Future proof sustainable building

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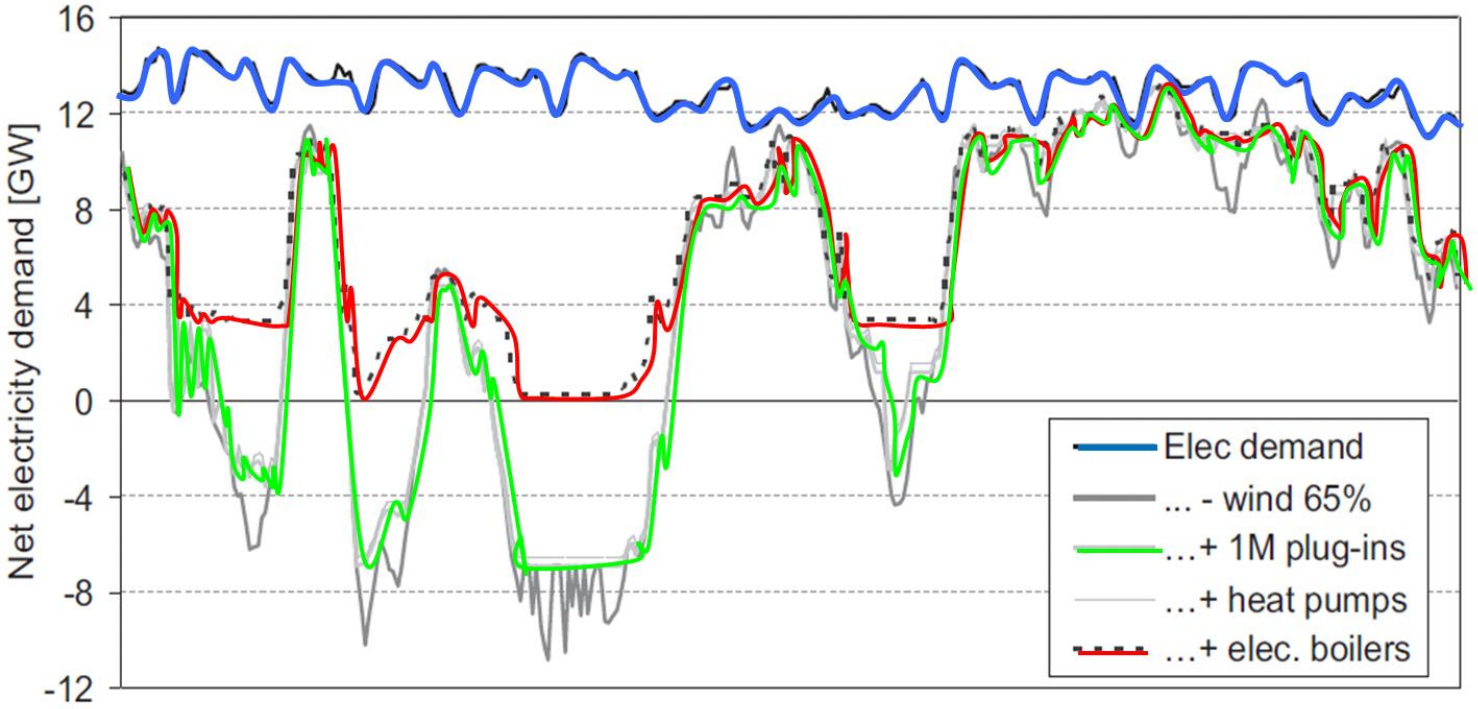
Real Estate and Construction sector

- 83% National wealth
- 60% Investments
- 15% GDP gross domestic product
- 20% Employment
- 35% Energy Consumption
- 32% CO2 ekv emissions
- 30-50% raw materials (more than any other industry)

Energy system

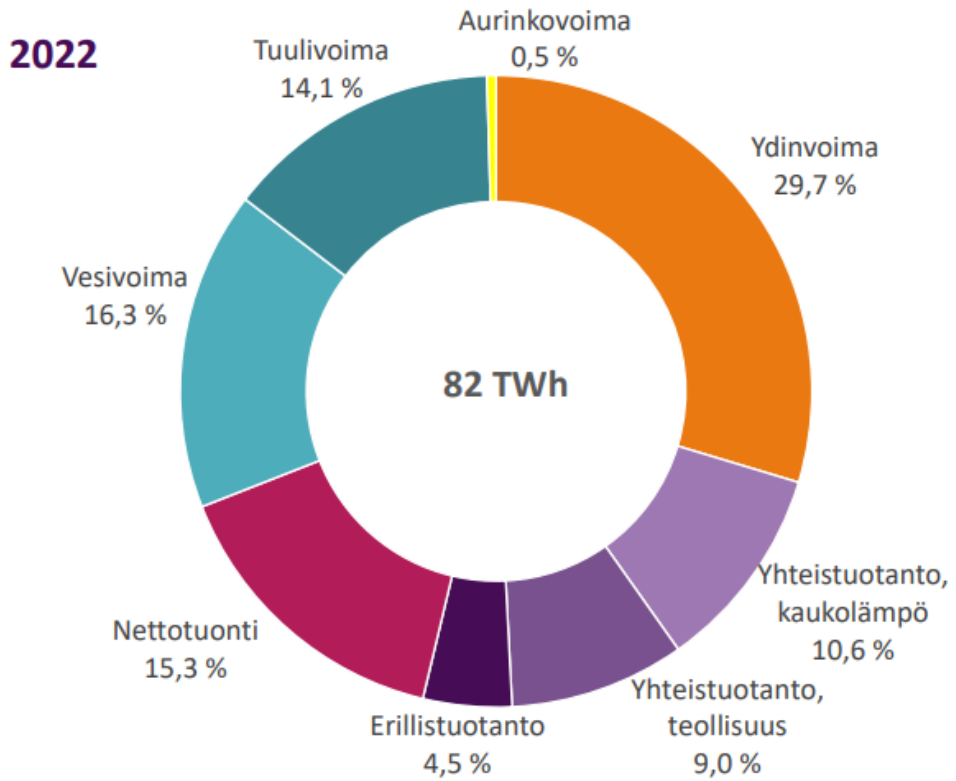
- *Fingrid estimates that in the year 2027 wind power will produce more than nuclear power. In addition, the solar power is estimated to increase at the same level as the hydropower*

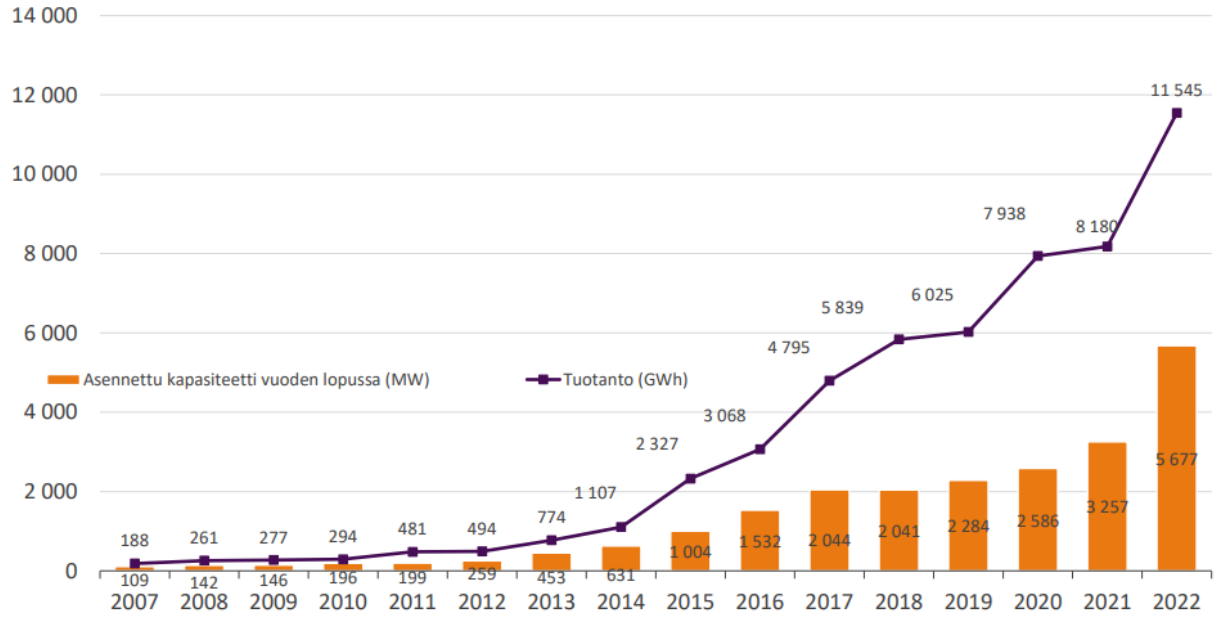
=>resiliency and demand side management is needed, as well as all other components



