Development of Sensor-Based Citizens' Observatory Community for Improving Quality of Life in Cities

CITI-SENSE.EU

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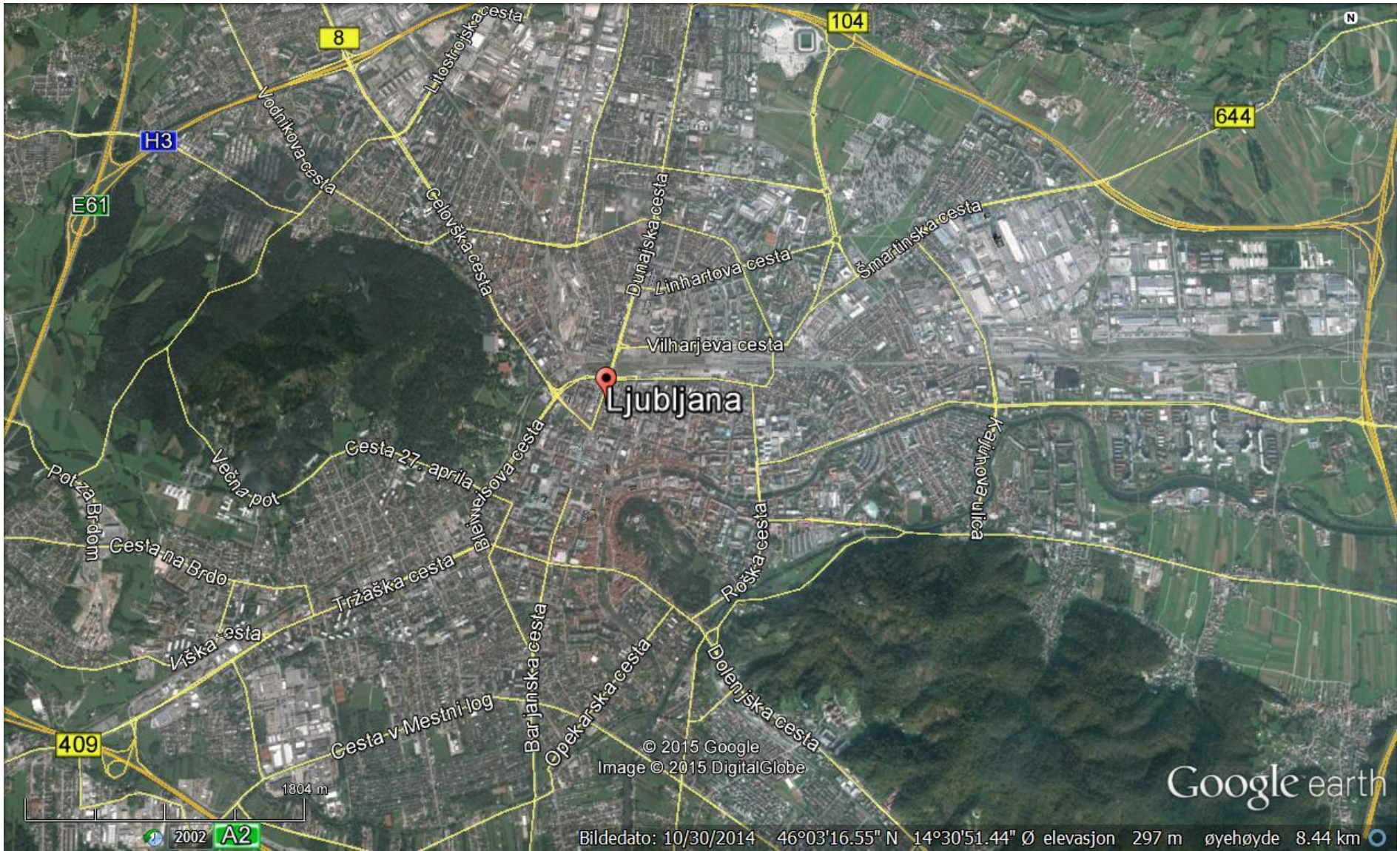
Outline

- Brief project overview
- Technical aspects
- Selected technical challenges
- In lieu of conclusions: status

Urban areas


Ljubljana
8
104
644
H3
E61
409
Litostrojska cesta
Vodnikova cesta
Celovška cesta
Dunajska cesta
Linhartova cesta
Šmartinska cesta
Vilharjeva cesta
Večna pot
Cesta 27. aprila
Blaiweisova cesta
Pot za Brdom
Cesta na Brdo
Tržaška cesta
Roška cesta
Kajuhova ulica
Viška cesta
Barjanska cesta
Opekarska cesta
Dolenjska cesta
Cesta v Mestni log
© 2015 Google
Image © 2015 DigitalGlobe
1804 m
2002
A2
Google earth
Bildedato: 10/30/2014 46°03'16.55" N 14°30'51.44" Ø elevasjon 297 m øyehøyde 8.44 km

Scientific context and objectives

To develop Citizens' Observatories to empower citizens to

- Contribute to and participate in environmental governance
- Support and influence community and policy priorities and associated decision making
- Contribute to the Global Earth Observation System of Systems (GEOSS)

