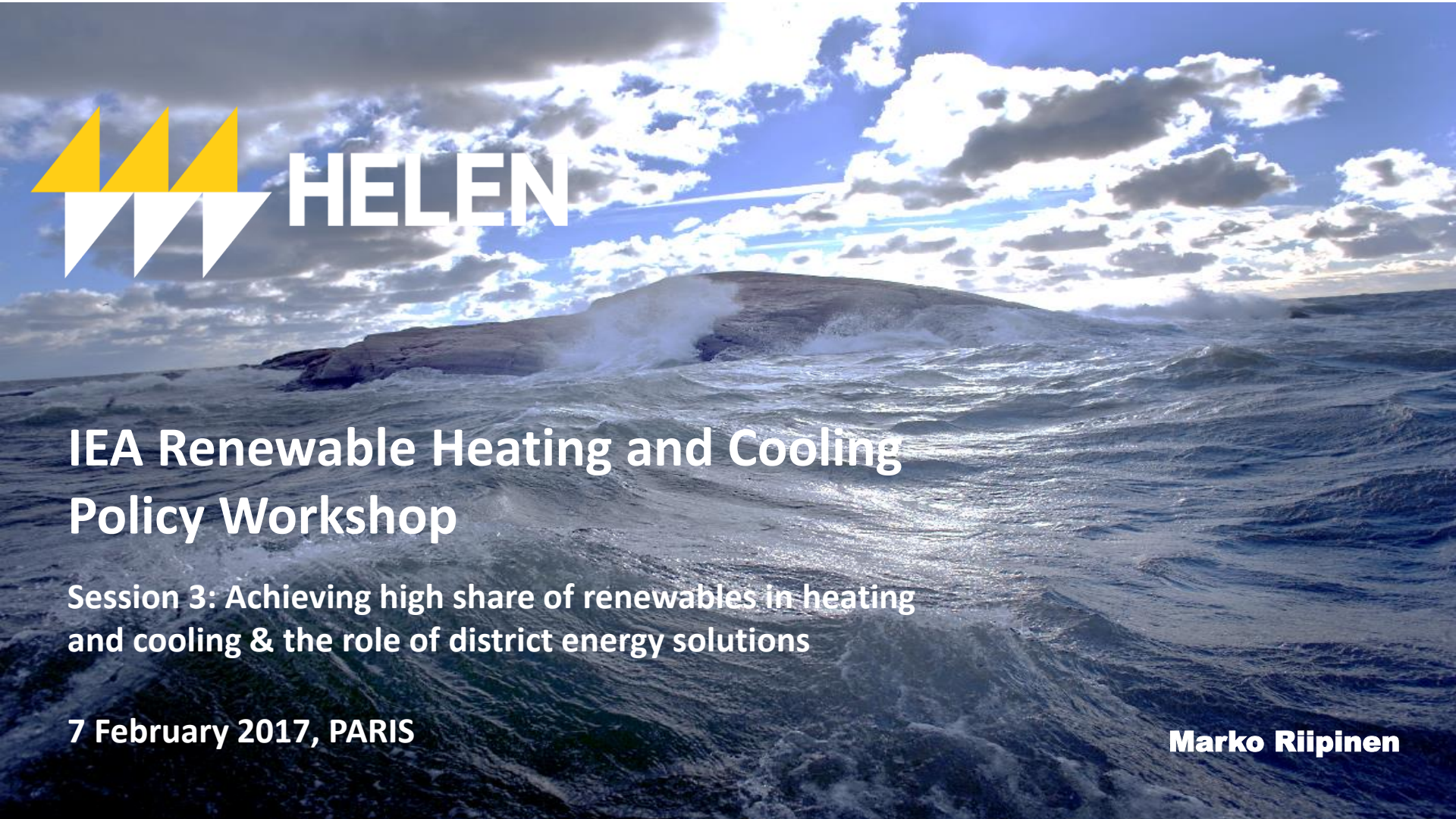


IEA Renewable Heating and Cooling Policy Workshop

Session 3: Achieving high share of renewables in heating and cooling & the role of district energy solutions