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

The capacity of wind power has increased 76% and the production 41%
=> need for demand side management and storages





Lähde Energiateollisuus 2023

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Power demand, we need smart buildings

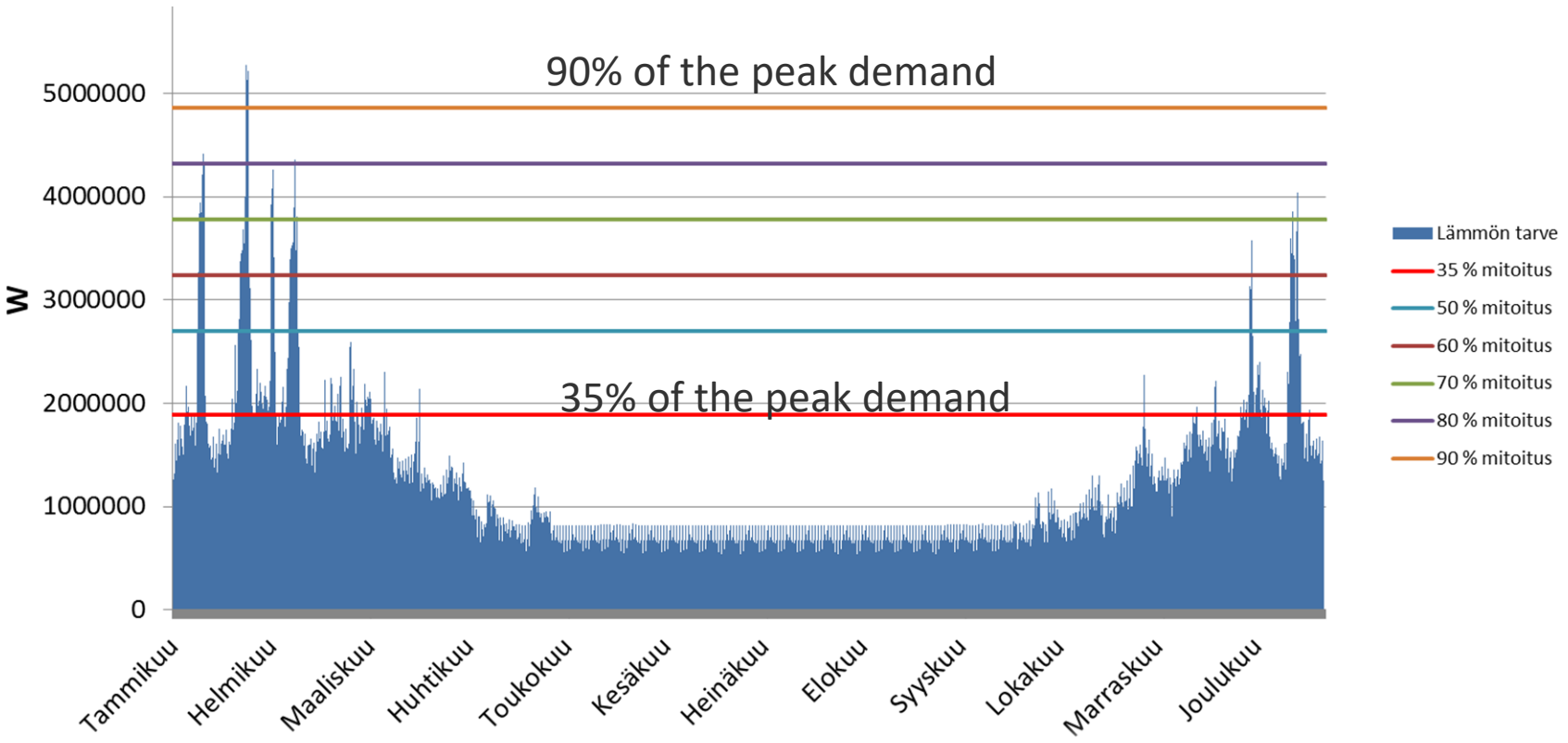

Figure: VTT Co-ZED-project

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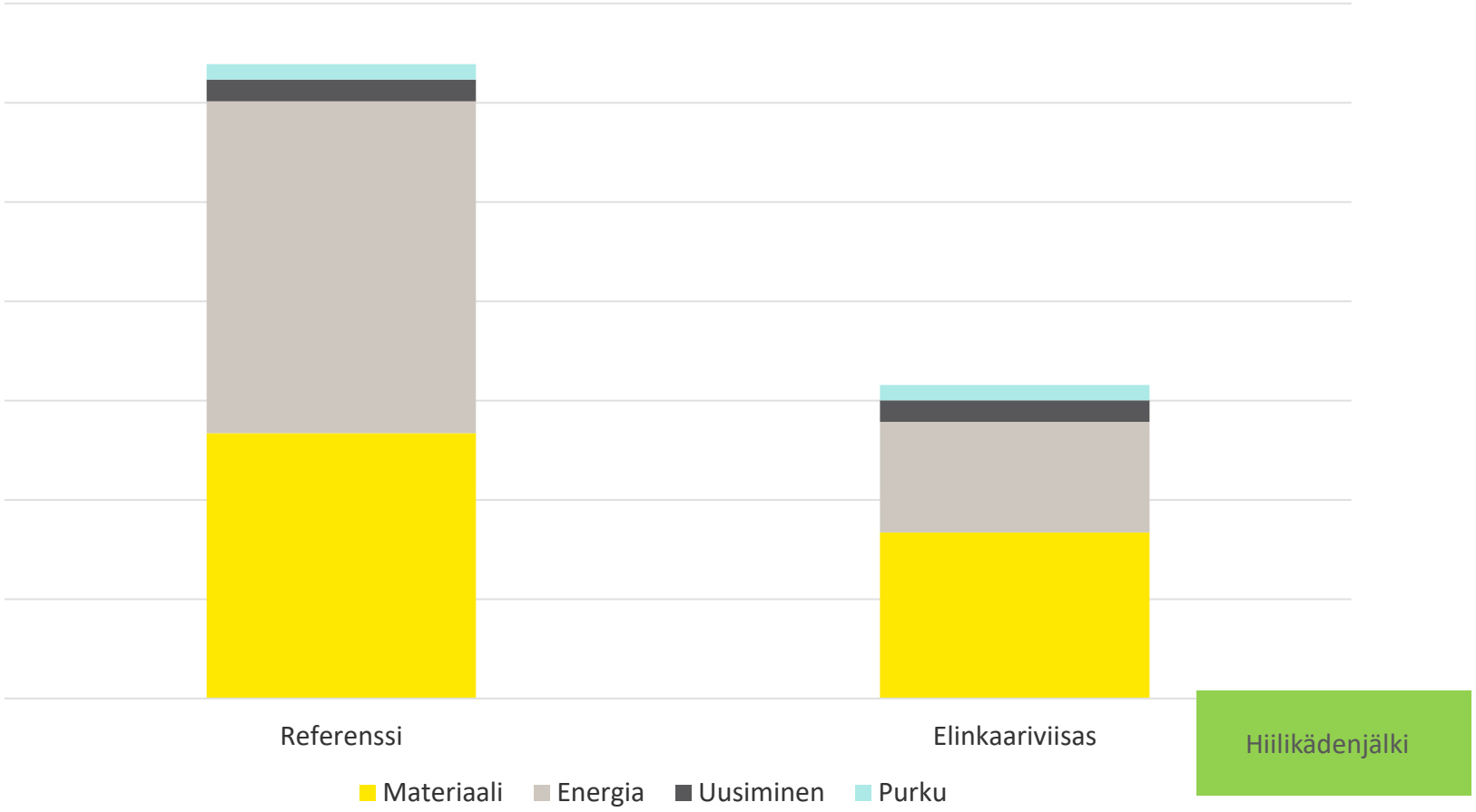
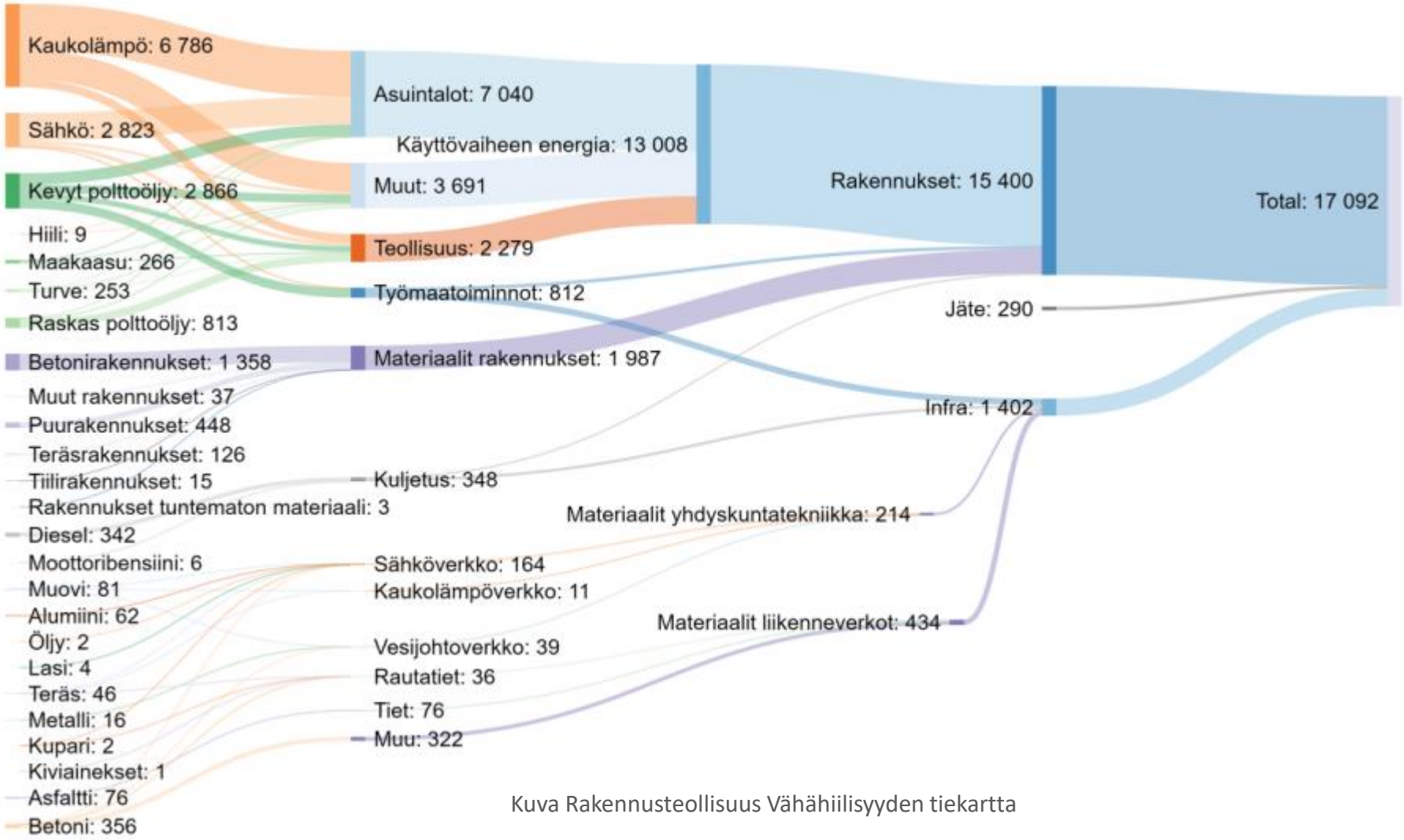
In new buildings materials have a bigger role in CO2 than before

