



# Kaukovainio

*Innovative energy solutions in co-operation*

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**Making-City**  
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**OULU** | Yhdyskunta- ja  
ympäristöpalvelut

Oulu Capital  
of Northern  
Scandinavia



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Euroopan unionin  
Horisontti 2020 -ohjelman  
rahoittama hanke

- Lighthouse cities in Making-City:  
Oulu and Groningen
- Follower cities from  
Italy, Spain, Turkey, Slovakia, Bulgaria and Poland.
- Low-carbon energy technologies
- Horizon 2020-funded, Smart Cities and Communities
- Main coordinator: Cartif/Spain
- 2019–2023
- 5 M /20 M euros

**Making-City-  
project**

## **Arina Kiinteistöt Oy**

CO<sub>2</sub>-refrigeration and excess heat supply for DH

## **Jetitek Oy**

CO<sub>2</sub>-refrigeration equipment

## **Oulun Energia Oy**

District heating supply and delivery

## **City of Oulu**

General enabler, helps in "everything"

## **University of Oulu**

R&D: how to replicate the concept?

## **Oulun Sivakka Oy**

Sustainable rental housing

## **VTT**

Modelling and control

## **YIT Suomi Oy**

New apartment homes

## **Partners in Oulu**









MARKET



post

ARINA



APTEEKKI

P



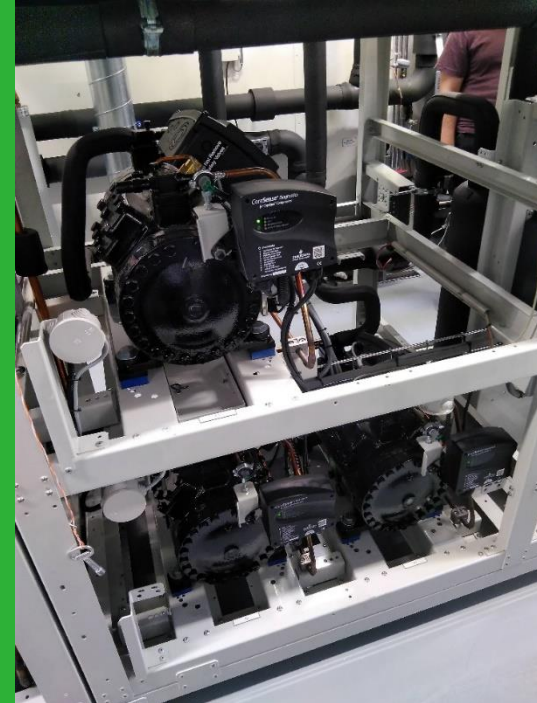
APTEEKKI

4h





## CO<sub>2</sub>-HP in Arina store



## Performance example:

- COP 4
- heat output 5 W/b-m<sup>3</sup>
- may produce >50% of heating and DHW, 24 kWh/m<sup>3</sup>



**Exhaust air  
heat pump  
for housing  
block**

- more heat from flue gas scrubber
- more electricity from CHP plant for the same heat load
- larger heat supply capacity (larger  $dT$ )
- if return DH water is heated by HP in another place, that HP has higher COP
- high COP (e.g. 6)

**District  
heating  
return water  
heat pump,  
advantages**



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## Oulu Energy, new bio-CHP

**>70% wood**  
**215 MW<sub>fuel</sub>**  
**75 MW<sub>electricity</sub>**  
**120+55 MW<sub>heat</sub>**



- Wall and roof solar panels
- AC air pre-heating/-cooling using ground under the building as a heat accumulator
- Heat recovery from wastewater
- Data collection, e.g. temperature and moisture
- Energy displays in apartments

