The transition from smart building to smart city scale

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Buildings and cities has a central role

- Urbanization is on of the big megatrends (93% of the urbanisation in developing countries)
- 78% of European citizens are living in cities (54% globally)
- 85% of GDB in Europe (70% globally) is created in cities
- 90% of all innovations are cone in cities
- At the same time over 70% of all CO2 emissions are originated from cities

UN New Urban Agenda first time includes smart cities

Smart city is not a value as a such, but it enables

- Good living
- Resource efficiency
- Economic growth

Smart city is not an admistrative region.

A city has many systems and sub systems which are interlinked and interconnected

- Both system design and operation are in system level, with multi objective optimization
- Since many systems are connected the decision making and leadership processes need to change.
- In addition the business models are in transition (many stakeholders, new eco-systems)

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Everything is connected

Every second 127 devices are connected to the internet

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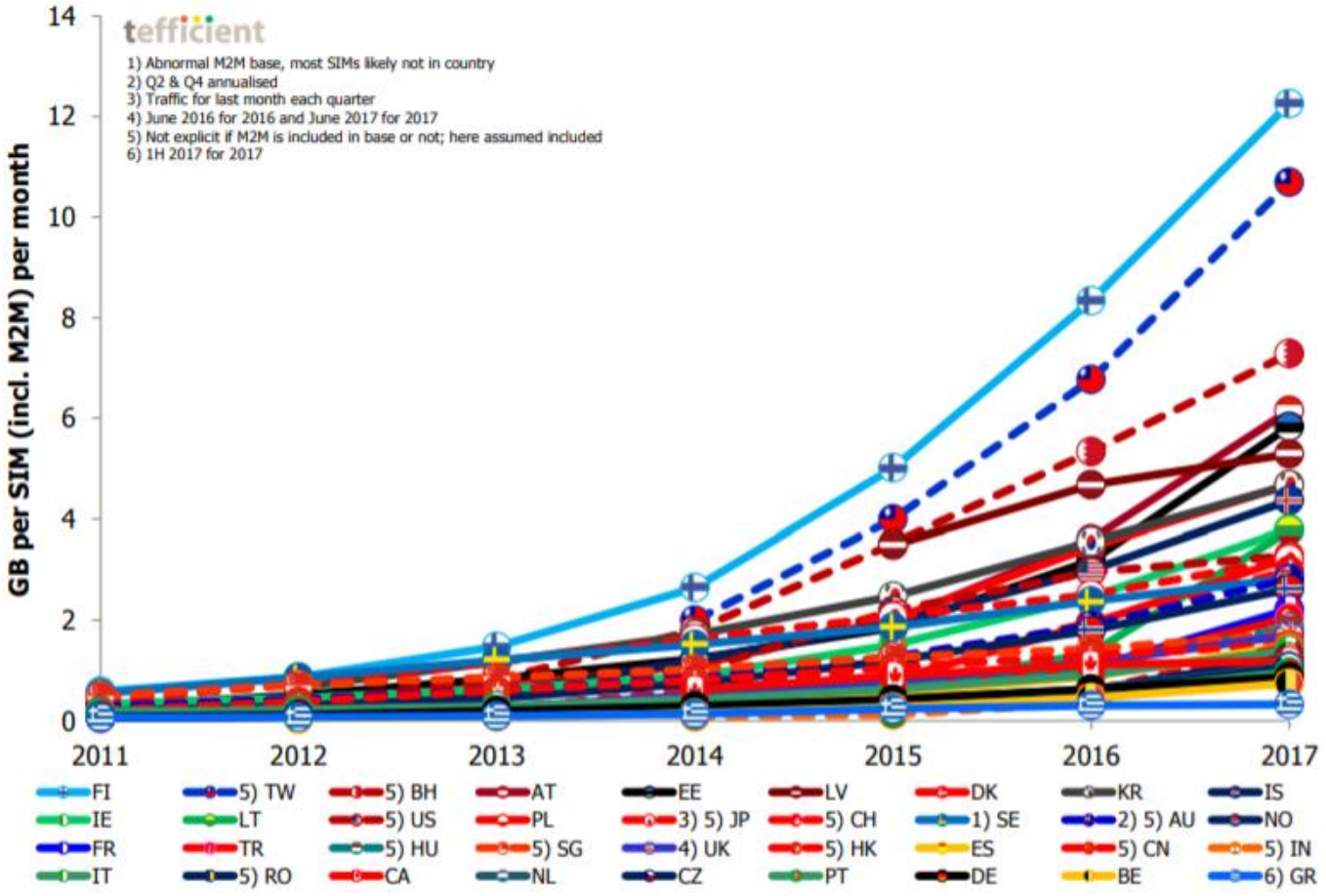
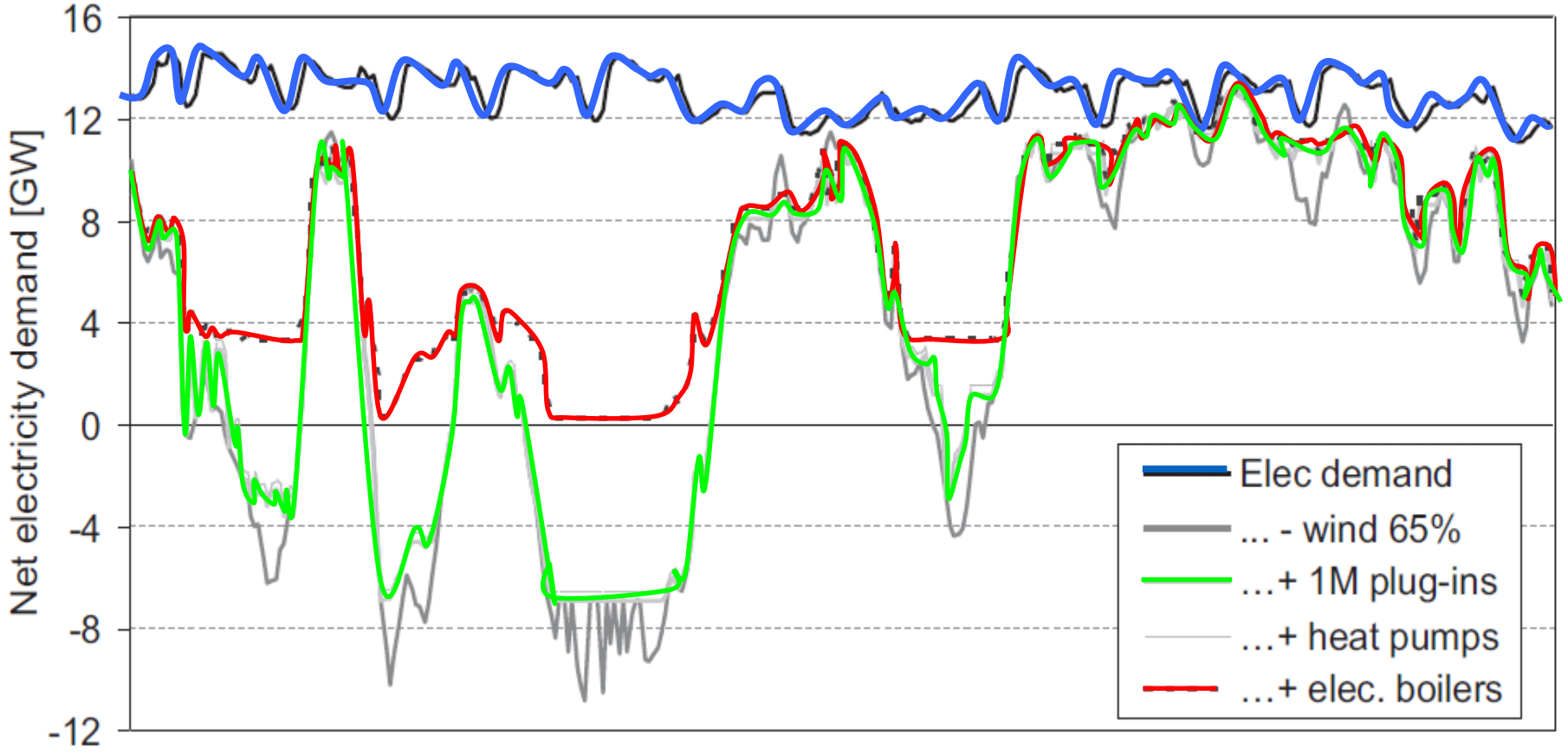
Use of mobile data per SIM



Energy system is changeing



Source: Kiviluoma J, 2013, VTT
http://www.vtt.fi/inf/pdf/science/2013/S35.pdf

City development

Dynamic simulation of different technology options in building and energy planning

Intelligent control algorithms based on real time data and demand side management can decrease CO_2 emissions remarkably