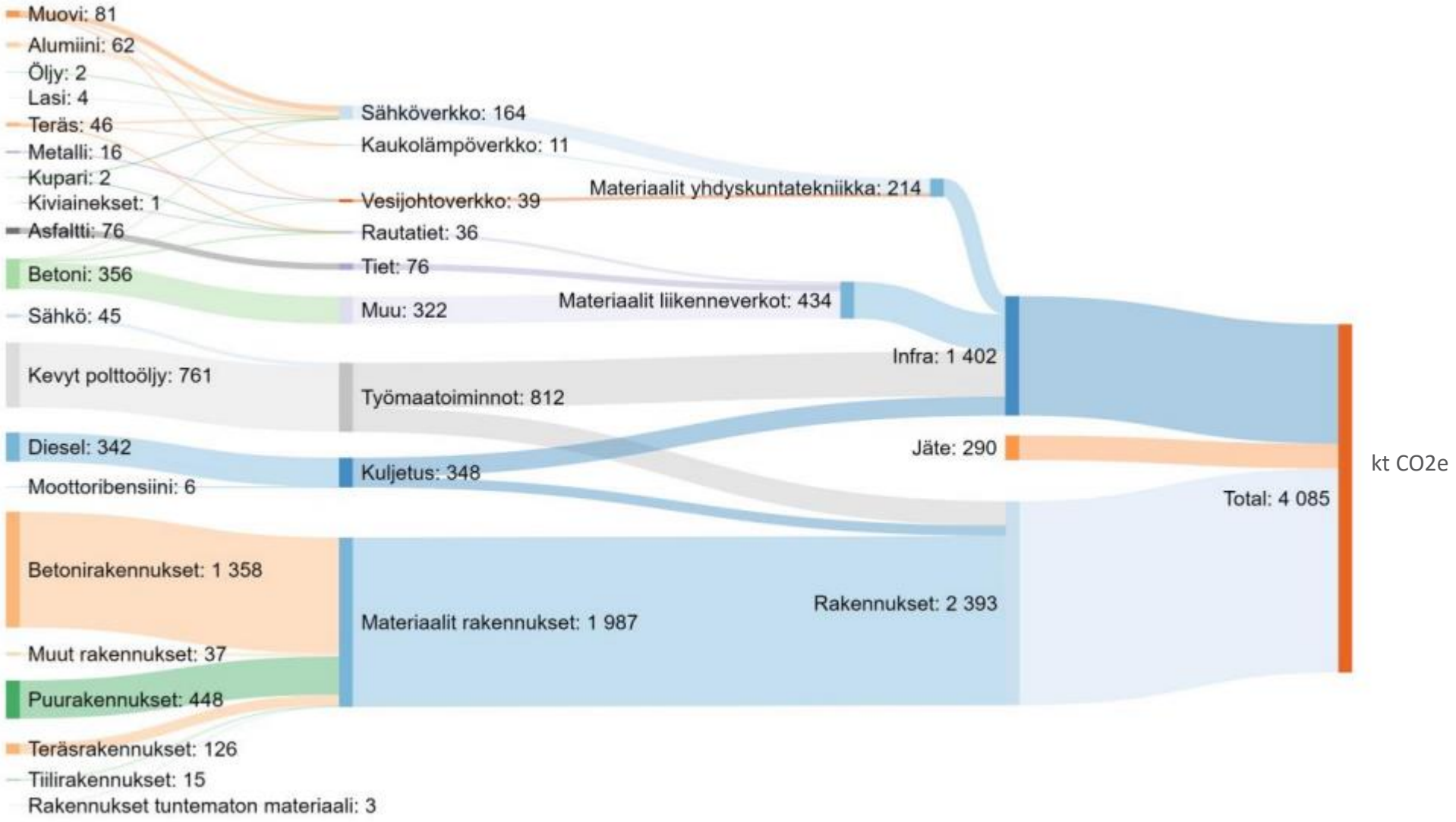


Energy use of existing buildings is still the dominant CO2 source



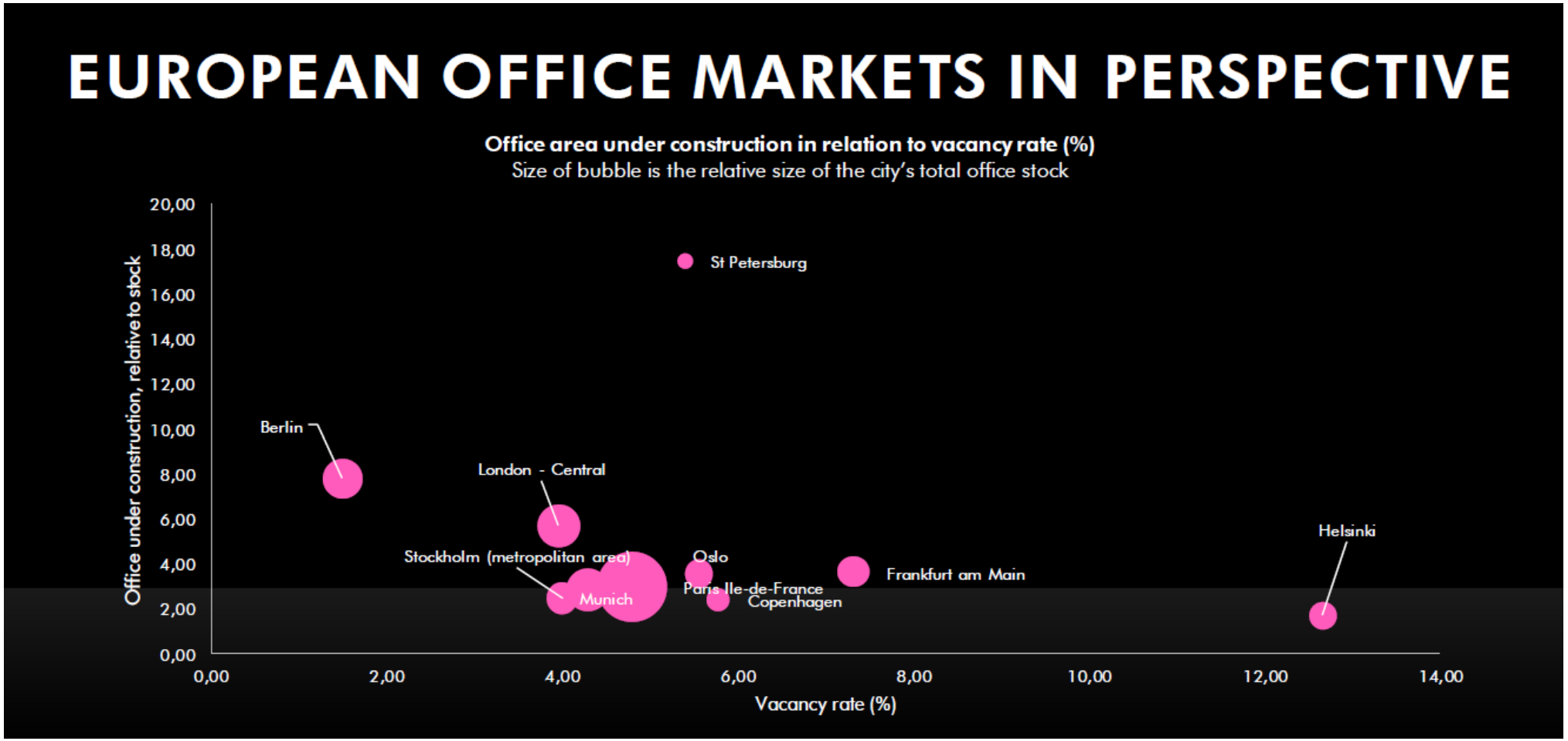
kt CO2e

Kuva Rakennusteollisuus Vähähiilisyyden tiekartta



Kuva Rakennusteollisuus Vähähiilisyyden tiekartta

Flexibility of spaces

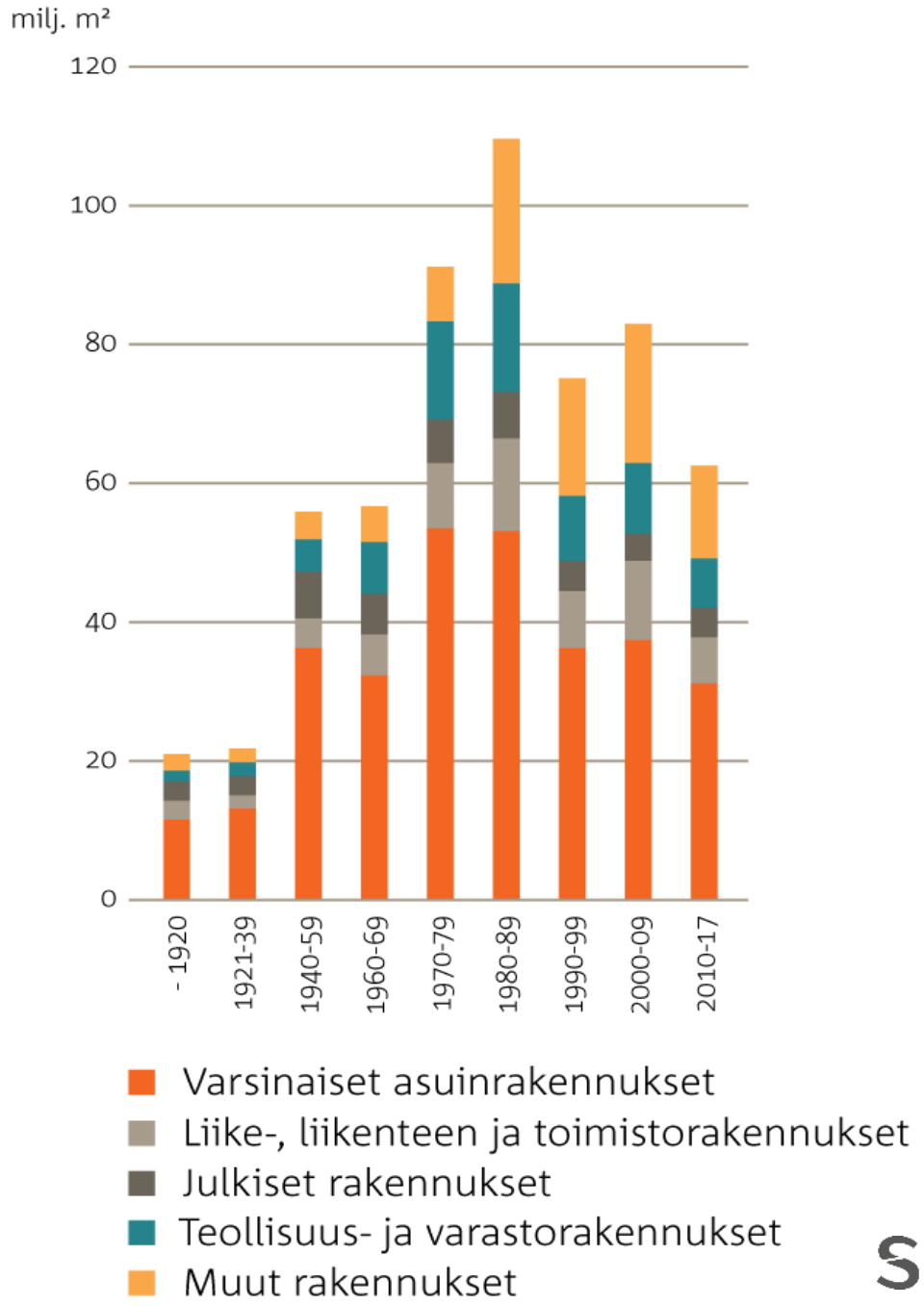


Lähde: CBRE Spark 2020, Sami Kiehelä, Amanda Welander

www.ril.fi

Renovation need is still high

- Main part our building stock is build between 1960-80 In next 10 years we need 9,4 mrd € for renovation of dwellings
- Municipal buildings need 9 mrd € for renovation
- We need new business models for the whole life cycle