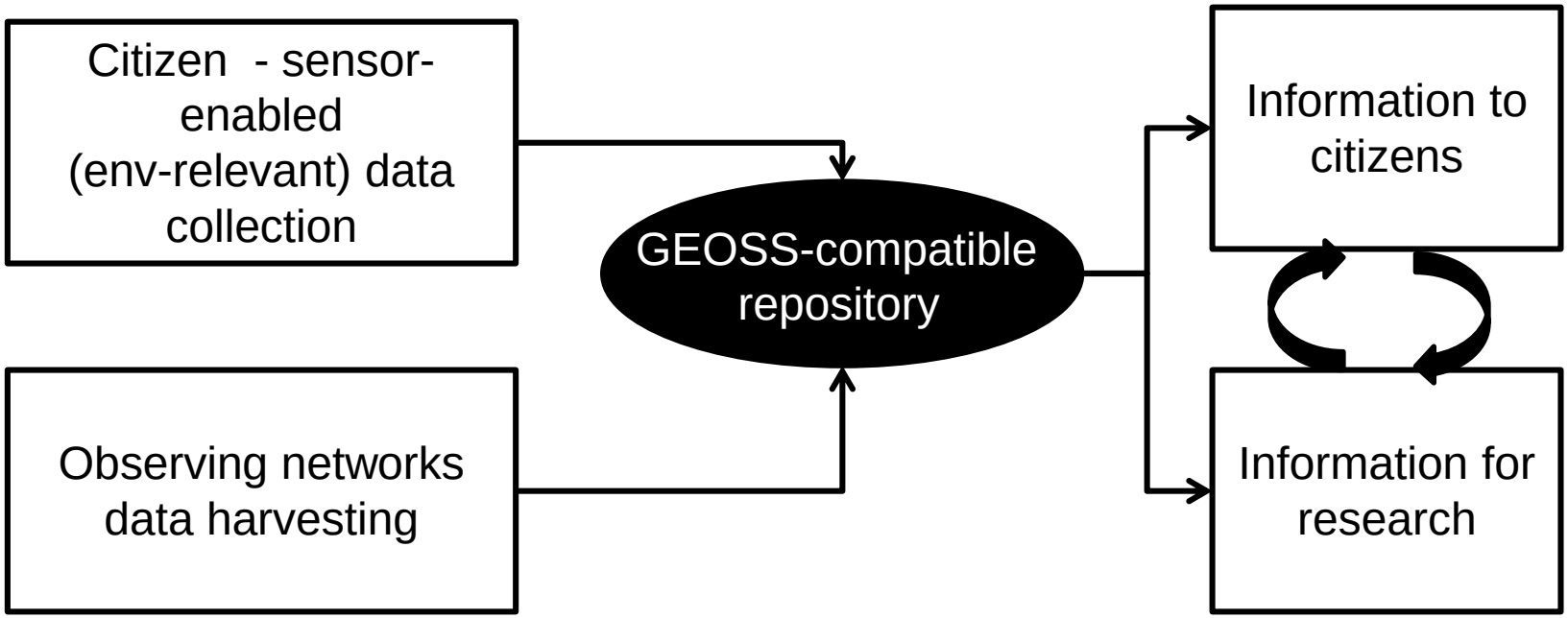
Citizens' observatories are

Communities that share

- technological solutions,
- information products and services and
- community participatory methods

Complement established environmental data and information systems, improve local environmental decision making.

CITI-SENSE objective



Changed focus reflects successful past efforts

- Sources: Transport
- Motivation: Climate; quality of life

For further progress, need to engage with the public

Scope: Empowerment Initiatives

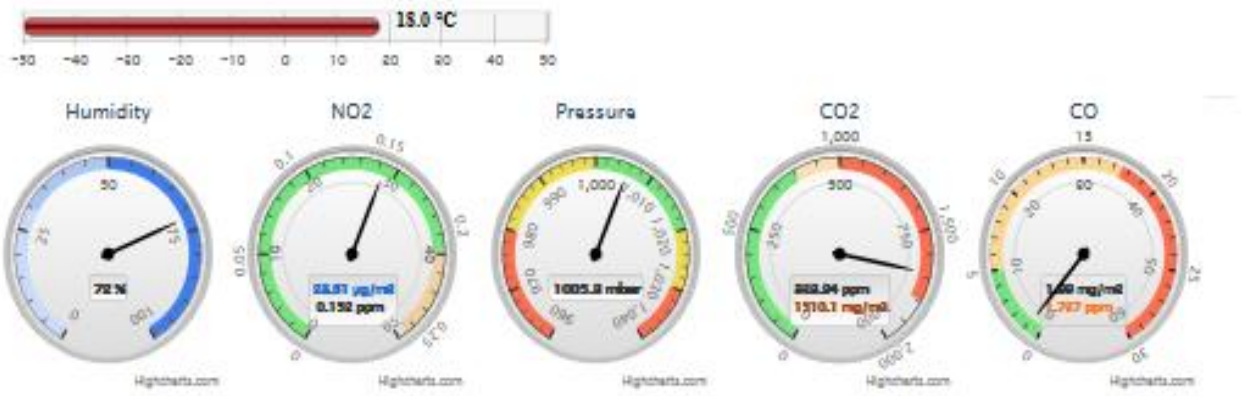
- Urban Quality
- School Environment
- Public Spaces

Urban Quality

Aims	Users	Physical Sensors	Social Sensors	Measurements
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

School Environment

- Shows real-time, school day and historical values
- Web, mobile devices
- Customised for CITI-SENSE pilot
- Data from devices and from automated stations
- Visualisation using third-party widgets
- Highly customisable to suit use-case or specific requirements



- Temperature, Humidity, Pressure
- CO_2, CO, NO_2, NO, O_3, SO_2

Public Spaces

What for?

- Design of public places
- Lead by the urban planners of the municipality
- Supported by citizens

Where?

