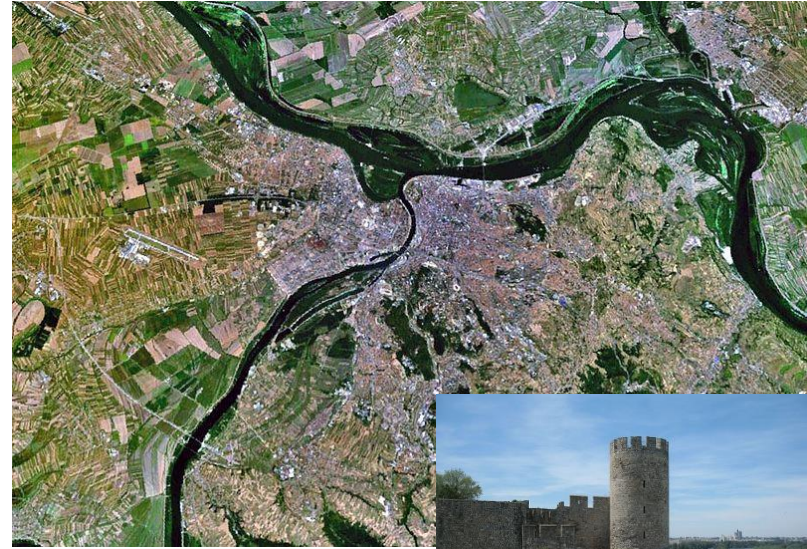
1,232,731 hab
3,424 hab/km^2

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EI Urban Quality: Edinburgh

- High levels of air pollution

- There are public active campaigns.

- Participants: activist groups and non-political community groups.

- Pollutants, noise & UV

420,893 hab
1,844 hab/km^2

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EI Urban Quality: Haifa

- High levels of air pollution

- Fast growing traffic

- Participants: students

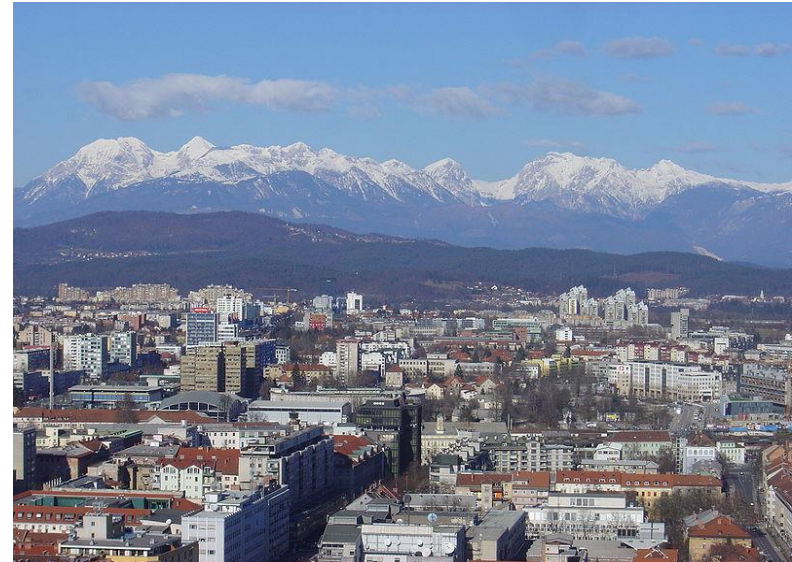- Pollutants, noise, UV & health parameters (before and after)

268,215 hab
4.186,30 hab/km²

El Urban Quality: Ljubljana

- High levels of air pollution
- Participants: health/environment related programmes and national human biomonitoring survey participants.
- Pollutants

280,278 hab
1,664 hab/km^2

El Urban Quality: Oslo

- Moderate levels of air pollution

- How to make information interesting to citizens

- Participants: youth activist associations, cyclist associations, asthma patients

- Pollutants

- Link with existing data
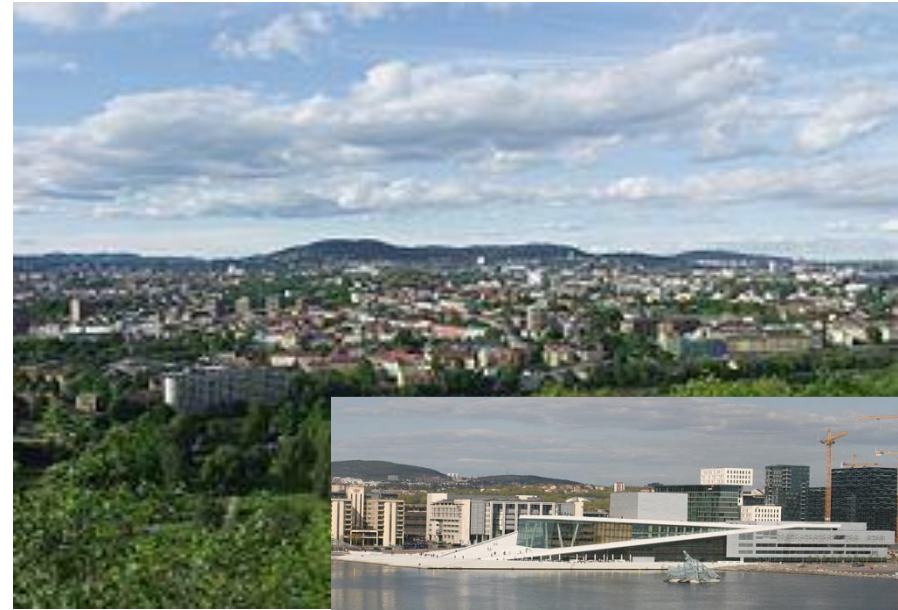
623,966 hab
1,400 hab/km^2

EI Urban Quality: Ostrava

- Very high levels of air pollution (heavy industry)

- high content of carcinogenic PAHs and benzo[a]pyrene.

- Monitoring system is insufficient.

- Dense static network

- Pollutants & biomarkers

310 464 hab
1,450 hab/km^2

El Urban Quality: Vienna

- High levels of air pollution

- Growing traffic

- Participants: subcontract 20-30 bike messengers, patient organizations and citizens.

- Pollutants

1,731,236 hab
4,002.2 hab/km^2

El Urban Quality: Vitoria-Gasteiz

- High levels of air pollution
- AQ information not easy to obtain by citizens
- Participants: citizens
- Pollutants

238,247 hab
860 hab/km^2

Thank you!!

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