In addition to renovation we are lagging behind in adaption to climate change

- Heavy rains and storms
- Wind, sun
- Raising sea level

https://www.hel.fi/static/kv/turvalliset-rakentamiskorkeudet.pdf

Life cycle wise construction site

All SRV construction sites have been net zero carbon sites from the beginning of the year 2022.

Zero emission construction site

- Energy efficiency
- Carbon neutral heating and electiricy
- Bio fuels

Circular Economy

- Minimizing raw material use
- Recycling and re-using
- Sorting waste70%
- Re-using the waste 96%

Lifecycle wisdom creates value in every project

ENVIRONMENT

0 CO_2 construction site 99% waste recovery
Always renewable energy and energy recovery
A-class Energy label
30-50% lower water use
15-40% lower embodied carbon
Recovering biodiversity

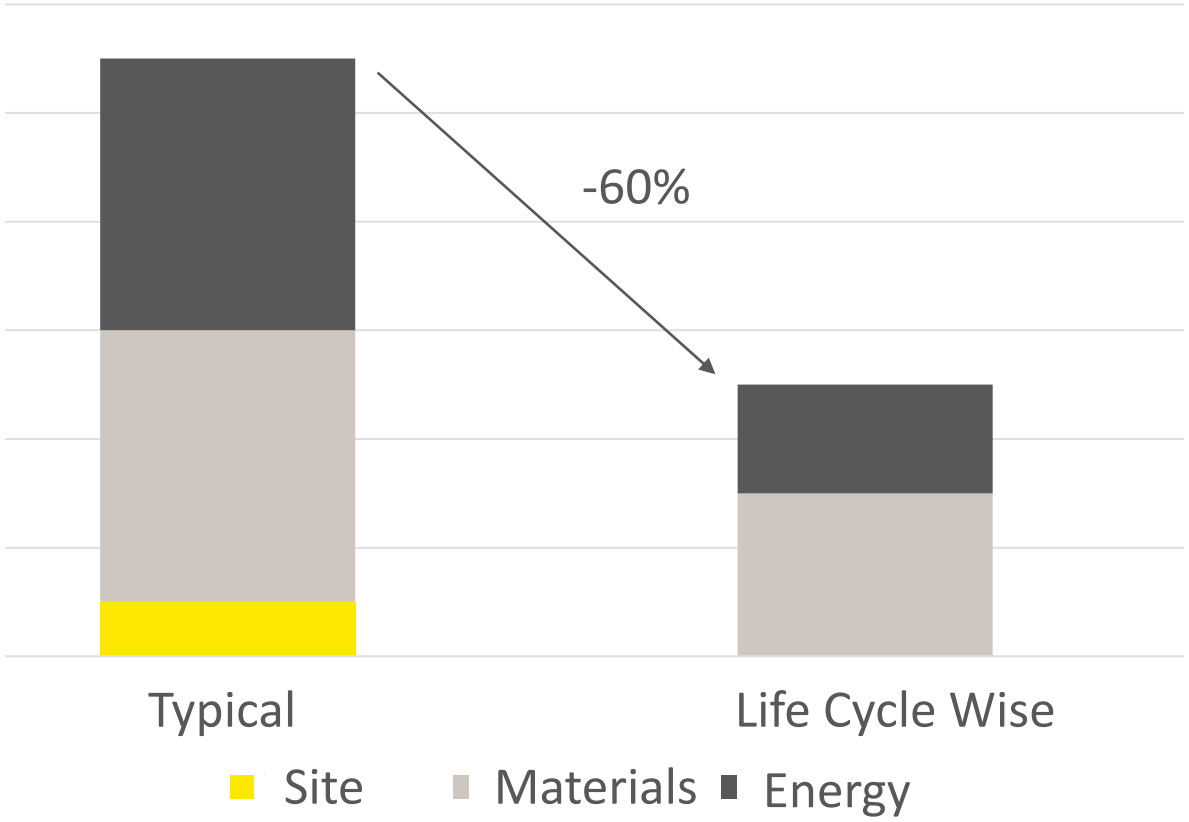
PEOPLE

IAQ classification S1 or S2
Well certification
Adaptable spaces supporting new ways of working
Urban green recovery spaces
Natural light
Haptic environments
Connectivity and services

FINANCIAL VALUE

LEED, BREEAM or RTS certified
25-35% reduced LCC
Energy demand side management

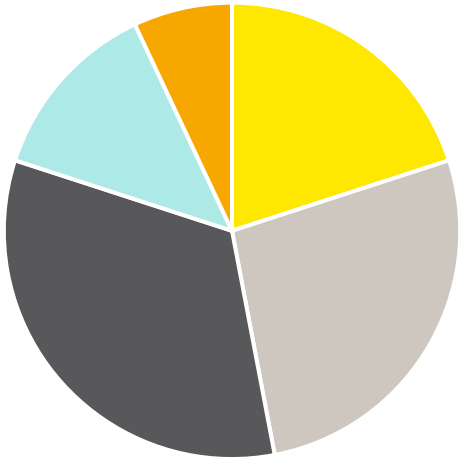
$CO_{2\ ekv}$ emissions

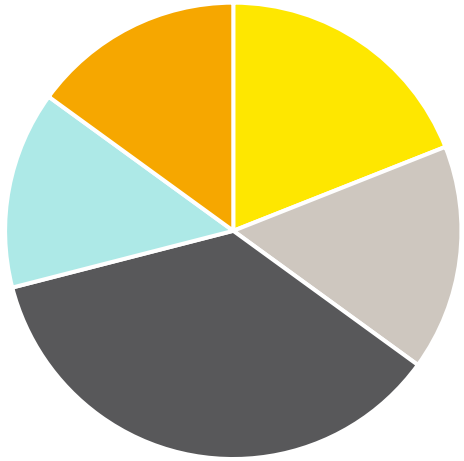


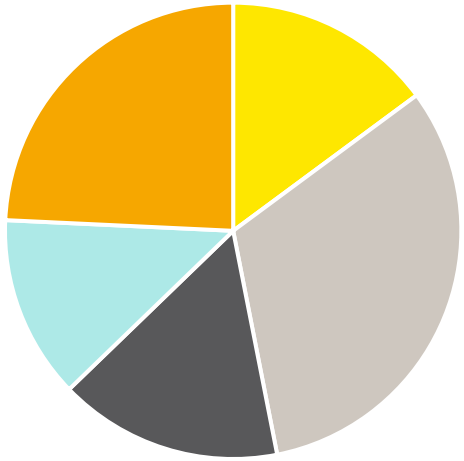
Embodied CO2

Reducing Embodied CO2:

1. Design
2. Reduced need and circular economy
3. Low carbon materials







Perustukset Pystyrakenteet Vaakarakenteet Muut rakenteet Talotekniikka Perustukset Pystyrakenteet Vaakarakenteet Muut rakenteet Talotekniikka Perustukset Pystyrakenteet Vaakarakenteet Muut rakenteet Talotekniikka