- Four places in town

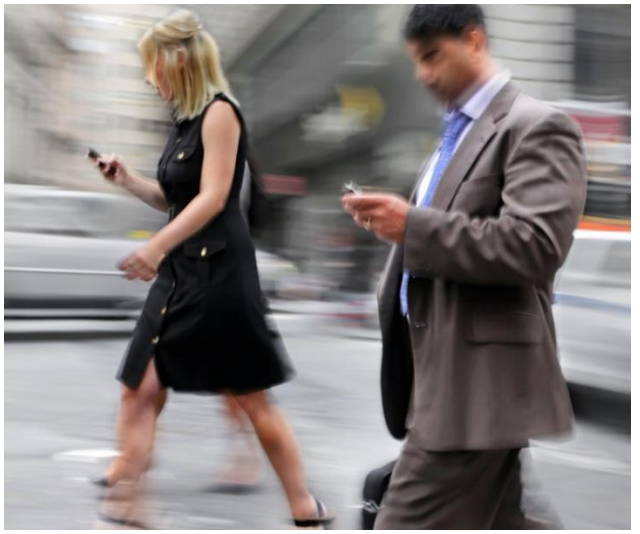
Who is involved?

- Citizens > 50 people per location
- Municipality

What is to be measured/evaluated?

- Thermal comfort
- Acoustic comfort
- UV radiation
- Urban landscape
- General satisfaction


CITI-SENSE People Aspects



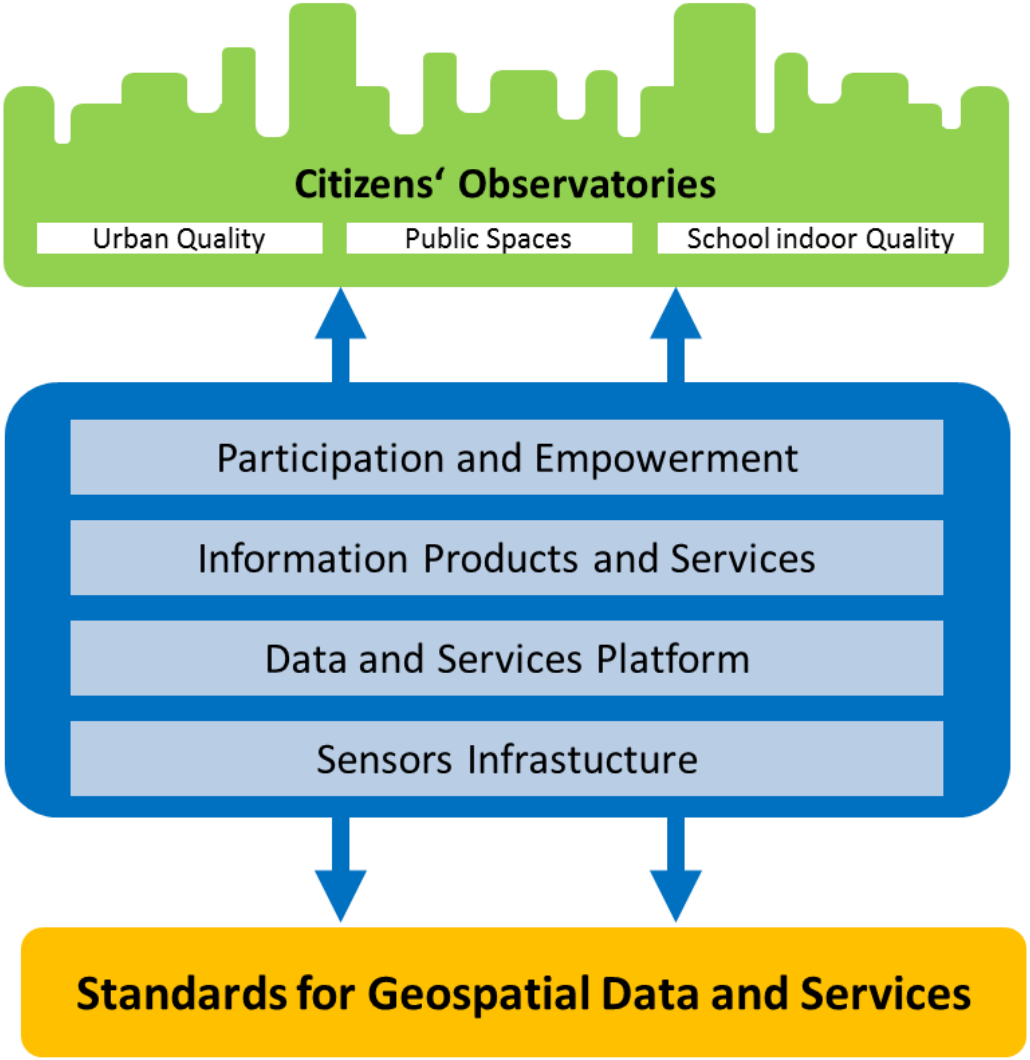
Motivation


Tell me, and I'll forget
Show me, and I may remember
Involve me, and I'll understand
Chinese proverb

What happens when citizens start to measure?

- Info to and from citizens
- But: citizens would only do it if they receive suitable feedback – «usefulness» of the products

