



CTT 2.0 Carbon Track and Trace Climate-Smart Cities



Climate-KIC is supported by the
EIT, a body of the European Union

 NTNU

Norwegian University of
Science and Technology

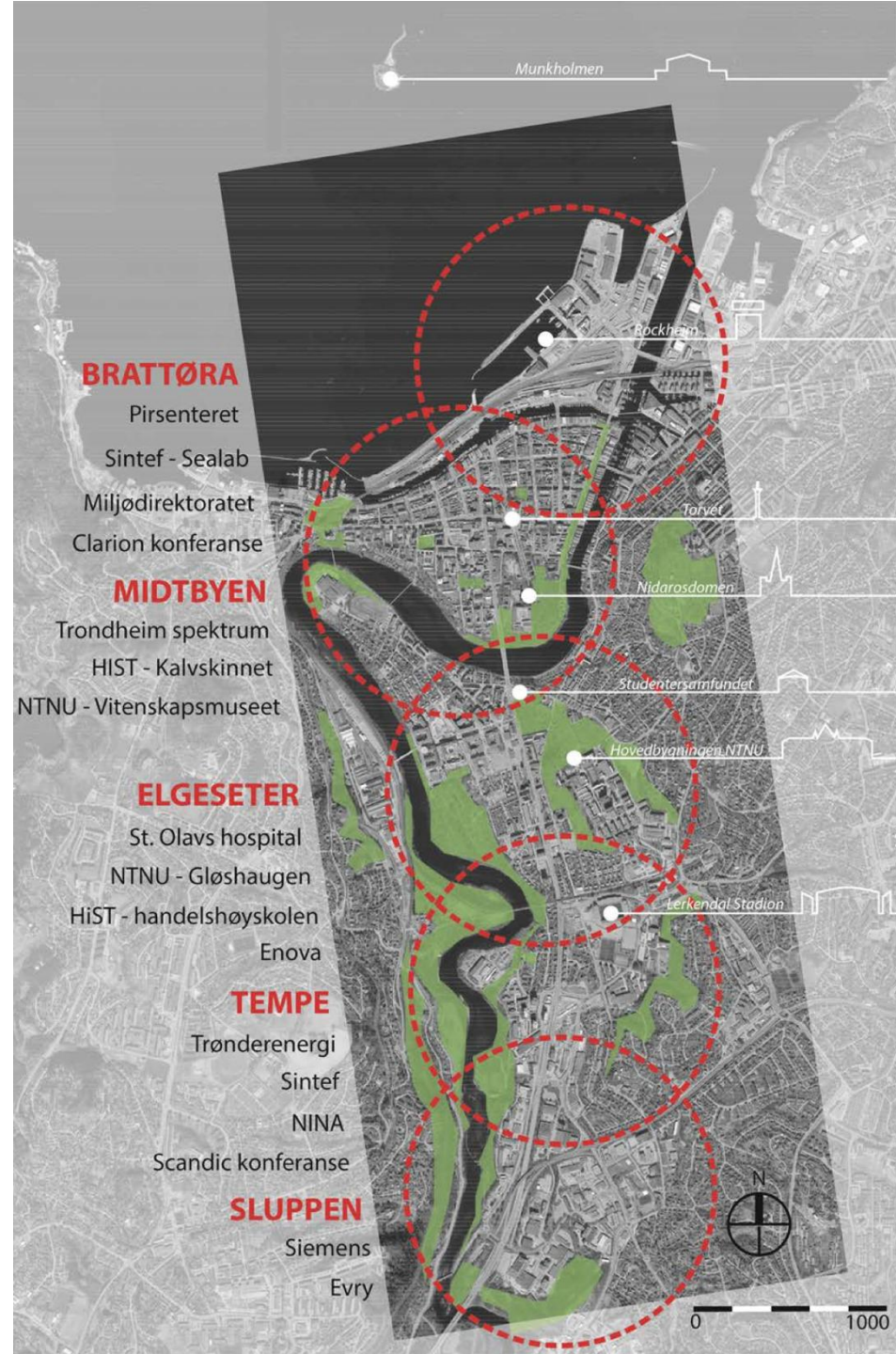
Dirk Ahlers, NTNU, Trondheim, Norway
Local Renewables Conference 2016, Freiburg



[Wikipedia]



Trondheim Knowledge Axis



Smart Sustainable City: From Science to Practice (and back)

Smart
Sustainable
Cities,
Communities
& Regions
@ NTNU

Built
Environment
(& everything
in between)

Urban
Metabolism
(Energy,
Mobility,
Resources..)