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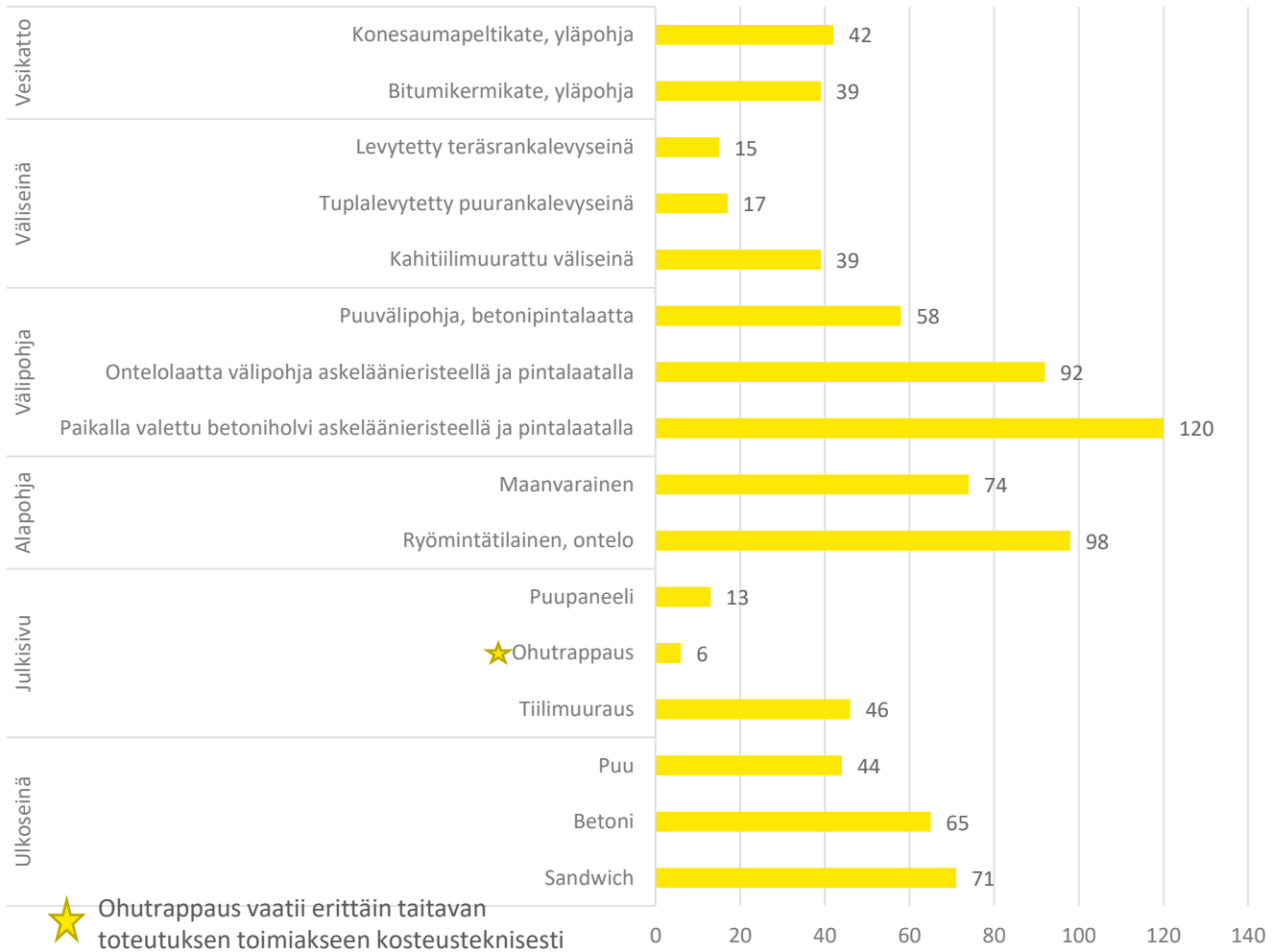
Rakennetyyppien keskimääräisiä hiilijalanjälkiä, kg CO_2ekv/m^2



Excample, Carbon negative concrete

- Carbon negativite concrete by combining an efficient carbonation process with low-carbon binders.
- Carbonation of steel industry slags and side-streams from the paper industry.
- Carbon footprint is negative: -60 kg CO2 per 1 m3 concrete. In a typical concrete the carbon footprint is 250–300 kg CO2/m3
- VTT Spin-off

https://www.vttresearch.com/en/news-and-ideas/carbonaide-aims-carbon-negative-concrete-technology

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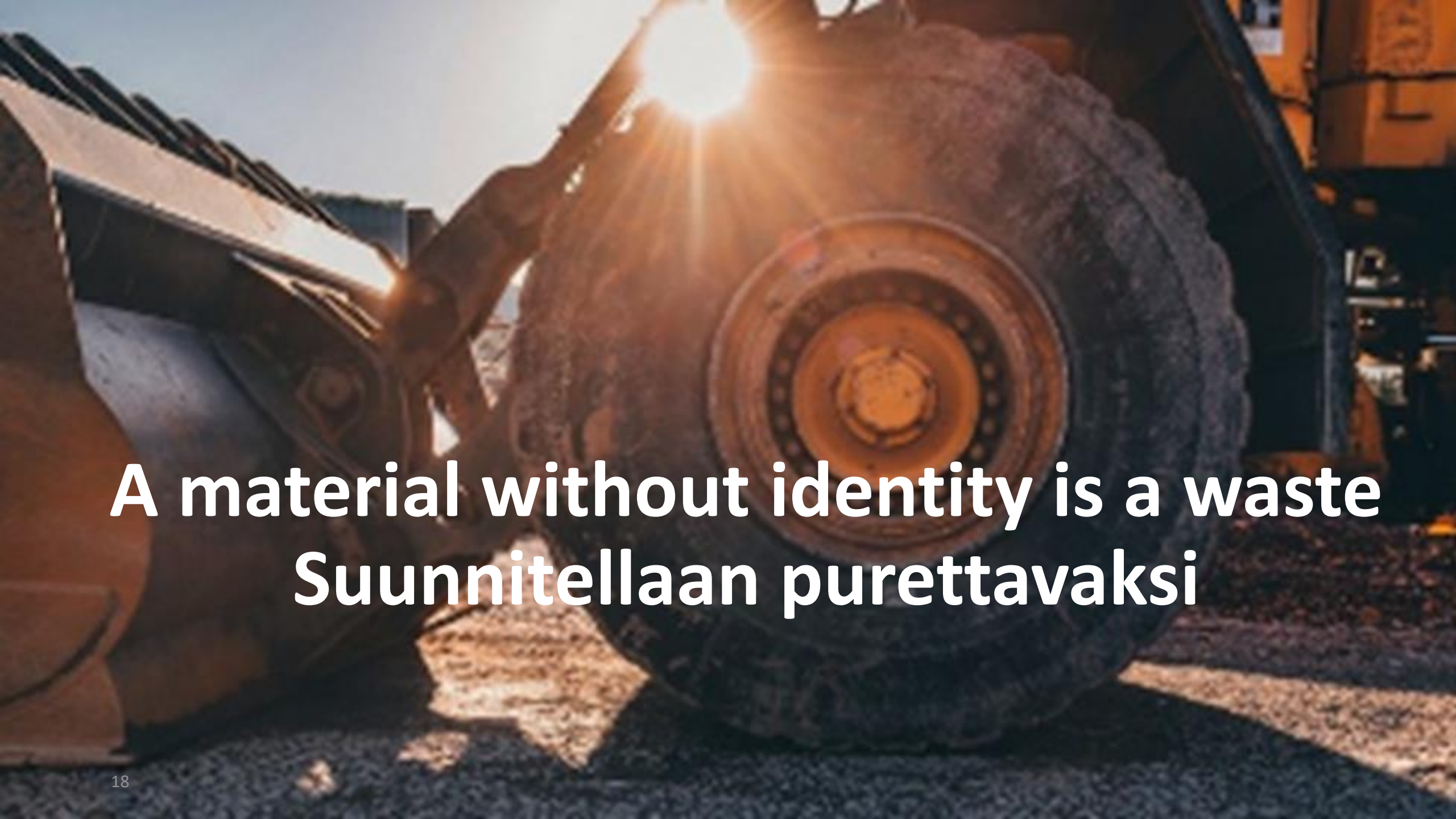