CITI-SENSE Implementation

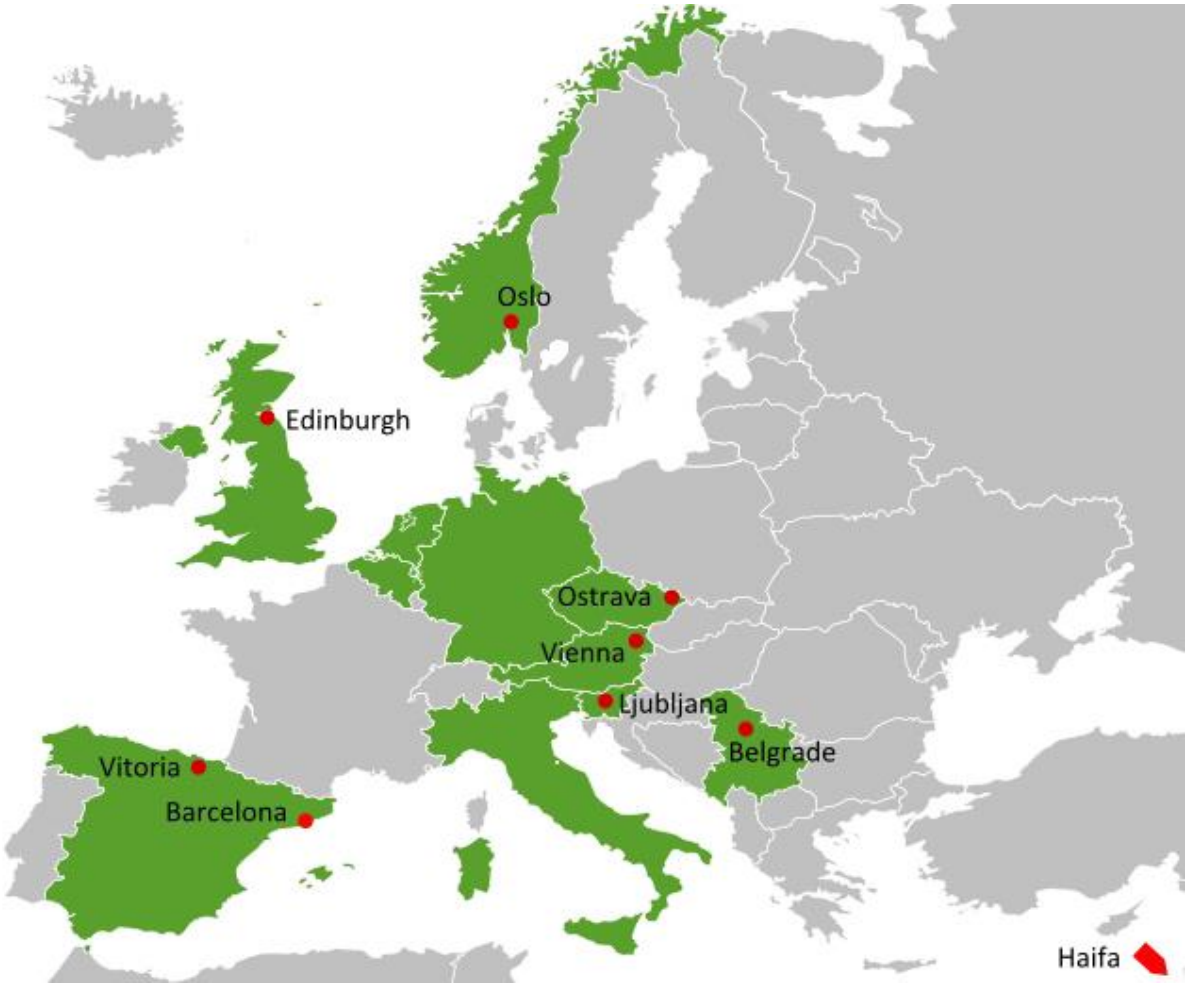


CITI-SENSE Test Cities

Nine cities:

- Barcelona
- Belgrade
- Edinburgh
- Haifa
- Ljubljana
- Oslo
- Ostrava
- Vienna
- Vitoria

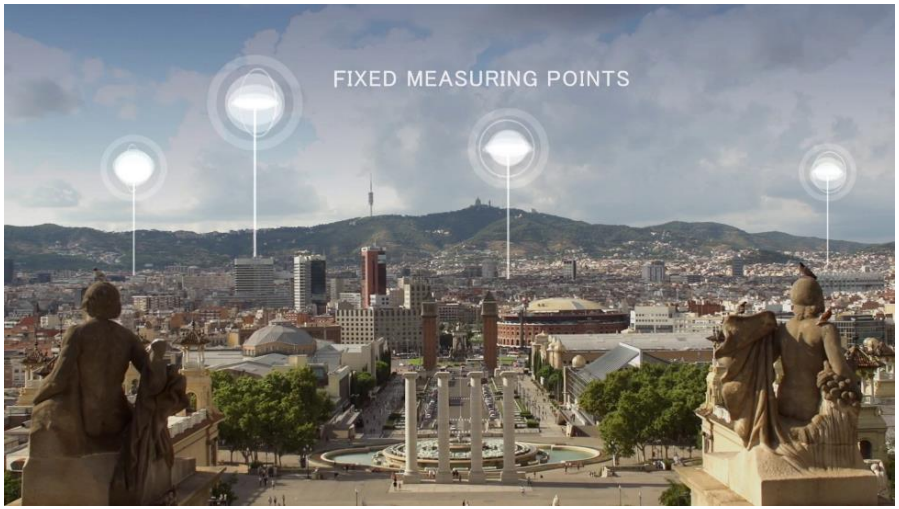
The cities gather sensor-enabled data on outdoor urban spaces and indoor school environments.