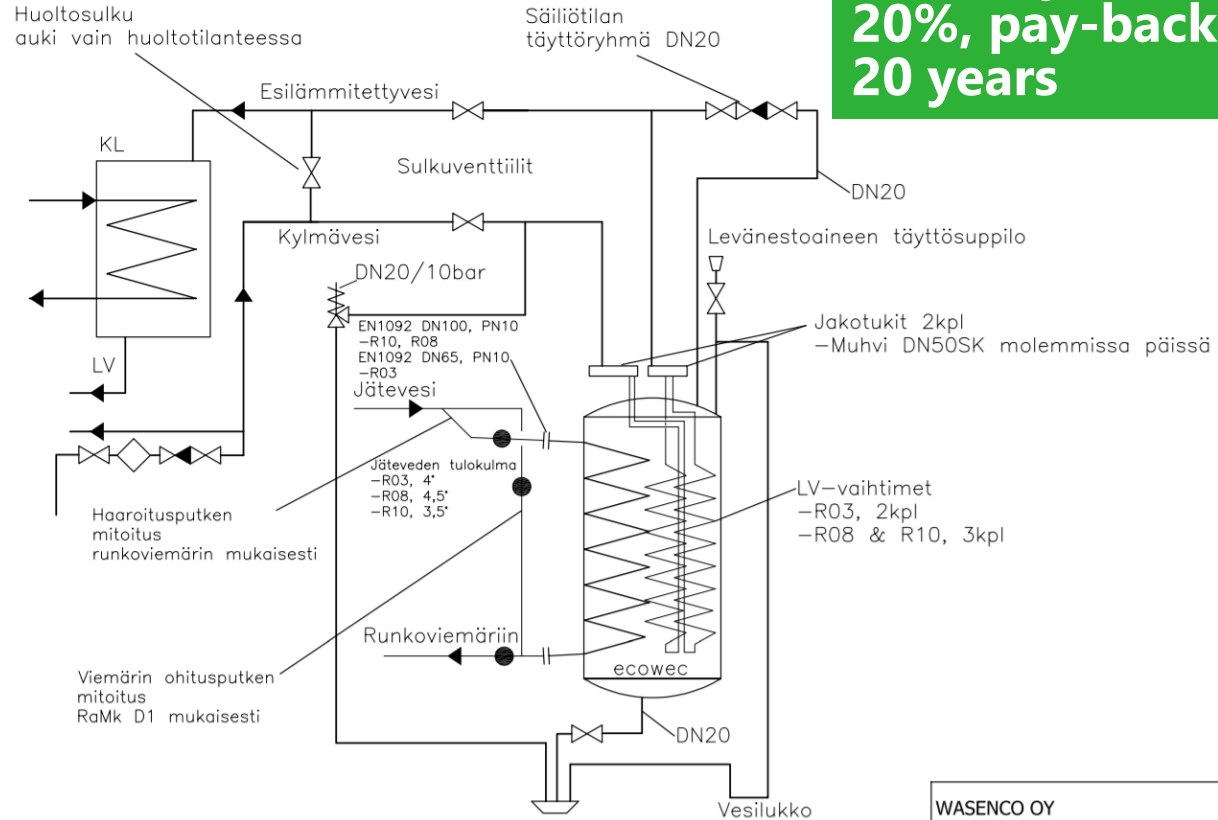
**Some other  
techniques  
for the demo**