People,
Governance
&
Institutions

Smart Tools & Technologies

Targets, KPIs & Assessment

Transition & Learning Processes

Value Creation & Business Models

Out of the Lab, Into the City





Urban Lab Trondheim

Landuse & transportation
planning

ZEB buildings

Smart Cities

Low energy/ emission
neighborhood planning

Health promoting areas

Social inclusion & participatory
processes

Urban governance

Public space and Art

Climate-Smart Cities

Climate Strategies & Smartness & Data

Cities need to drive mitigation





CS3CS — Workshop on City Strategies for Smart Sustainable Climate Solutions

Dirk Ahlers, Patrick Driscoll, NTNU

ICE Conference, 13.06.2016, Trondheim

<http://dhere.de/CS3CS2016/>
[#CS3CS](#) [#ICE16ITMC](#) @ICE_Conference



NTNU
Smart Sustainable Cities



Climate Smart Through the Use of Data

Trondheim becomes climate smart: Carbon Track and Trace

Help your city to find climate change solutions!

You develop ideas, we provide a work-space, free coffee and food, access to 3D printers, sensors, data, hardware, mentors and experts.

Join us for a 24-hour hackathon focused on these 3 main challenges:

existing open data sets to calibrate and check emissions to better understand city emissions?

from ground-level emissions sensors be used to drive change?

systems are expensive, so can we build cheaper, or systems?



carbontracktrace.com/climathon2016

Register free at billetto.no/en/events/climathon-trondheim



NORDIC SMART CITIES AND COMMUNITIES CONFERENCE

Scandic Lerkendal Hotel 6-8 September 2016 - Trondheim, Norway



Photo: CHiP/Trondheim

Hvordan kan vi utvikle bedre og smartere byer?

Carlo Ratti, MIT
Senseable Cities
Massimo Busoli, Head of the NTNU EU Office, Brussels
Smart Cities in a European Context

Jonas Enga, Koordinator BYFORSK NFR
Smart Cities Nordic Aspects
Jonas Bylund, Urban Europe Alliance
A Different Kind of Smart?

Simon Loveland, Trondheim Kommune
How Trondheim Municipality is Becoming Climate Smart through the Use of Data

Prof Miimu Airaksinen, Technical Research Centre of Finland
How Do You Know if Your City/Community is Getting Smarter?

Lukas Wedemeyer, Kristiansand Kommune
How to Develop Smart City Strategies for Your Own Municipality/Region?



Norwegian University of Science and Technology

Norwegian University of Science and Technology

Norwegian University of Science and Technology

Norwegian University of Science and Technology

Norwegian University of Science and Technology

Norwegian University of Science and Technology

Norwegian University of Science and Technology



Join the Climathon movement, drive climate action in Trondheim!

Climathon brings together the challenges of the world's cities with the people who have the passion and ability to solve them.

Climathon is a global 24-hour climate change event organised by Climate-KIC which will take place simultaneously in 121 cities around the world on **28 October 2016**.

Bring your ideas and develop them into measurable, integrated and engaging solutions.