Urban Air Quality EI:

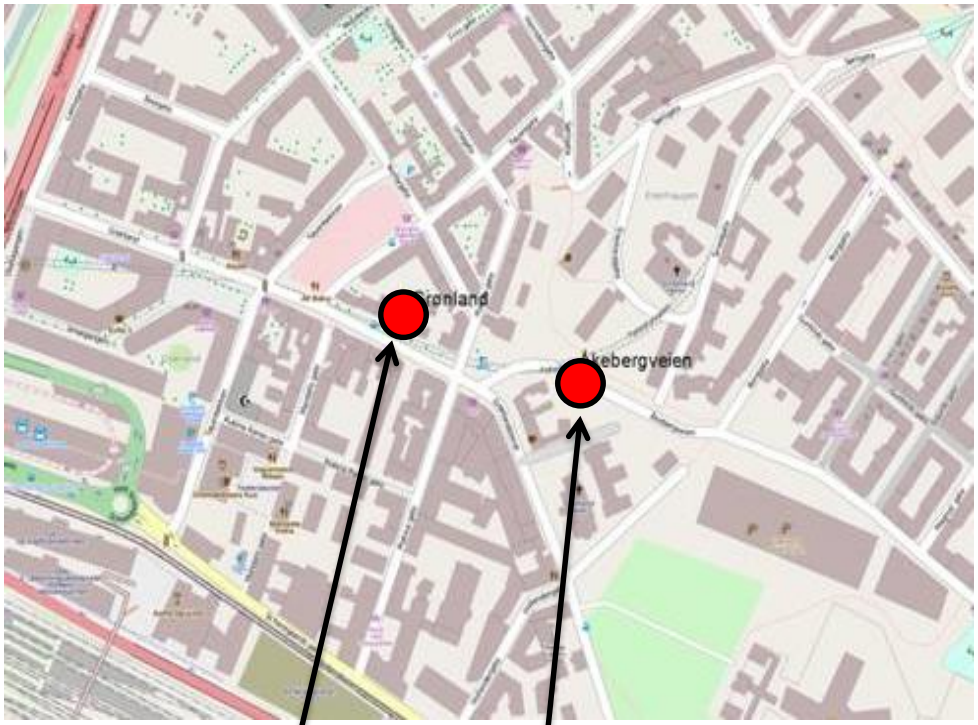
Focusing on sensor devices

CITI-SENSE technical aspects



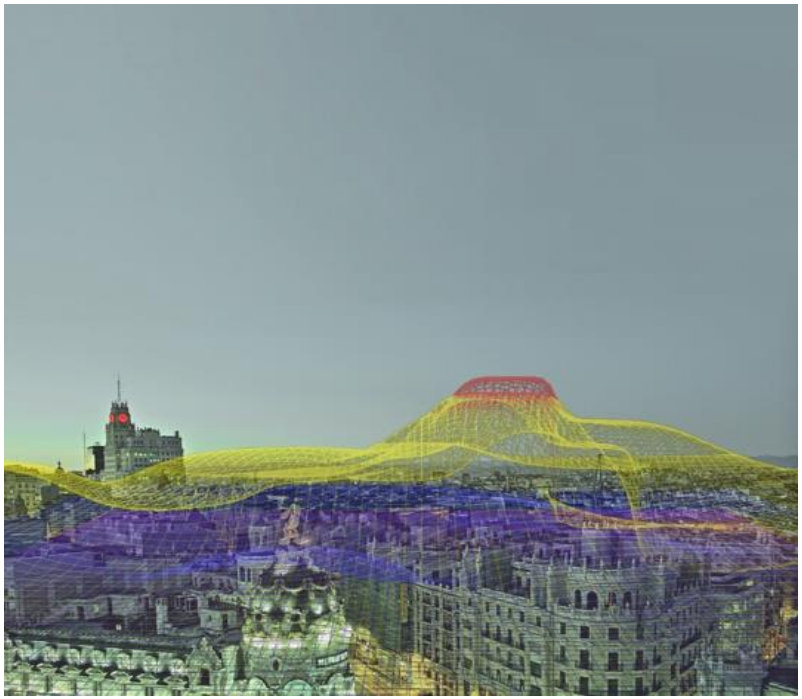
CITI-SENSE creates a distributed data collection network using innovative static, portable and personal devices (low-cost reliable micro sensor packs) that communicate with data repositories through mobile phones or other devices