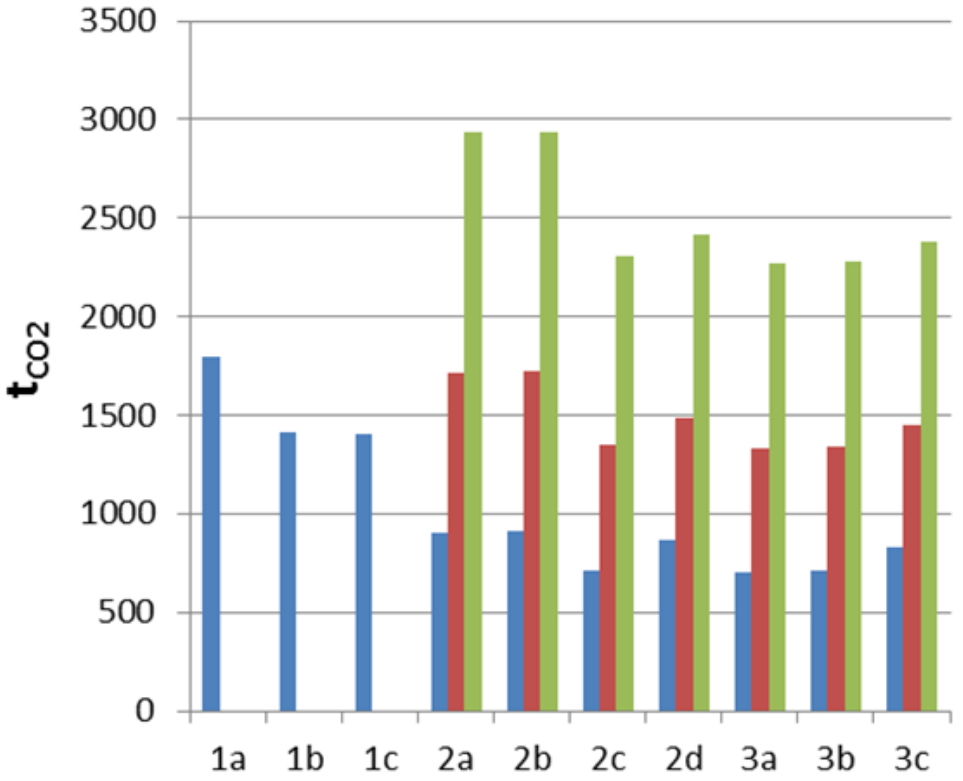


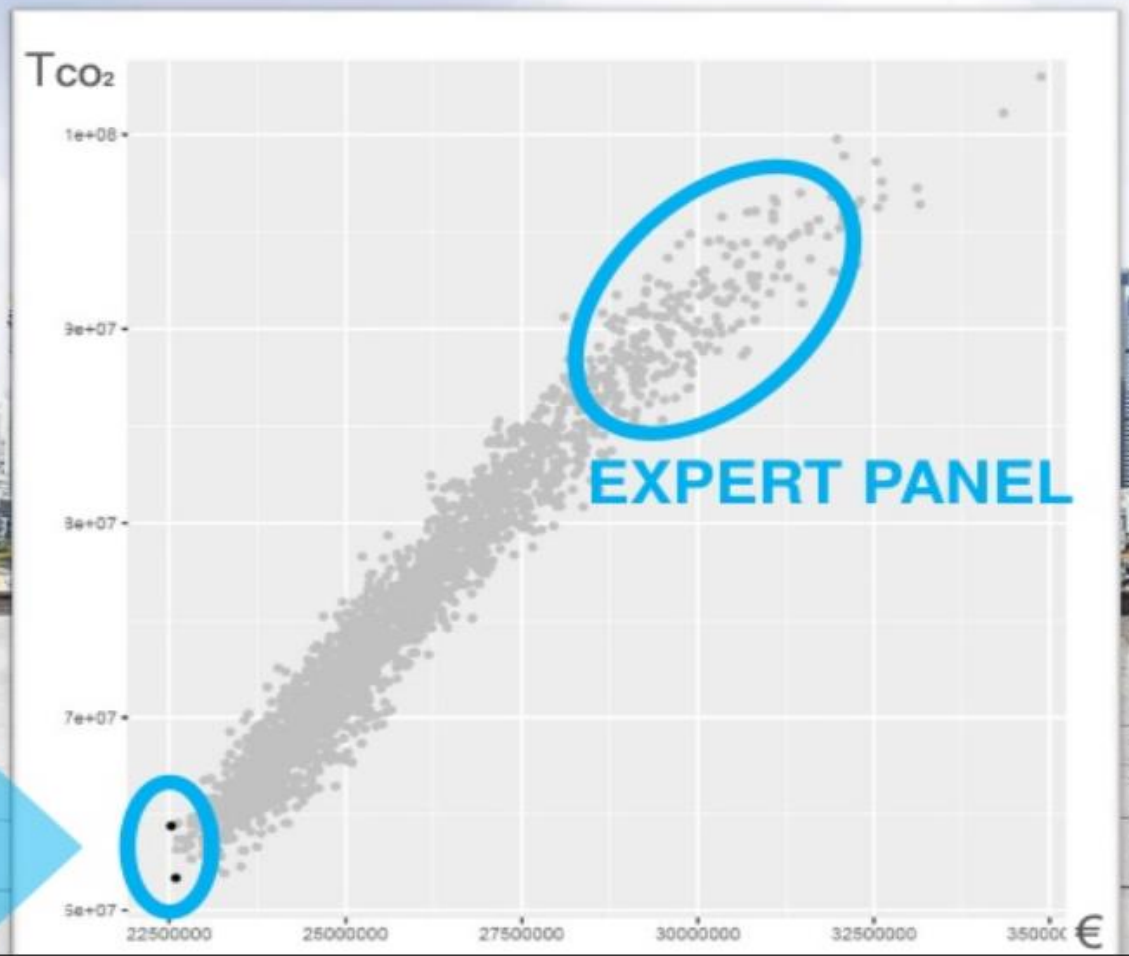
Figure: VTT Co-ZED-project

AI-assisted energy planning

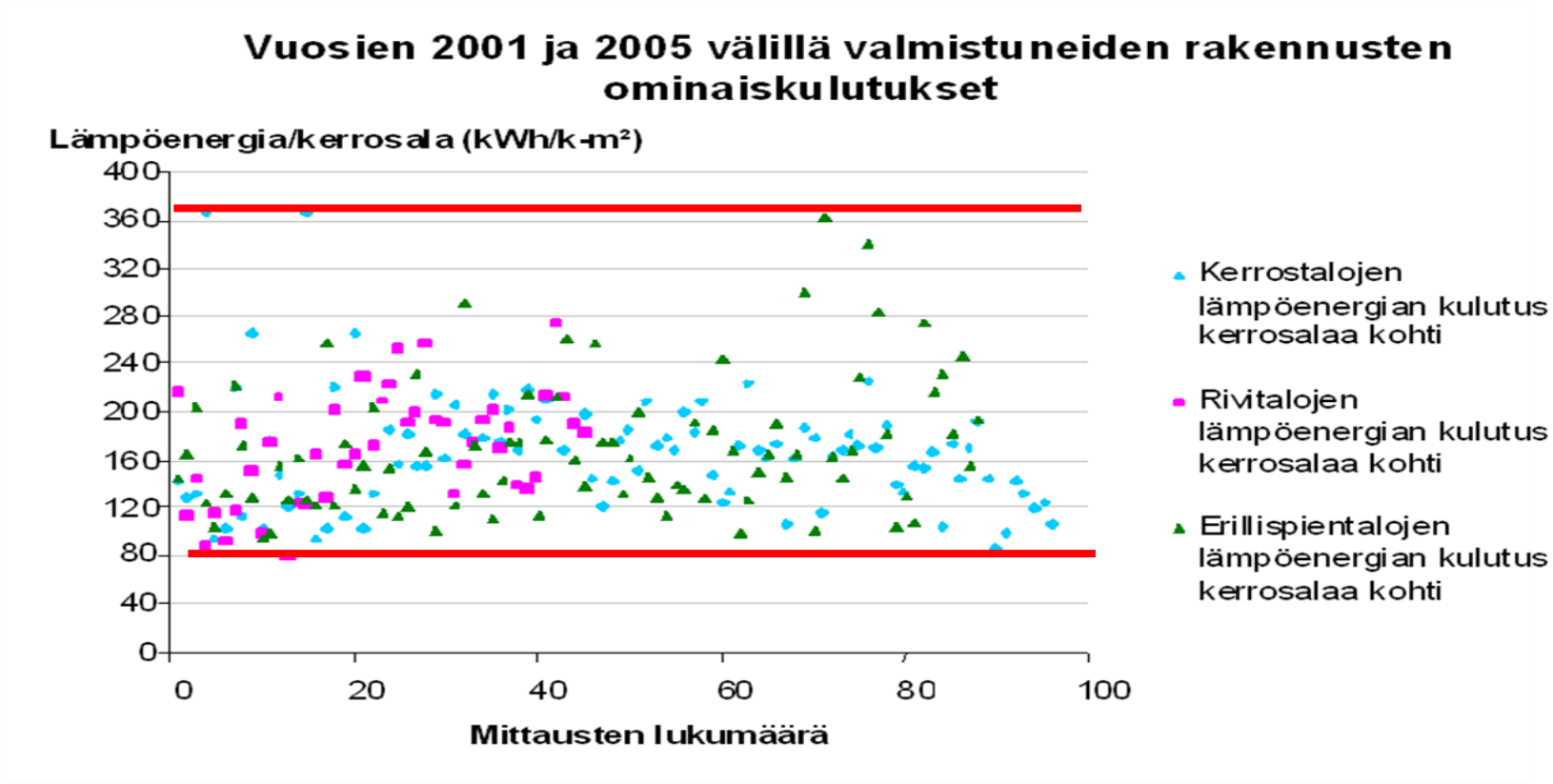
Case example: Östersundom

- Lifetime cost **14–17 %** smaller after optimization
- CO_2 emissions were **29–32 %** smaller
- Planning was supported by a genetic algorithm that went through **2 000** scenarios in 4 hours