A material without identity is a waste
Suunnitellaan purettavaksi

AJANKOHTAISTA | 4.3.2022

Betonielementtien uudelleenkäyttöpilotti onnistui

Peikko ja Consolis Parma

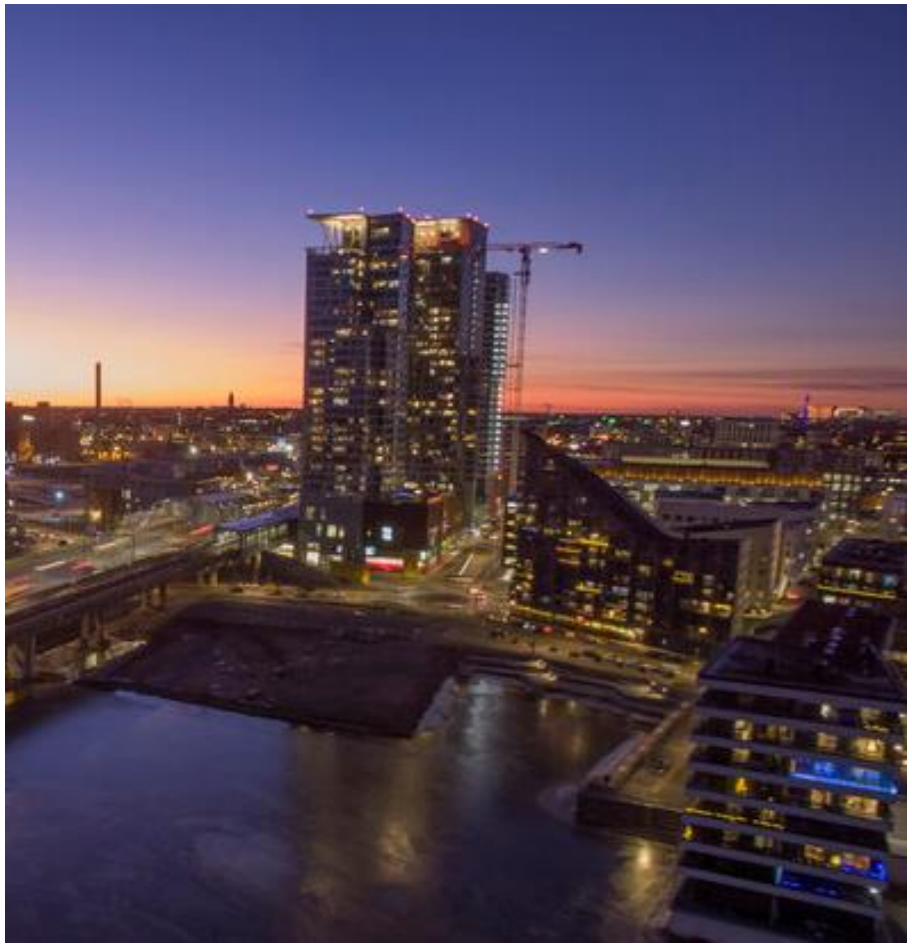
Re-using of components

- CE marking
- Harmful substances
- Quality and quantity of recycled components
- Time table, storages, logistics
- Business models

Re-used building cmponents

- Need of material banks
- Many development projects ongoing

- Helsinki curcular economy cluster, quality checks
  - tiles
  - steel
  - windows
  - doors
  - Roof tiles
- https://testbed.hel.fi/kiertotalous/kirjasto/ehjana-irrotettujen-rakennustuotteiden-uudelleenkaytto-on-nyt-helpompaa/



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Construction Biodiversity programm

Carbon neutrality, circular economy and biodiversity are supporting each others

Drivers for biodiversity loss	Examples of prevention
 Land use changes	Transfer of habitats from the construction sites to eco-system hotels, ecological bridges, increasing biodiversity in brown fields, saving biodiversity in green fields, especially trees
 Use of natural resources	Minimising material use and loss of materials at construction site (Lean construction) Circular materials and components (material reuse, recycle and material recovery)
 Climate change	Low carbon materials, renewable energy and energy efficiency including demand side management
 Pollution	Plans and good practices of chemical handling
 Non-native species	Prevention of the spread of non-native species, e.g. transfer of soil and rocks

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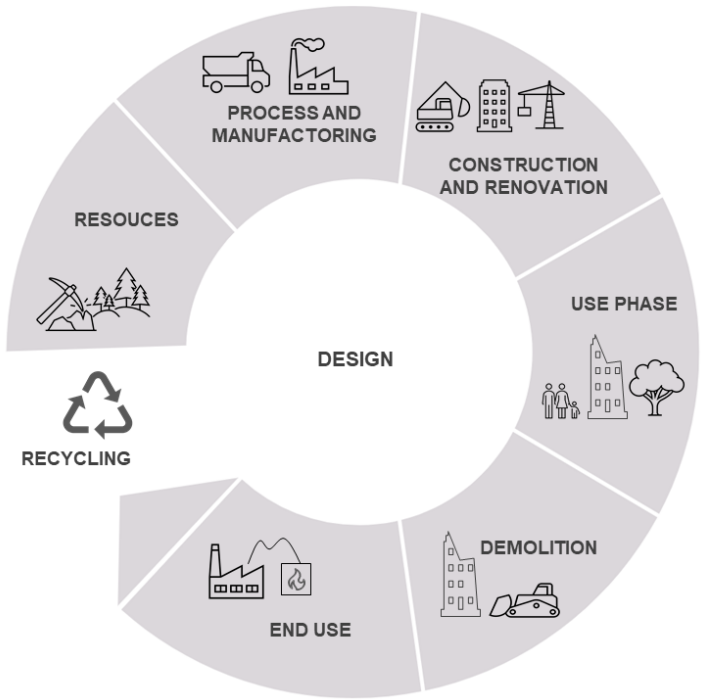
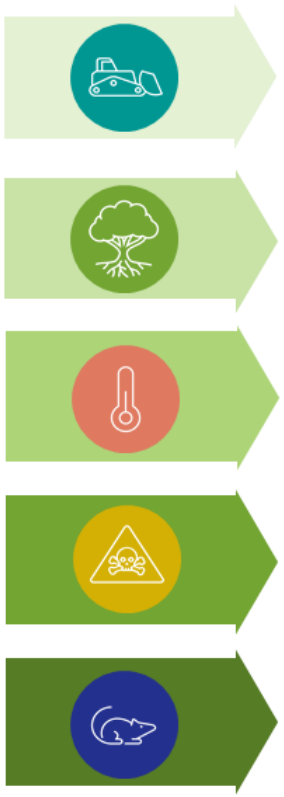
Whole value chain
Measuring and monitoring