7 February 2017, PARIS

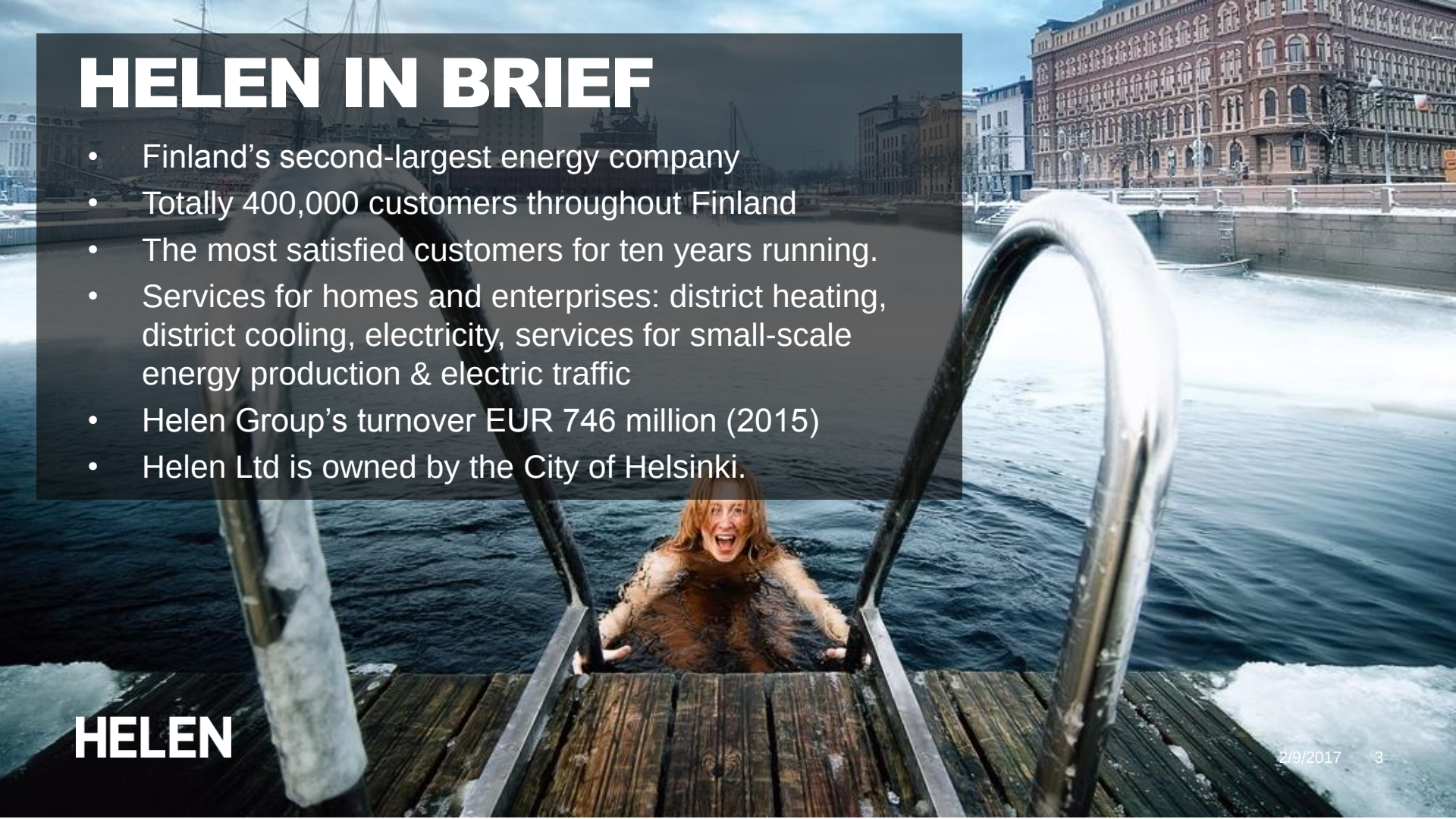
Marko Riipinen

AGENDA

- Helen in Brief
- City Energy System in Helsinki
  - Combined District Heating & District Cooling
  - Recirculation of Energy Flows
- Towards Climate Neutral Future
  - Increasing Renewable Energy Production
  - Improving Energy Efficiency & Developing New Services