#Climathon
climathon.climate-kic.org

Climate-KIC is supported by the EU through the Smart Growth Programme



TRONDHEIM KOMMUNE



Kunnskap for en bedre verden



The CTT project

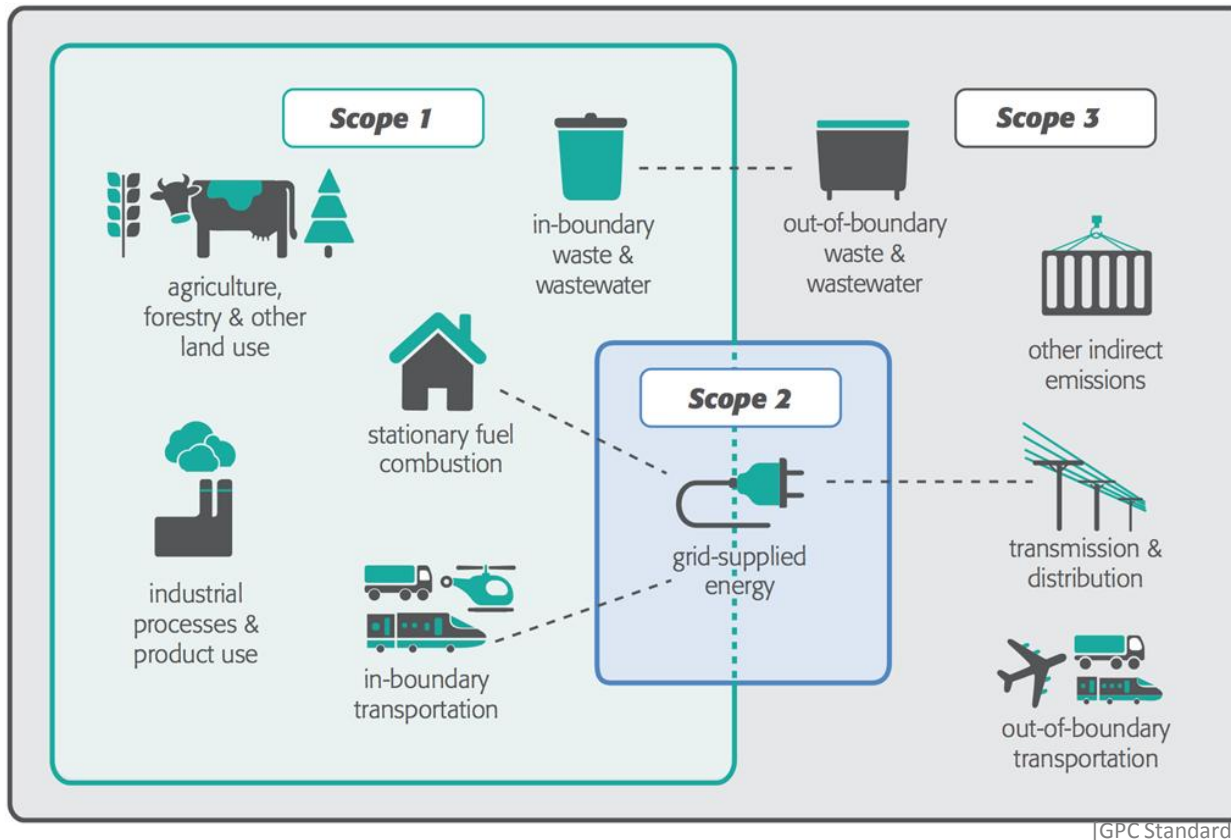
Carbon Track and Trace



What is the basic problem we are trying to solve?

- Cities do not have adequate tools to measure the impact of their climate strategies and measures
- Existing greenhouse gas emissions inventory methods are too coarse, too inaccurate, and too uncertain to provide effective feedback to municipal climate goals.
- Need to combine and understand different data types to understand what motivates changes in behaviour.