AI-assisted Energy Optimization



User behaviour has a high impact on energy consumption



Source TTY

Moving from internet of things to things of meaning

- Buildings have tens of thousands data points. We need M2M reading
- Combining data from different sources give rich overall picture and new knowledge
- The role of new technologies is high in building stock transformation
- Only the energy management of the buildings is estimated to be globally 5.5 mrd. US $ at year 2020

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Drones

- Location
- Site management
- Quality control
- Maintenance
- Last mile services

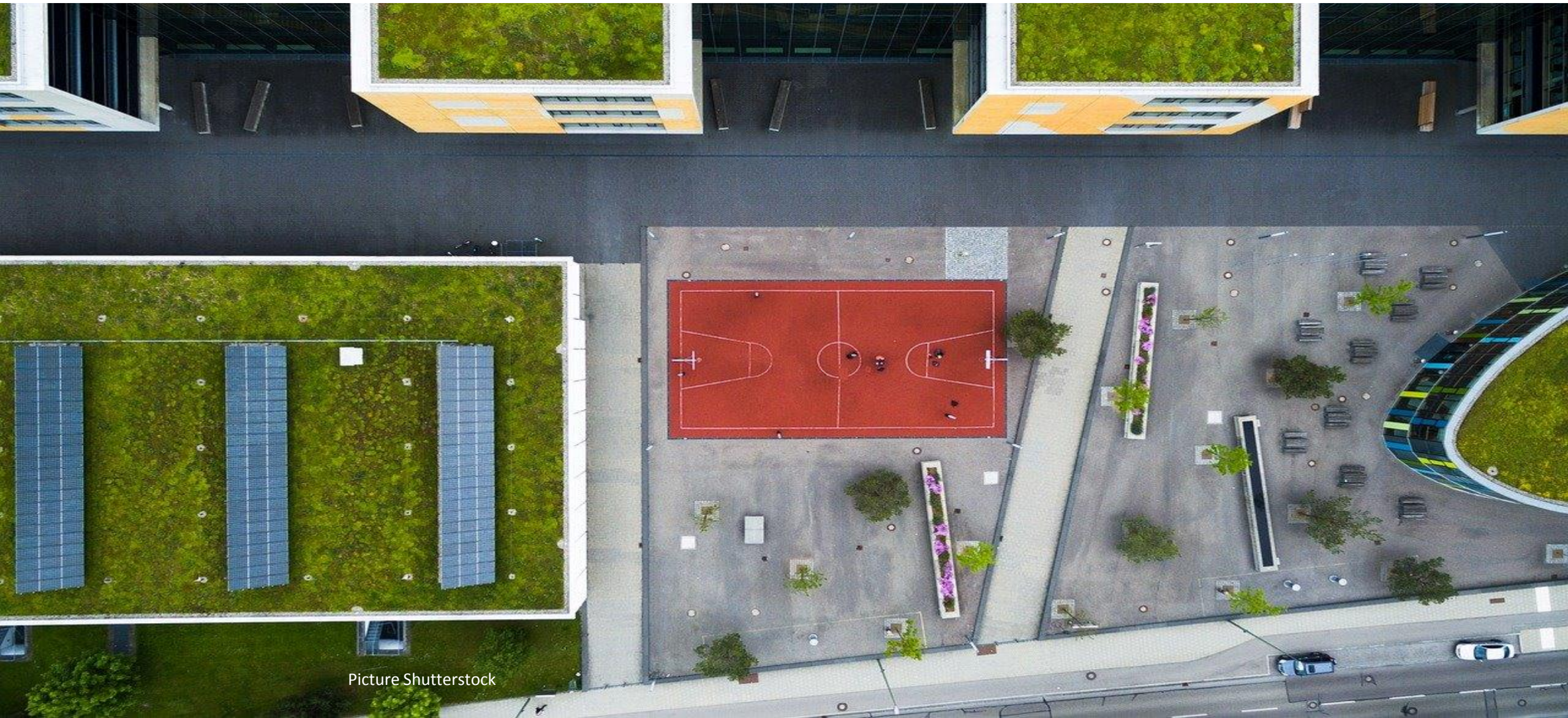
Picture Drone Services Canada Inc.

What kind of city and to whom?