HELEN IN BRIEF

- Finland’s second-largest energy company
- Totally 400,000 customers throughout Finland
- The most satisfied customers for ten years running.
- Services for homes and enterprises: district heating, district cooling, electricity, services for small-scale energy production & electric traffic
- Helen Group’s turnover EUR 746 million (2015)
- Helen Ltd is owned by the City of Helsinki.



HELEN

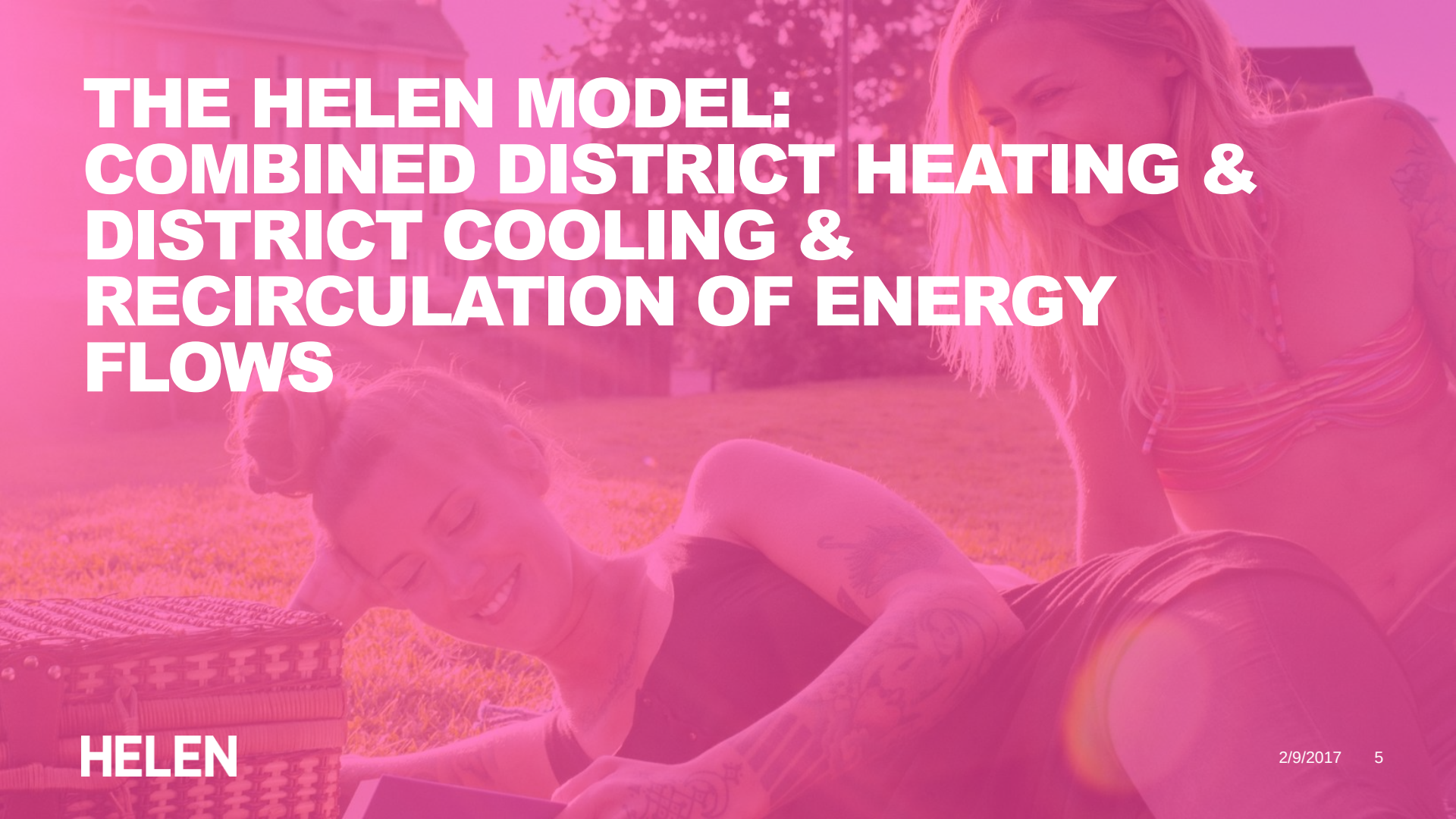
CITY OF HELSINKI

- The capital city of Finland
- Northernmost capital city of European Union
- Population 630 000
- Thermal energy demand is greater than electricity demand

The highest temperature ever recorded in the city centre was 33.1 °C on July 1945 and the lowest was −34.3 °C on January 1987.