GHG emissions are not easy to track, especially from transport and consumption

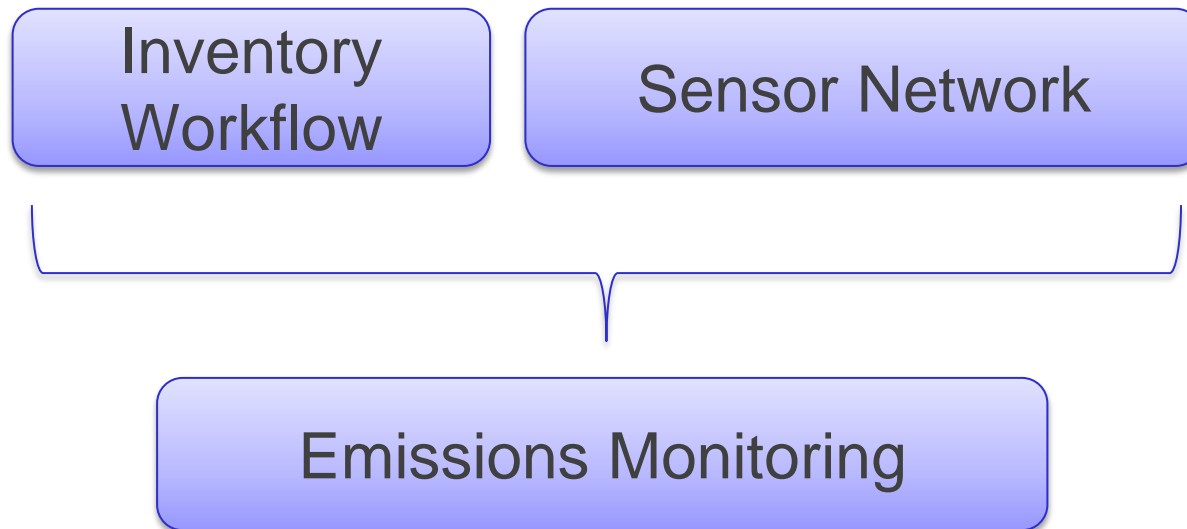


Carbon Track & Trace - CTT

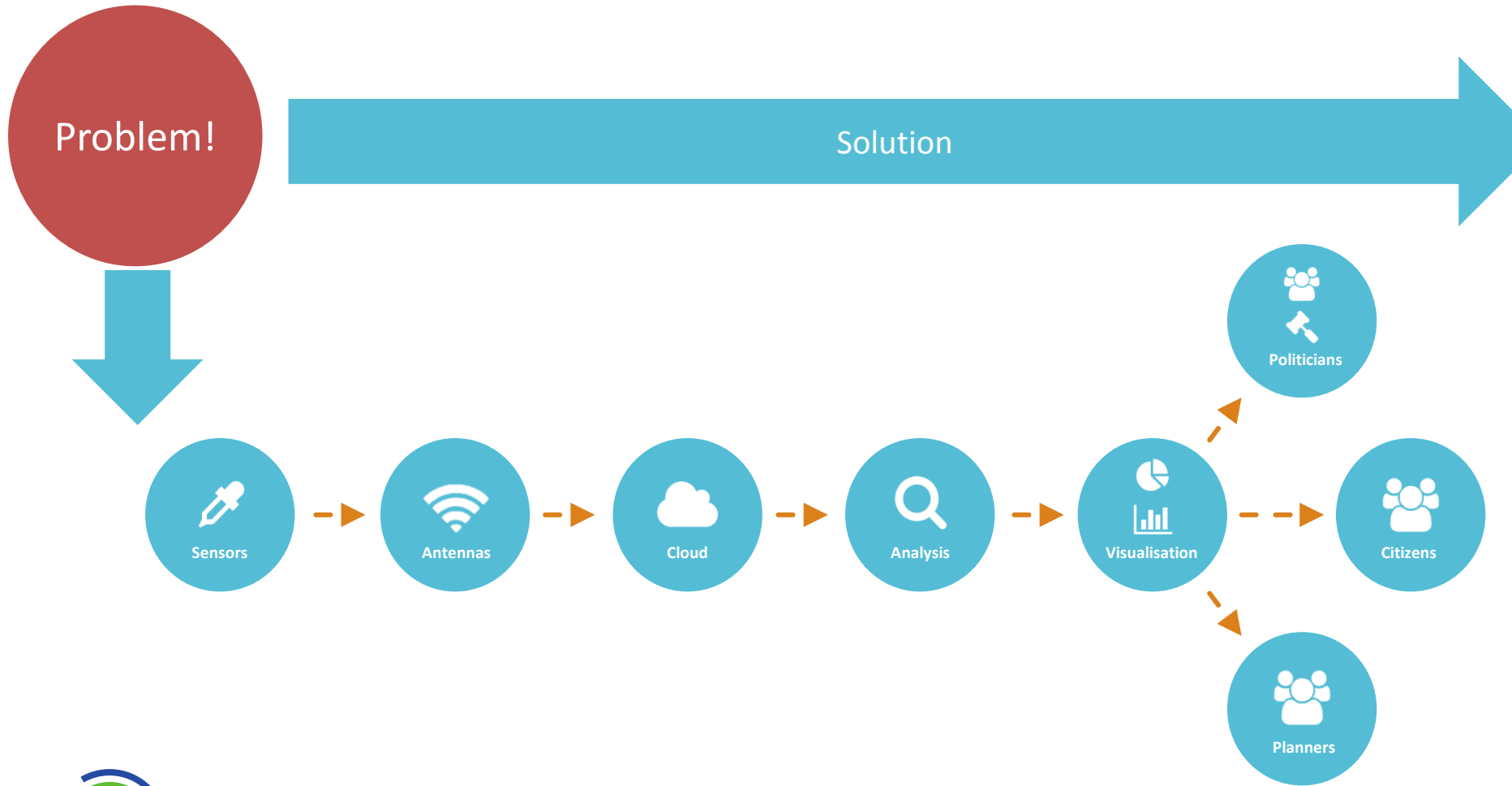
- Monitoring, Reporting, Understanding of city-level greenhouse gas emissions
- Both emission inventories and *real-time local* measurements
- Better accounting leads to better prioritization of mitigation projects
- Pilot areas in Trondheim and Vejle