- Existing buildings and infrastructures in cities
- Long life span of buildings
- We are designing city structures for inhabitants who are not even born yet !
- Adaptability of buildings and infrastructures

Kuva M.Airaksinen

How to measure the performance of such a complex system like a city ?



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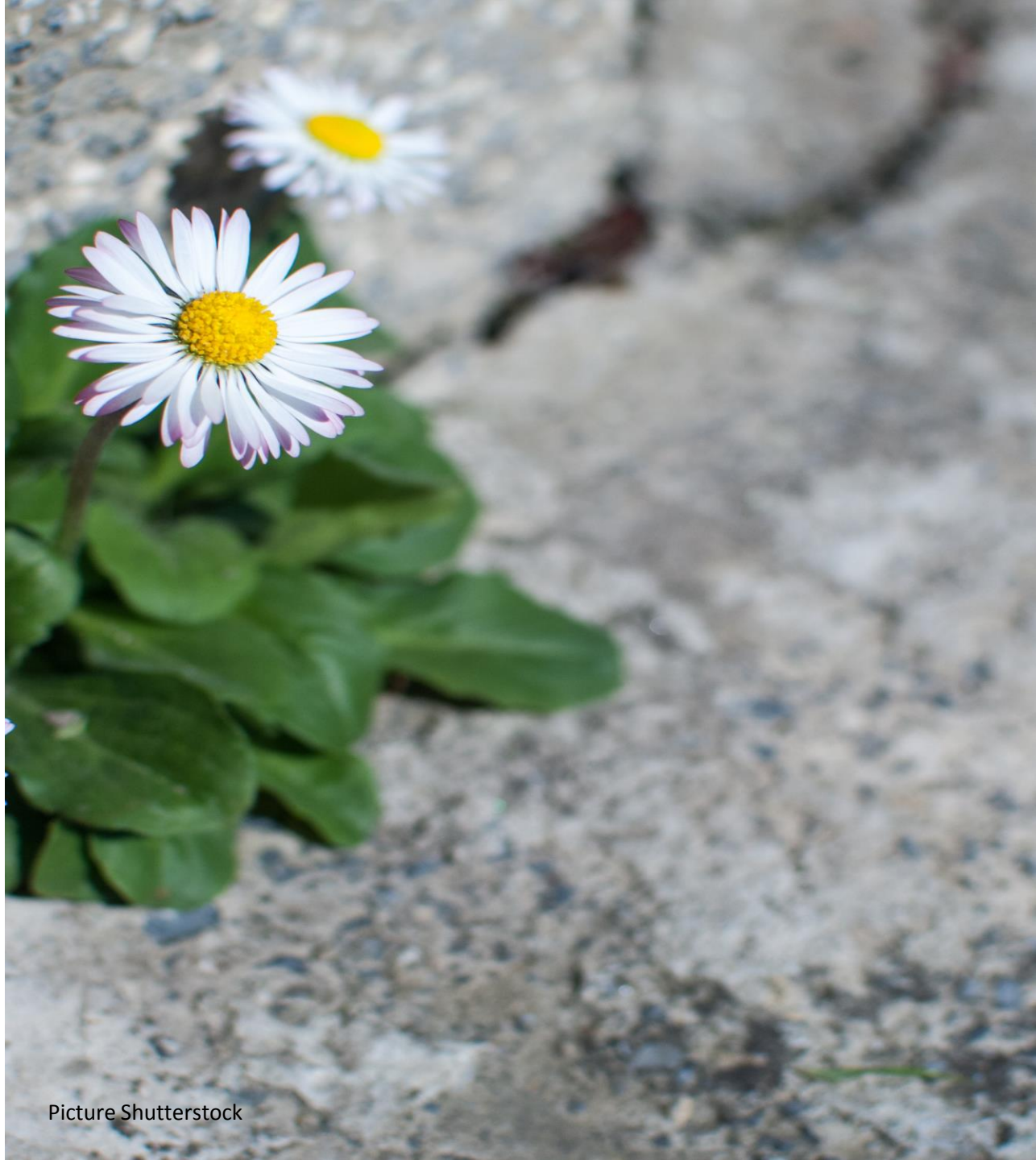
Foundation of the smart cities is the sustainability, technology is enabling better efficiency and user well-being

People	Planet	Prosperity	Governance	Propagation
•Health (3)	•Energy & mitigation (7)	•Employment (2)	•Organisation (6)	•Scalability (10)
•Safety (4)	•Materials, water and land (10)	•Equity (2)	•Community involvement (5)	•Replicability (8)
•Access to (other) services (7)	•Climate resilience (1)	•Green economy (3)	•Multi-level governance (2)	
•Education (3)	•Pollution & waste (4)	•Economic performance (5)		
•Diversity & social cohesion (3)	•Ecosystem (2)	•Innovation (5)		
•Quality of housing and the built environment (6)		•Attractiveness & competitiveness (1)		