HELEN

THE HELEN MODEL: COMBINED DISTRICT HEATING & DISTRICT COOLING & RECIRCULATION OF ENERGY FLOWS



HELEN

HELEN'S CURRENT, AWARDED ENERGY SOLUTION

90%

of properties in Helsinki are heated with District Heating

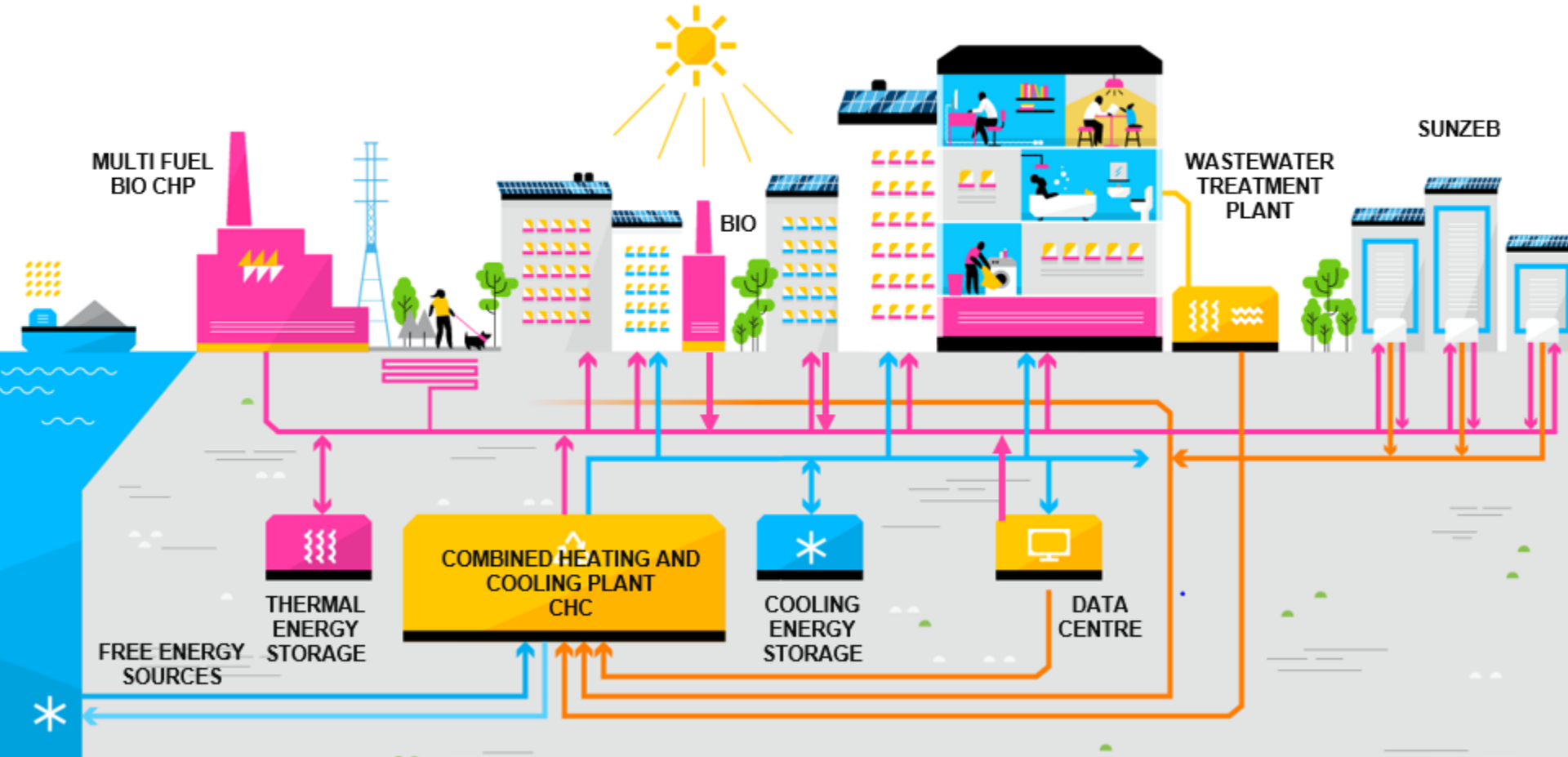
90%

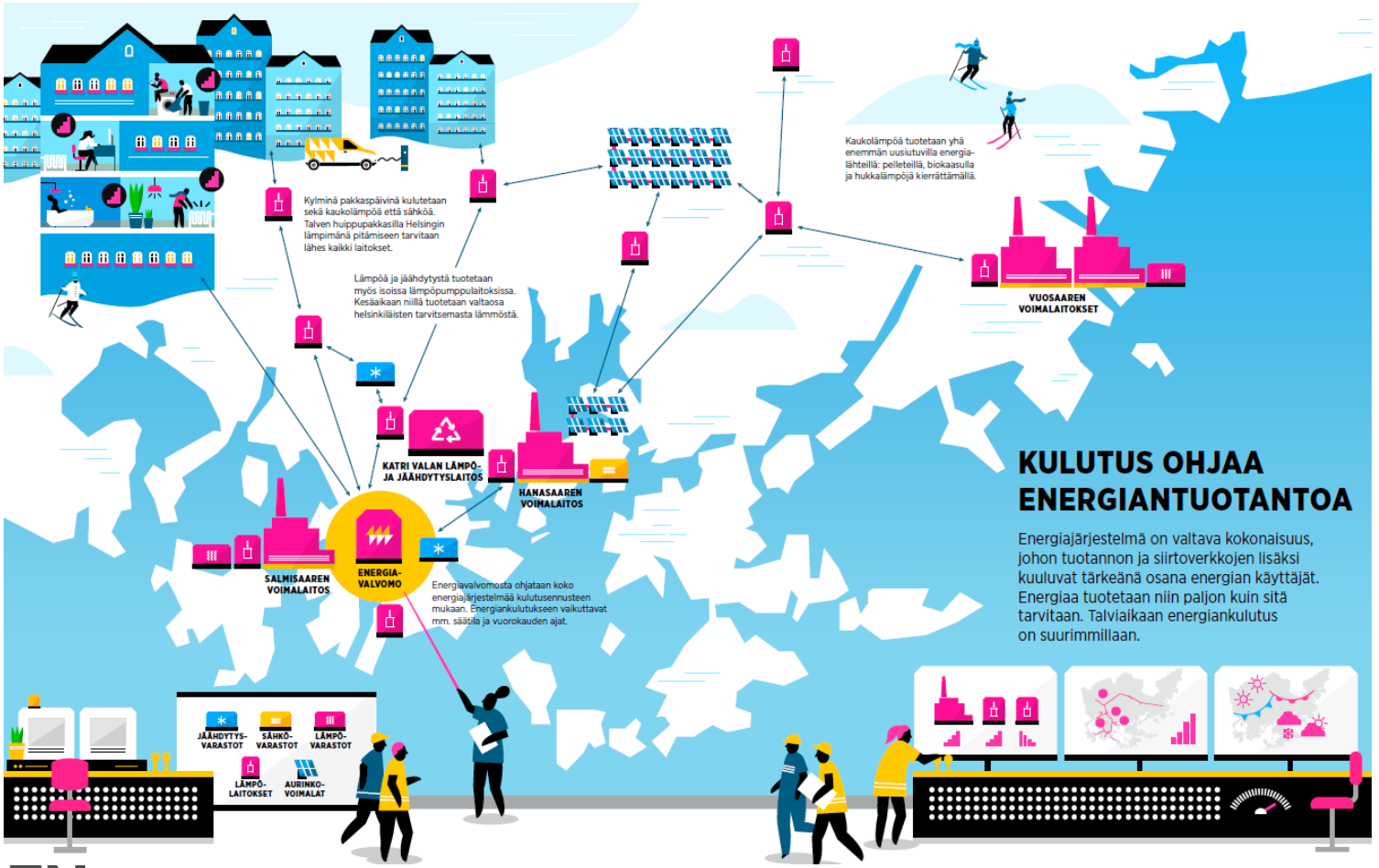
Of District Heat is produced with Combined Heat and Power generation