Integrating workflows and sensors



CTT Value Chain

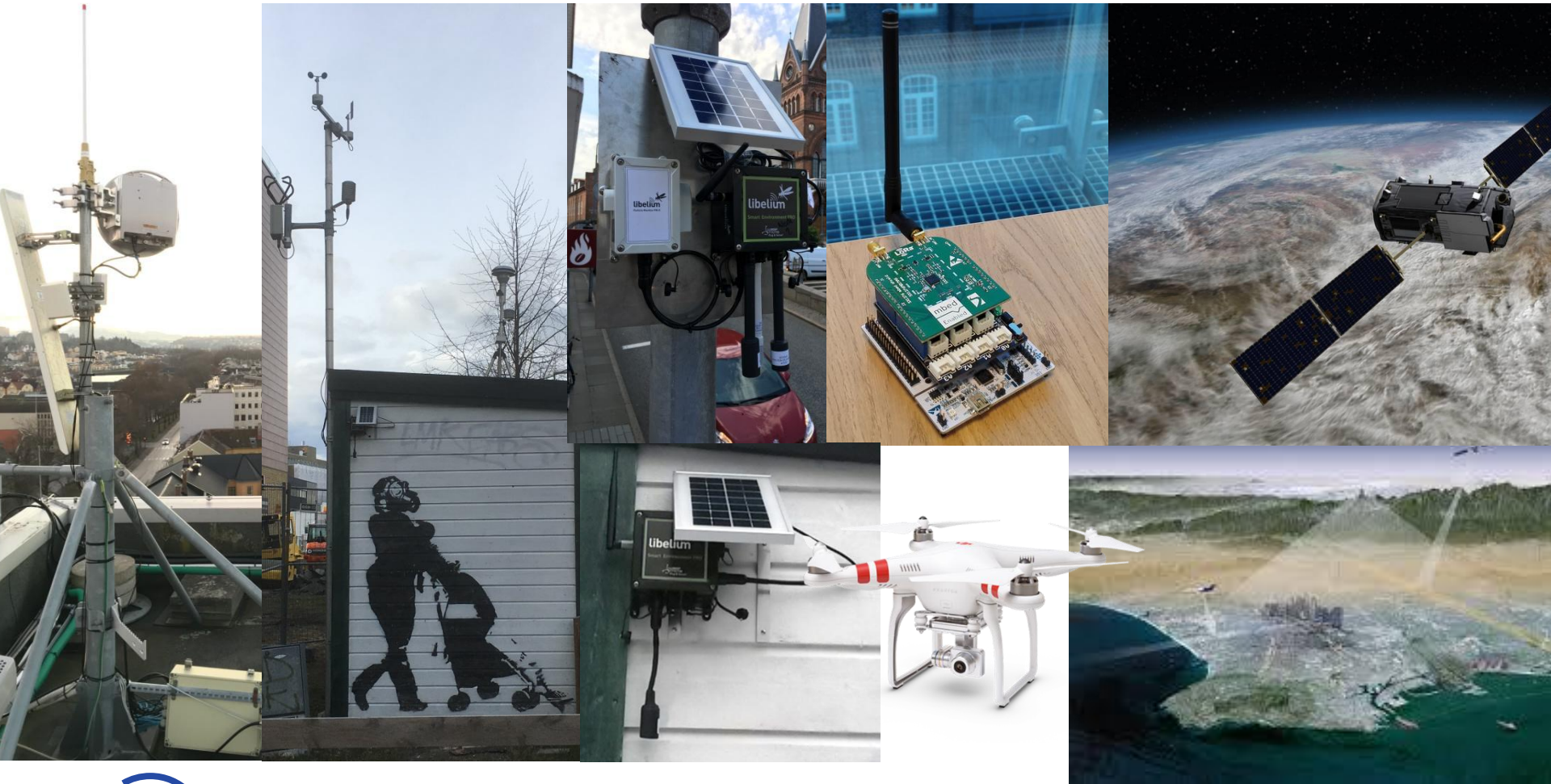


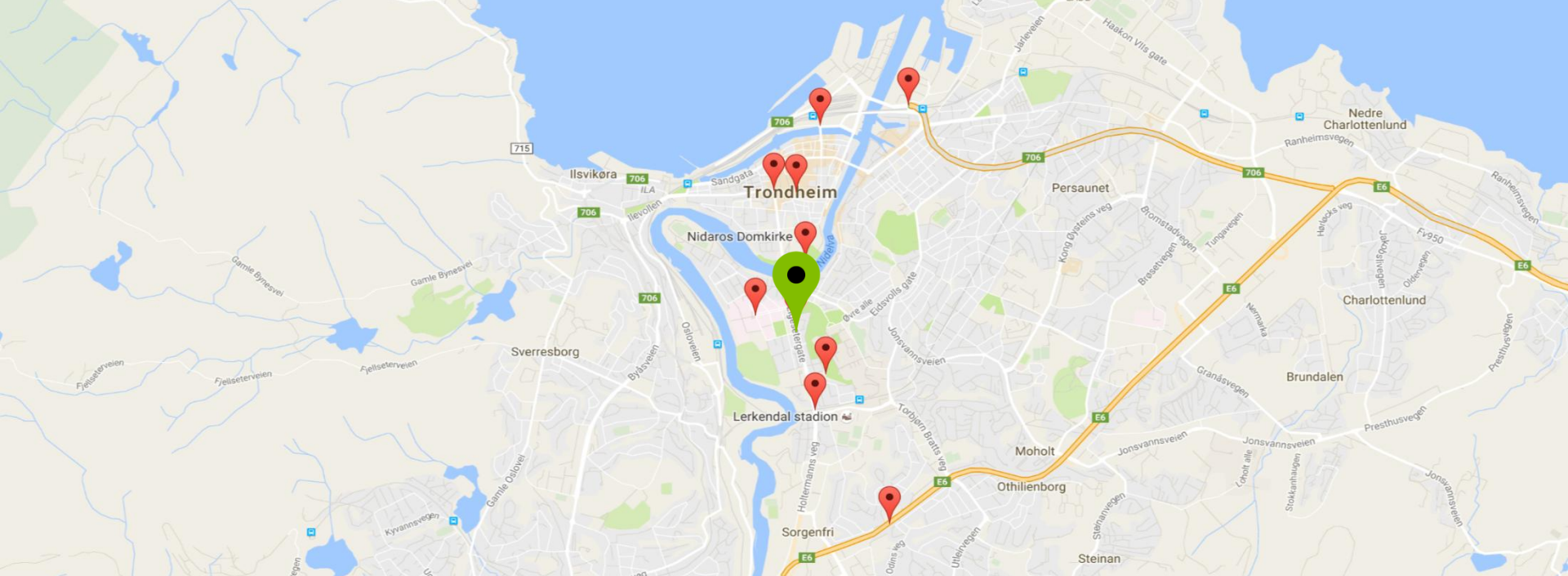
Approach and Activities

- Integration of emission data into city planning and decisions support
- Deployment of LoRa sensor network in Trondheim and Vejle
- Development of an analytics framework of GHC emissions
- Work towards GPC-compliant inventories
- Development of a business plan, fundraising
- Scaling out, deployment/testing internationally