Urban quality

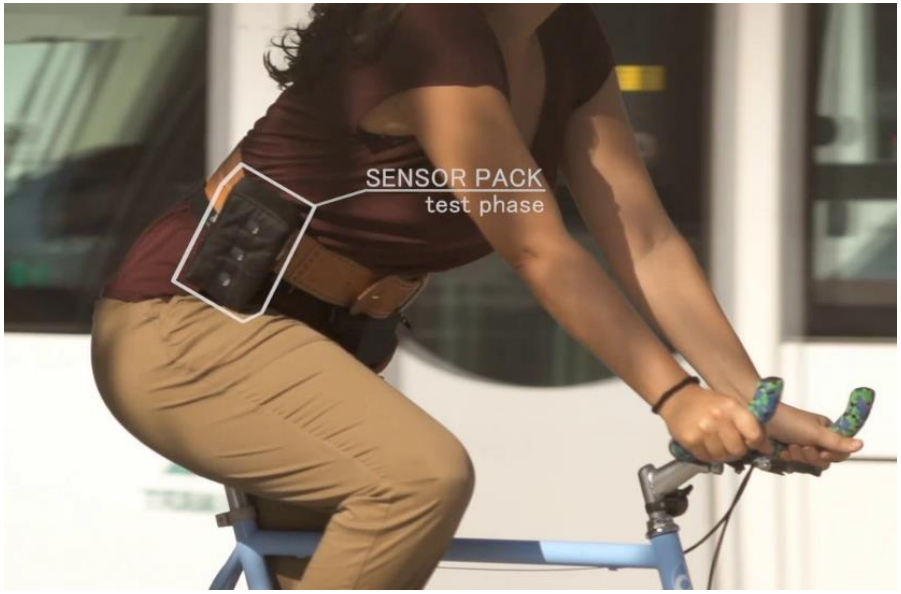


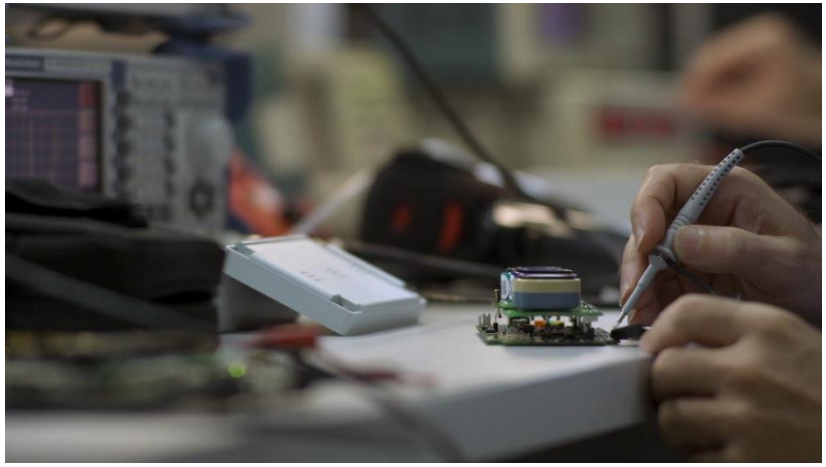
Traffic station

Urban background station

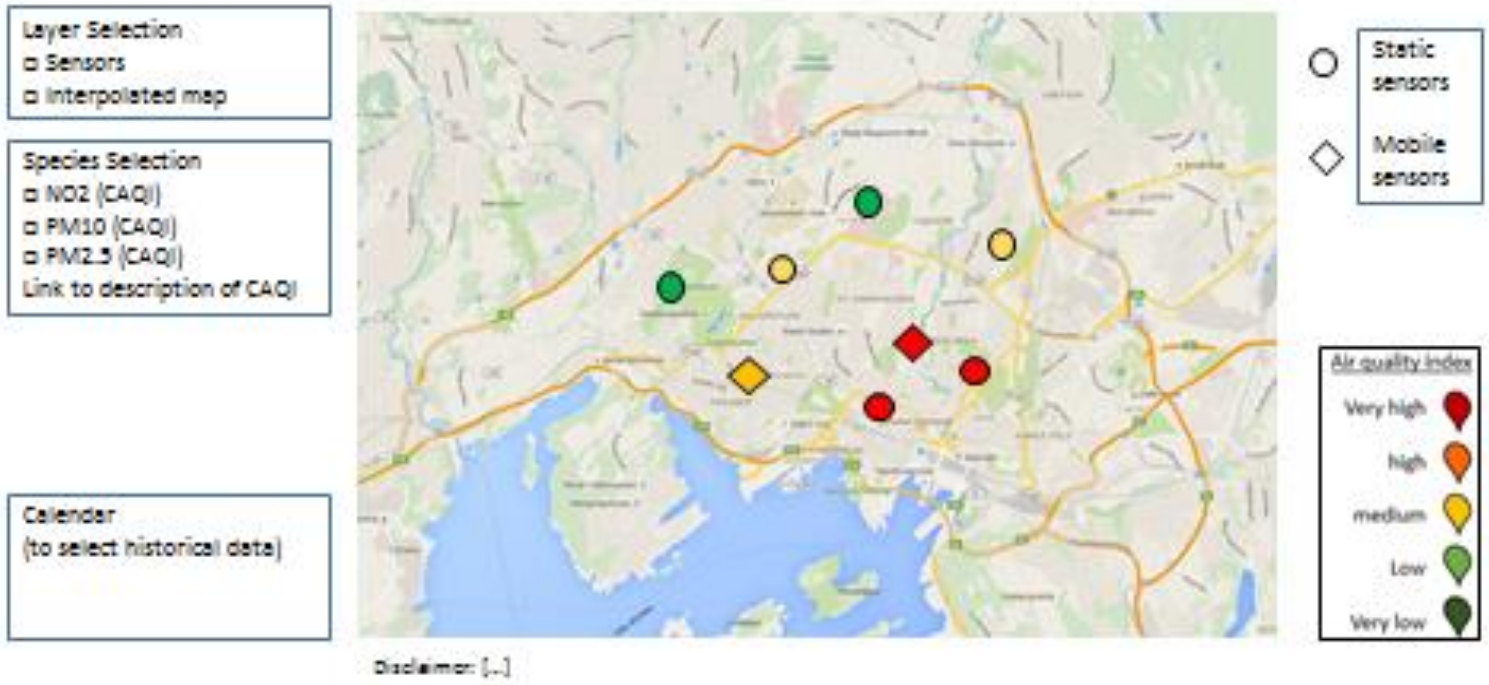


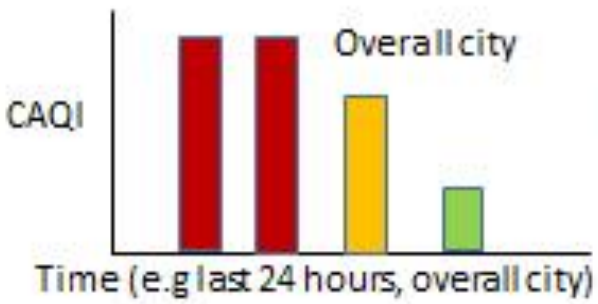
Technologies



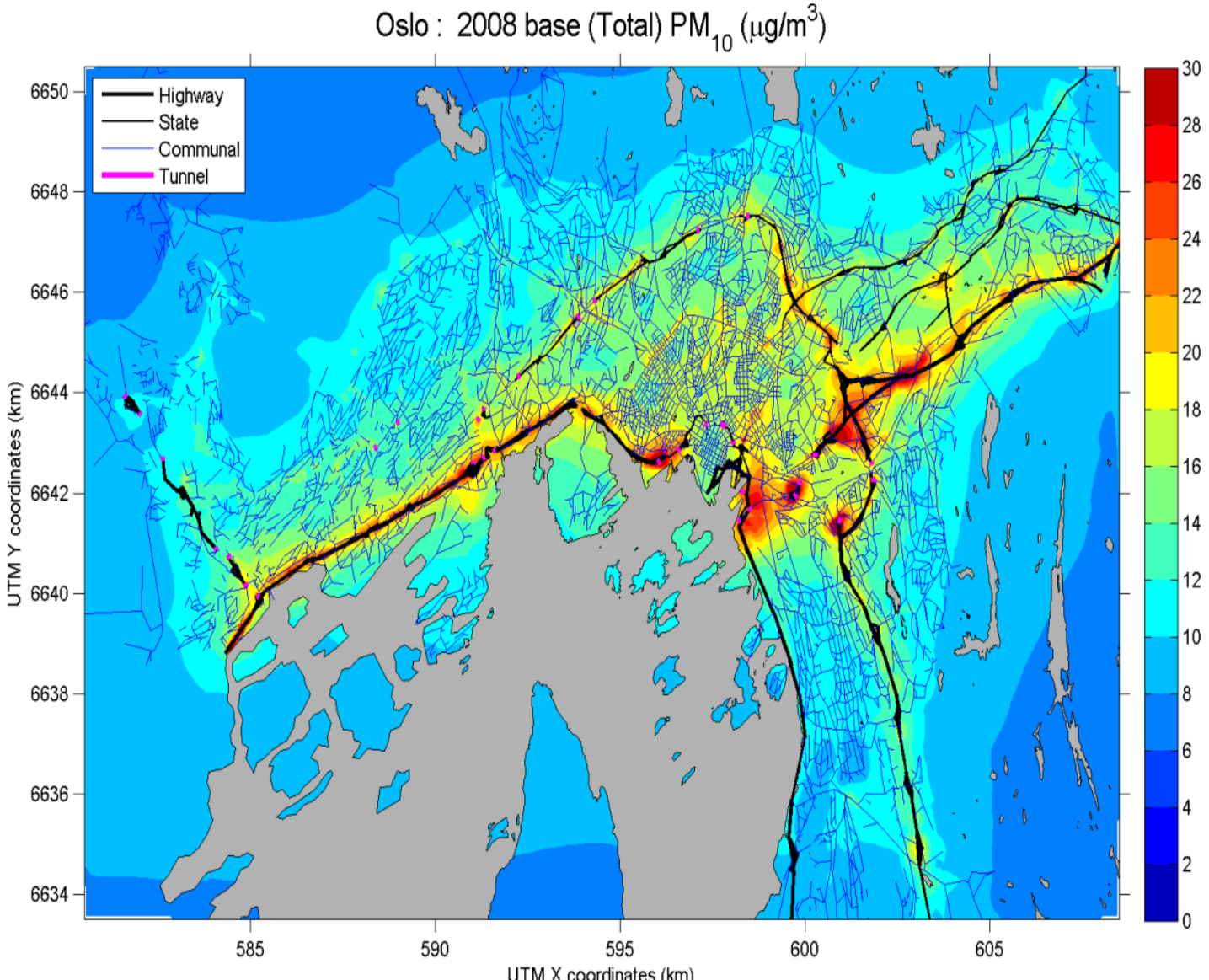


Sensor view (after clicking on a sensor symbol)





AQ maps


Oslo : 2008 base (Total) PM10 (μg/m3)
Highway
State
Communal
Tunnel
UTM Y coordinates (km)
6650
6648
6646
6644
6642
6640
6638
6636
6634
585
590
595
600
605
UTM X coordinates (km)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0

Varying info requirements

CITIZENS

- What questions do they own?

OTHER GROUPS OF CIVIL SOCIETY (DEFINED QUESTIONS?)

- Traceable origin
- Veracity
- Compliance with other requirements (e.g., legal)

RESEARCH (DEFINED QUESTIONS)

- Traceable origin
- Veracity
- Content

AUTHORITIES (DEFINED QUESTIONS)

- Manage air quality
- Compliance with legal requirements

Measurement of air quality

By many methods

Existing monitoring systems

- Compliance monitoring >> comparability; specified in the Legislation (EC/50/2008)
  - Coverage
  - Data Quality Objectives
  - CEN Standardization of Monitoring Technologies
  - QA/QC
  - Reference laboratories
  - Other legal requirements (warnings,..)
  - Support to MS
- Other environmental information systems

Sensor platforms

Static platforms

Geotech

AirBase

Portable platforms

Ateknea

Alphasense

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

Enough sensitivity and selectivity (but, put into a box…)

Connectivity - GSM/3G/4G mobile network, Wi-Fi network, Local Area Network (LAN)/Ethernet, …

Static - can be mounted on different places: street lights, house windows, …

Mobile - can be carried by persons or mounted on bikes, cars, …

Capabilities and *Challenges*

We can measure:

- NO_2 + O_3
- NO
- CO, H_2S, SO_2
- VOCs (not specific)
- PM_{10} and $PM_{2.5}$

But we also want to measure:

- NO_2, O_3 separately
- PAH's (e.g. Ostrava)
- Formaldehyde (IAQ)
- Ultrafines
- Oxidative stress of PMs
- Pollen, biophages
- Benzene, separate from BTEX