Source: www.citykeys-project.eu

Future building is resilient and active part of the whole city system

- Future adaptive building creates well-being
- New technologies like AI, printed sensors and adaptive algorithms will transform also existing stock smarter
- Smart building predicts changes and can prevent unwanted occasions



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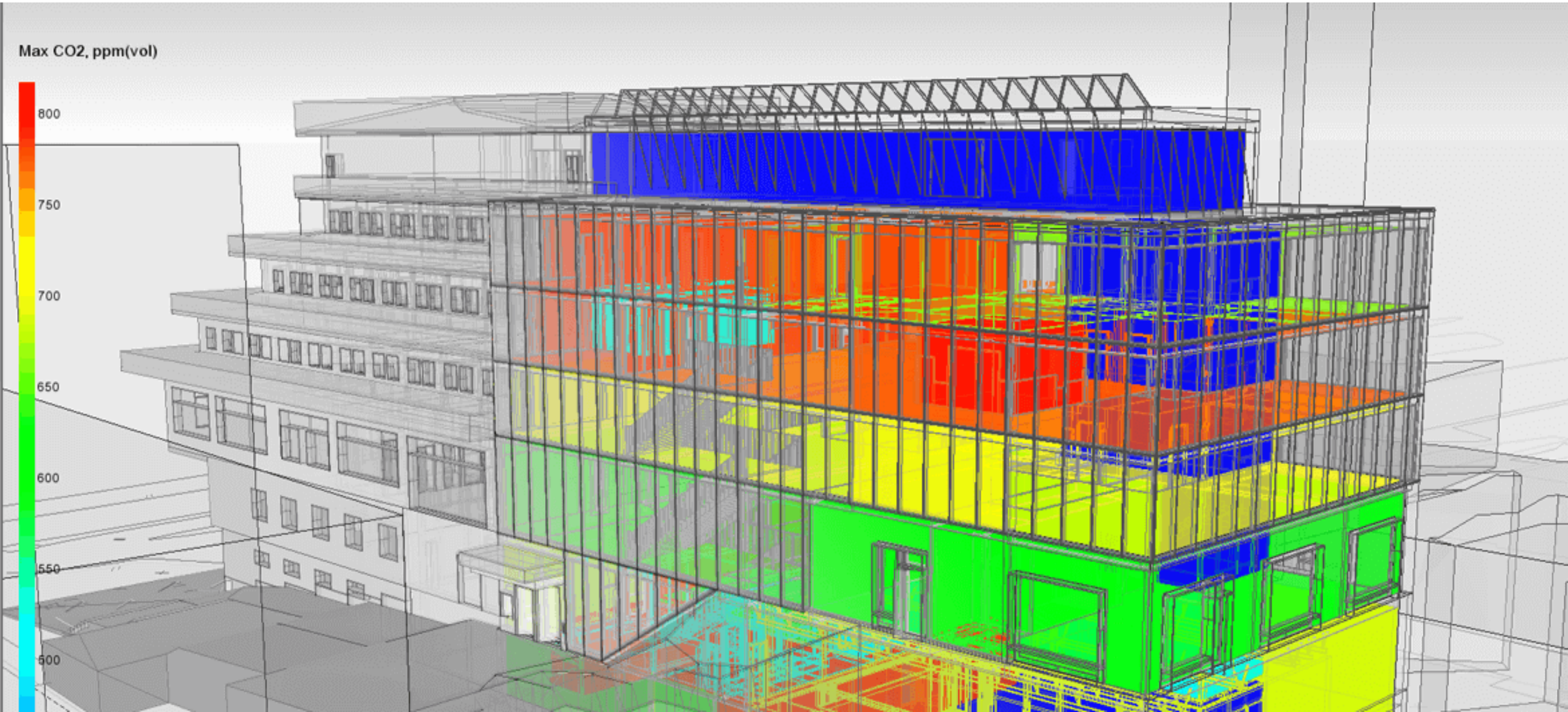
3D printing

Kuva Timo Kiukkola

Communicating roads

Building Information Models (BIM), Algorithms and Artificial Intelligence (AI)



Adaptive building

Predictive and learning system

Predictive maintenance

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Flexible space use and new models for ownership

Multi-use spaces, shared spaces

Why climate resilience is important in cities?

The economic losses caused by weather- and climate-related extremes in the 33 European Environment Agency member countries between 1980–2016 was **over 450 billion euros**.

Main reasons were:

- floods ~40%
- storms 25%
- droughts ~10%
- heat waves ~5%

The insurance coverage is 35 %.

Regarding impacts on human health, heat waves are the deadliest.