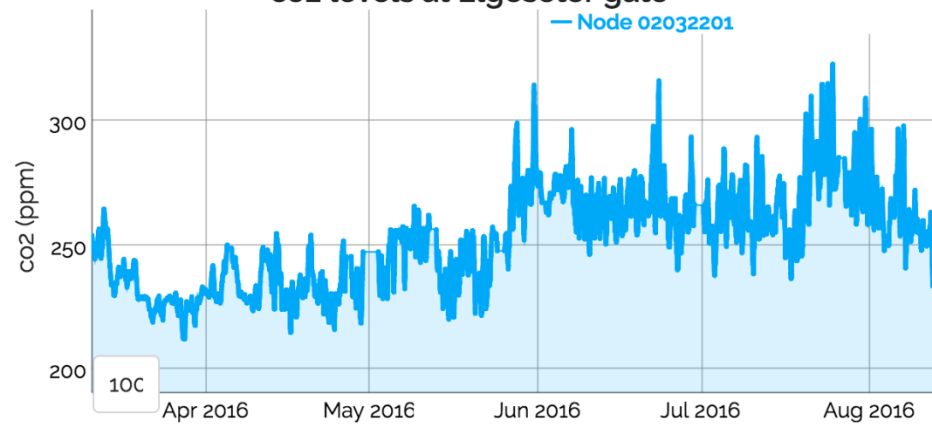


Sensor/networks system

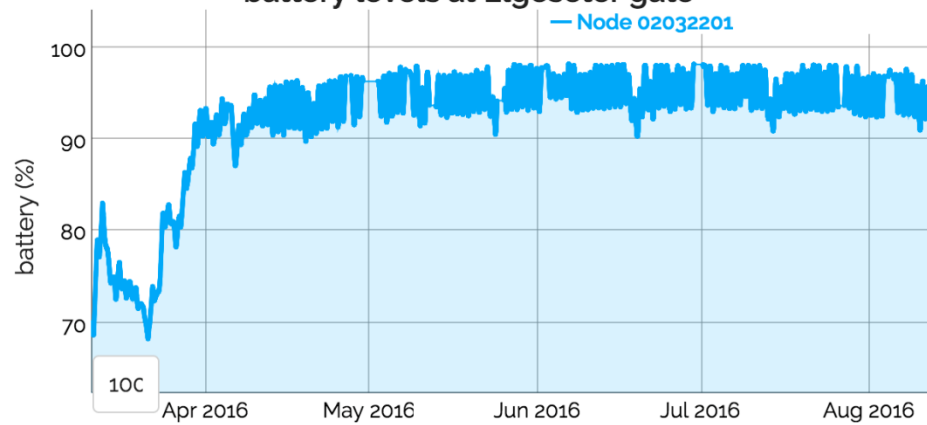




co2 levels at Elgeseter gate



battery levels at Elgeseter gate





HEGGDALEN

BRATTØRA

NYHAVNA

VOLDSMINDE

ILSVIKA

Trondheim

LADEMOEN

NEDRE ELVEHAVN

MØLLENBERG

ILLA

2

ROSENBERG

Kongens gate

INNET

BAKKLANDET

Festningsparken

PERSAUNET

STRINDHEIM HAGEBY

FAGERLIA

MIDTBYEN

SINGSAKER

ØSTBYEN

NIDARØ

Klostergata

Parkveien

Tyholtveien

Tyholtveien

Tunggalletta

Trondheim Golfklubb

Steinberget

ØYA

Eggen

Norwegian University of Science and Technology

Høllveien

Norwegian University of Science and Technology

SVERRESBORG

Tittfredshet

BERG

EBERG

Moholt Kirkegård

ANGELLTRØA

BYÅSEN

Titfredshet

Norwegian University of Science and Technology

BERG

EBERG

Moholt Kirkegård

ANGELLTRØA

NYBORG

Titfredshet

Norwegian University of Science and Technology

BERG

EBERG

Moholt Kirkegård

ANGELLTRØA

Solhøgdevegen

Titfredshet

Norwegian University of Science and Technology

BERG

EBERG

Moholt Kirkegård

ANGELLTRØA

John Skaarvolds veg

Titfredshet

Norwegian University of Science and Technology

BERG

EBERG

Moholt Kirkegård

ANGELLTRØA

Trondheim Par3 Golf

Titfredshet

Norwegian University of Science and Technology

BERG

EBERG

Moholt Kirkegård

ANGELLTRØA

Havstein kirkegård

Titfredshet

Norwegian University of Science and Technology

BERG

EBERG

Moholt Kirkegård

ANGELLTRØA

HAVSTEIN

Titfredshet

Norwegian University of Science and Technology

BERG

EBERG

Moholt Kirkegård

ANGELLTRØA

Ecosystem

- CTT 2.0 consortium
 - NTNU, DTU
 - ICLEI-World, ICLEI-Europe, LSCE, South Pole Group, Virtual City Systems
 - Trondheim Municipality, Vejle Municipality, T:Lab, NumaScale, Sør-Trøndelag Fylkeskommune, Norwegian Institute for Air Research