Alphasense air
Sensors for Air Quality Networks

Main issues

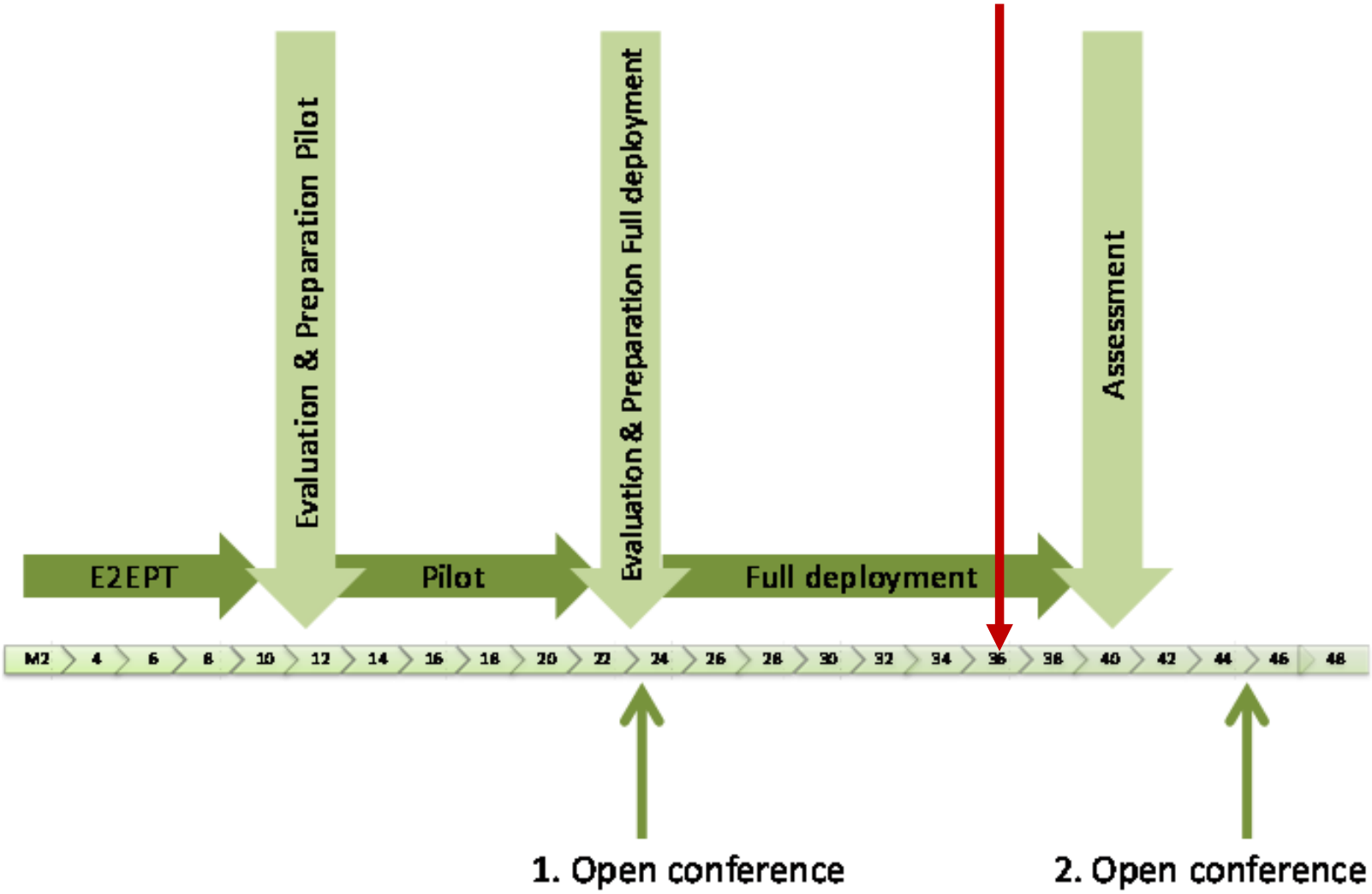
- What are users expectations, and what participation modalities can we expect?
- Technological supply - meets demand?
- Product supply - meets demand?

- Users – diverse community, local situation determines interest and modalities, perhaps little in common except special groups; both expectations and involvement will vary
- Technological demand does not match supply (yet), combinations of methods and technologies needed; ICT requirements daunting but a lot in progress
- Air quality: much driven by legislation, good grip on what the managers need. The role and potential for, and of, the public and publicly contributed data is as yet unknown (limited evidence, to be expanded on)

Challenges

- **Sensor devices**
- Complexity of the infrastructure
- **How to interpret and communicate own collected air quality information**
- How to achieve empowerment

Timeline


Evaluation & Preparation Pilot
Evaluation & Preparation Full deployment
Assessment
E2EPT
Pilot
Full deployment
M2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
1. Open conference
2. Open conference

Our goal:

To create infrastructure
and to demonstrate feasibility of
sustainable Citizen's Observatories
related to urban quality

And despite the challenges, we seem to be making progress.

Progress has been made:

- Products: co-development of perception questionnaires, CAQI, AQ maps - apps and web pages
- Platform: tested most data flows, different retrieval methods
- Sensor devices: hoping for an early resolution, finishing toughes.

Remaining challenge: interpretation of the sensor measurements and identification of their information value.

CITI-SENSE partners

Partners:

CITI-SENSE is a four year Collaborative Project partly funded by the EU FP7-ENV-2012 under grant agreement 308524, started in October 2012.

- CITI-SENSE CO's central web portal: http://co.citi-sense.eu
- Common CO project's web site: http://www.citizen-obs.eu/
- LinkedIn: https://www.linkedin.com/groups/Citizens-observatories-5164755
- Facebook: https://www.facebook.com/int.cit.obs
- Twitter: https://twitter.com/Citizensobs
- CITI-SENSE web site: http://citi-sense.nilu.no/

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