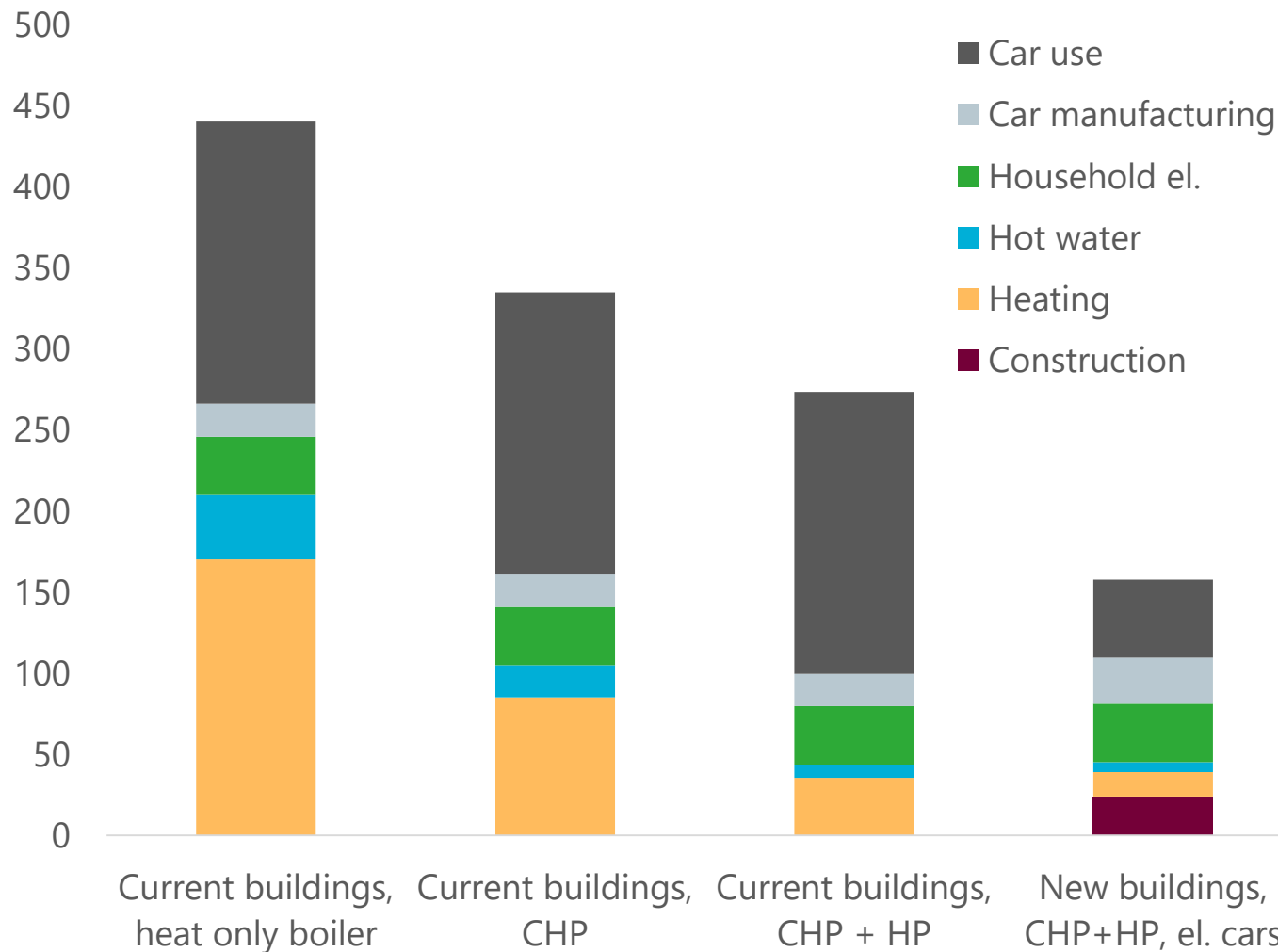


**Wall surface  
for solar  
panels**

# Wastewater heat recovery, savings 20%, pay-back time 20 years







**Heat and  
electricity  
consumption  
+ embodied  
energy in  
materials,  
kWh/m²/a**

- Background: especially needed are
  - one week flexibility
  - seasonal balancing,  
i.e. consumption reduction in wintertime
- In practice:
  - low heat losses
  - lower average temperature with e.g...
  - non-continuous heating & quick temperature lift:  
floor + air heating and low thermal mass
- From quantitative to qualitative thinking, context sensitivity and diversity as a value

**Issues to be  
promoted,  
thinking the  
energy system  
as a whole**