- Additional local projects, collaboration with DTU, H2020 proposals, Smart Sustainable Cities initiatives

What have we learned so far?

- The ecosystem we are building is complex, buggy, and prone to rats
- Innovation projects in Smart Cities need space to fail
- Understanding the needs of the cities takes time (and vice versa)
- Low cost sensors, open systems, and Big Data analytics in combination are a promising way forward



Next steps

- Better understanding of user needs
- Adding noise and traffic measurements
- Using IR drones to map woodstove emissions and numbers in Vejle
- Data validation
- Integrating air quality and CO2 data into existing decision support/planning support systems (3D)
- Utilise remote sensing data from NASA, ESA, JAXA, and TanSat.
- Creating more citizen observatories
- Engaging students (Thora Storm) to work with sensors, systems, and data analytics to learn

Climathon



Join the Climathon movement,
drive climate action in Trondheim!

Climathon brings together the challenges of the world's cities with the people who have the passion and ability to solve them.

Climathon is a global 24-hour climate change event organised by Climate-KIC which will take place simultaneously in 121 cities around the world on **28 October 2016**.

Bring your ideas and develop them into measurable, integrated and engaging solutions.

#Climathon
climathon.climate-kic.org

Climate-KIC is supported by the
EIF, a body of the European Union



TRONDHEIM KOMMUNE

 **NTNU**
Kunnskap for en bedre verden





Dirk Ahlers

dirk.ahlers@idi.ntnu.no

<http://carbontrackandtrace.com/>

<http://smartsustainablecities.org/>

<https://www.ntnu.edu/smartcities/>

 **NTNU**

Norwegian University of
Science and Technology



Climate-KIC is supported by the
EIT, a body of the European Union