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Weather
and
user behavior

When compared to people's regular activity patterns, certain weather conditions affected people's movements and activities noticeably at different times of the day

(Horanont et al 2013)

Figure VTT

Data and privacy

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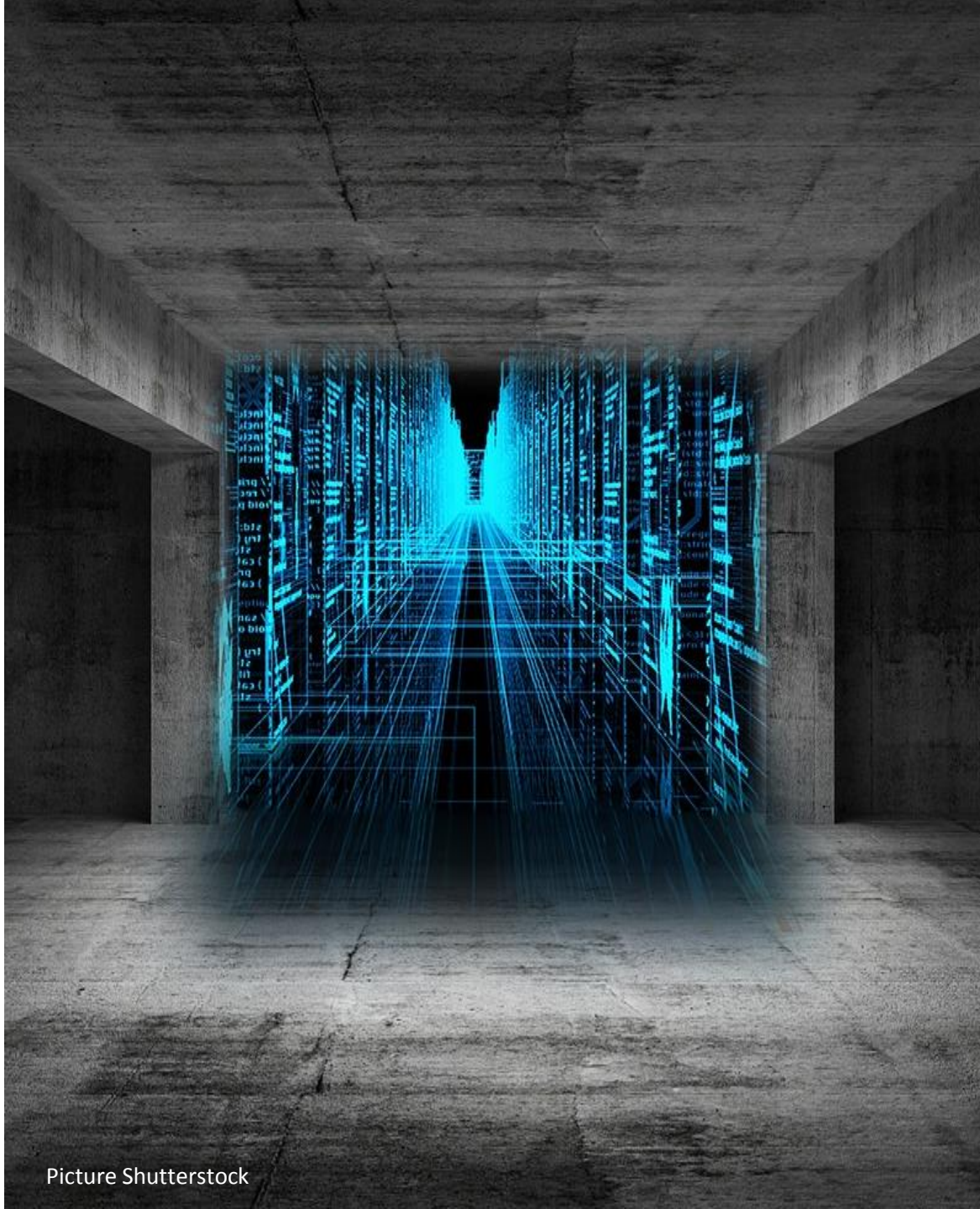
Augmented reality

Cyper security

- Only in Europe 315 million people are using internet daily
- Different domains of our infrastructures are connected
- Cyper security is a growing business area, the European market is estimated to be over 100 mrd $ (European Commission 2017)
- The amount and quality of attacts is increasing, the World Economic Forum estimated that the global costs are
  445 mrd $ yearly (WEF 2016)



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Services

Future services like
Living as a service

Just like a garden, the services are changing their color and form and they are perceived differently by different persons. Need for evolution of services.

Picture M Airaksinen

The future is always overpredicted

but underimagined

Picture M Airaksinen