Science based facts
Best practices
New innovations

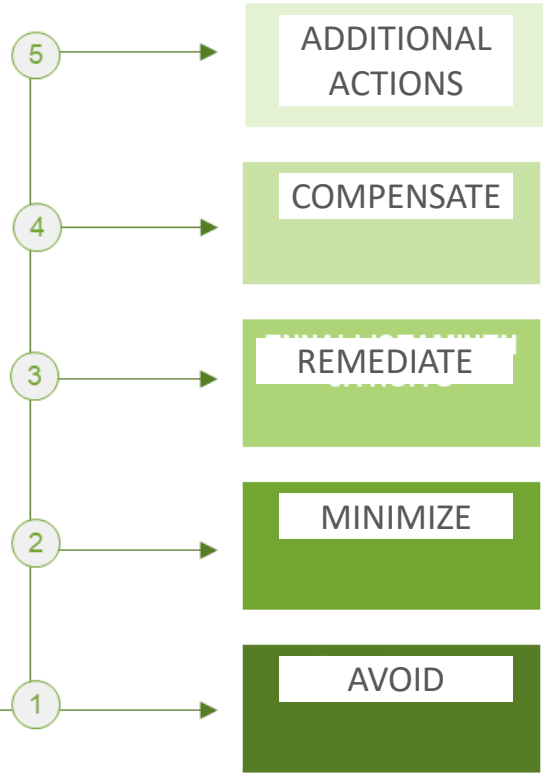
Value chain/circle



Drivers



Mitigation hierarchy



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Well-being and Biodiversity

- Green areas are increasing wellbeing and biodiversity
- In addition green areas are helping in rain water management as well as reducing heat island effects (climate change adaptation)
- Green areas also improve air quality

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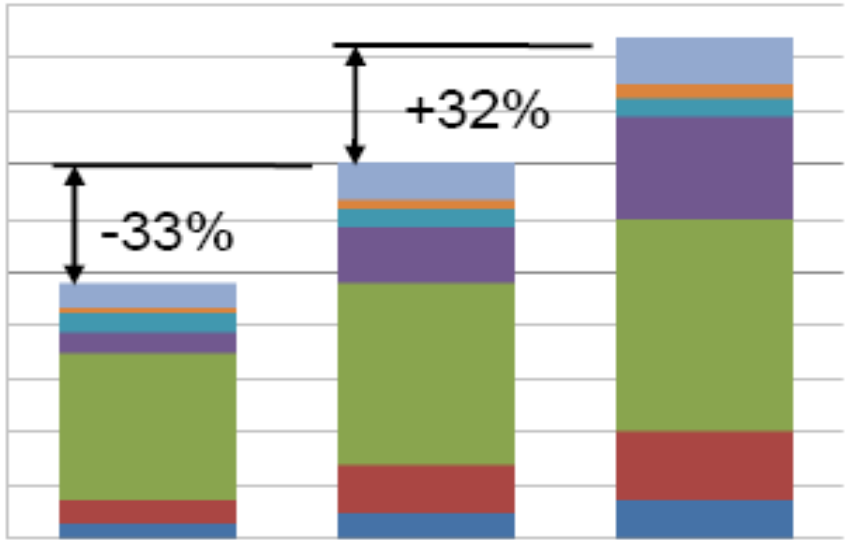
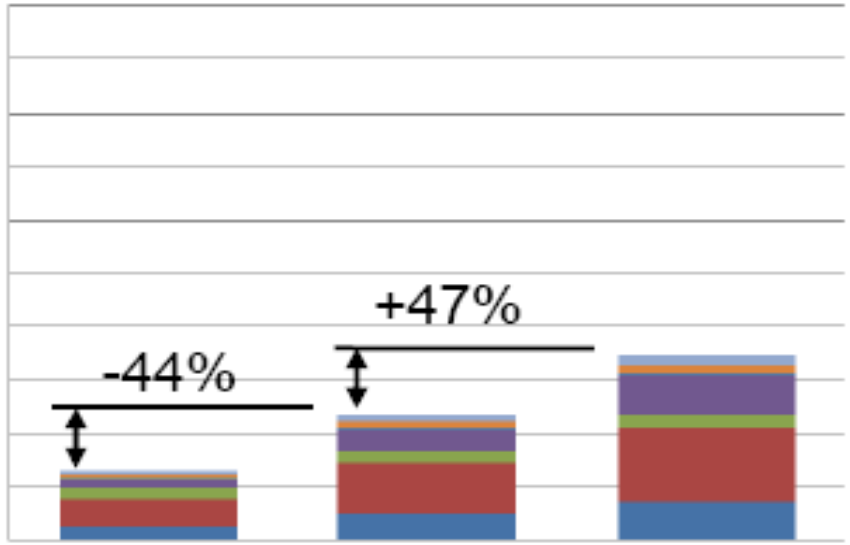
Users are important

In typical relatively new building the users influence is roughly +/-30%
In low energy building the users influence is roughly +/-50%

=> Need for smart buildings (not only for energy but also for services)



Typical rather new building



Low energy building

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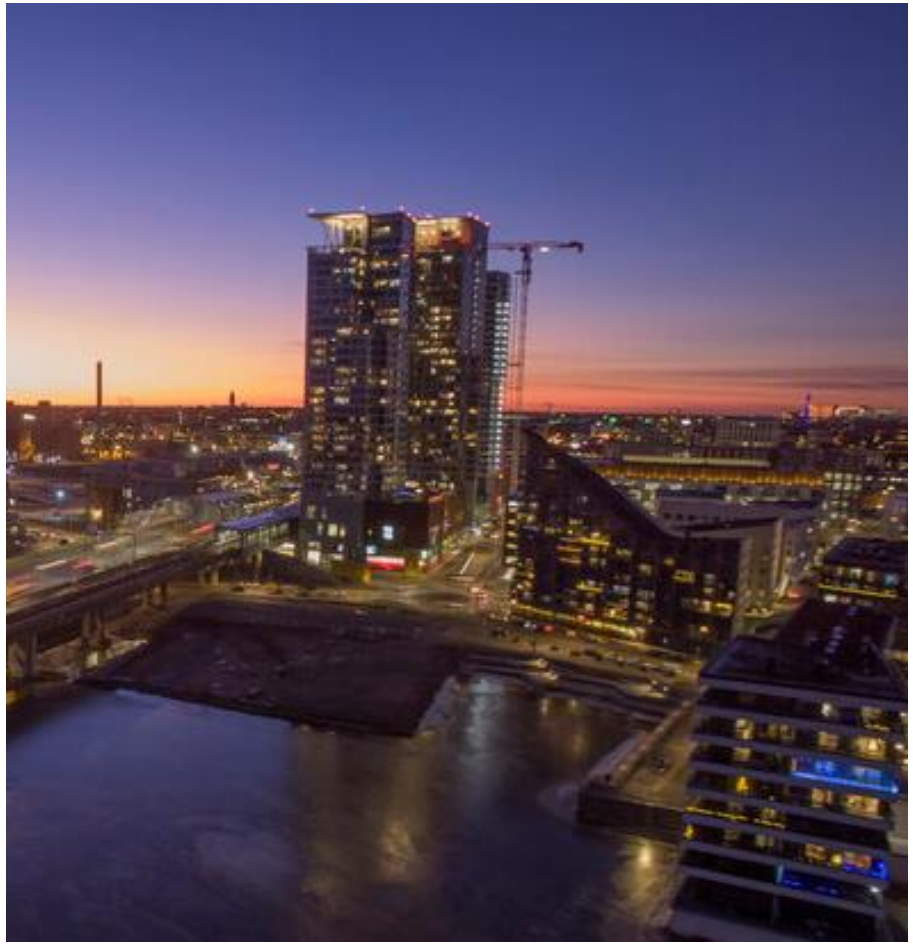
We need smart HVAC systems, predictive systems and cyber security



- According to recent research 40% of reserve power can be avoided
- Peak power deamend can be reduced at least 10-25% in offices and commercial buildings
- Predictive and adaptive systems can save 10-30% energy without compromising wellbeing (VTT Human Thermal Model)
- Need for rea time data
- The amount and quality of cyber attracts is increasing

=> Need for system level changes

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Resiliency

The importance of resiliency increases.
Resiliency against climate change (adaptation), pandemics, changes in user needs and preferences.

Need of data from difference sources and in real time

At the same time we need to consider privacy and cyber security

$$\text{Sustainability} = \frac{\text{Quality of Life}}{\text{Environmental impact} * \text{Resources} * \text{Cost}}$$

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”We shape our buildings
and thereafter they shape us.”
-Winston Churchill