90%

efficiency in combined energy production

HELEN'S CITY ENERGY SYSTEM




Kylminä pakkaspäivinä kulutetaan sekä kaukolämpöä että sähköä. Talven huippupakkasilla Helsingin lämpimänä pitämiseen tarvitaan lähes kaikki laitokset.
Lämpöä ja jäähdytystä tuotetaan myös isoissa lämpöpumppulaitoksissa. Kesäaikaan niillä tuotetaan valtaosa helsinkiläisten tarvitsemasta lämmöstä.
Kaukolämpöä tuotetaan yhä enemmän uusiutuvilla energialähteillä: pelleteillä, biokaasulla ja hukkalämpöjä kierrättämällä.
VUOSAAREN VOIMALAITOKSET
KATRI VALAN LÄMPÖ- JA JÄÄHDYTYSLAITOS
HANASAAREN VOIMALAITOS
SALMISAAREN VOIMALAITOS
ENERGIA-VALVOMO
Energiavalvomosta ohjataan koko energiajärjestelmää kulutusennusteen mukaan. Energiankulutukseen vaikuttavat mm. säätila ja vuorokauden ajat.
JÄÄHDYTYS-VARASTOT
SÄHKÖ-VARASTOT
LÄMPÖ-VARASTOT
LÄMPÖ-LAITOKSET
AURINKO-VOIMALAT
KULUTUS OHJAA ENERGIANTUOTANTOA
Energiajärjestelmä on valtava kokonaisuus, johon tuotannon ja siirtoverkkojen lisäksi kuuluvat tärkeänä osana energian käyttäjät. Energiaa tuotetaan niin paljon kuin sitä tarvitaan. Talviaikaan energiankulutus on suurimmillaan.

TOWARDS BRIGHTER AND CLIMATE NEUTRAL FUTURE

HELEN

FEWER EMISSIONS AND MORE RENEWABLE ENERGY

- We aim to produce energy in a climate-neutral way by 2050.
- We are increasing the use of biofuels, building solar and wind power and further improving energy efficiency.
- We are investigating extensive utilisation of solar heat, geothermal heat and heat pumps.

HELEN

100 MW

Finland’s largest pellet boiler to Salmisaari 2017

Replaces use of fossil fuels. Generates heat for 25,000 residents in apartment blocks.

It will use 21 tonnes of pellets per hour, i.e. 40,000 tonnes per year

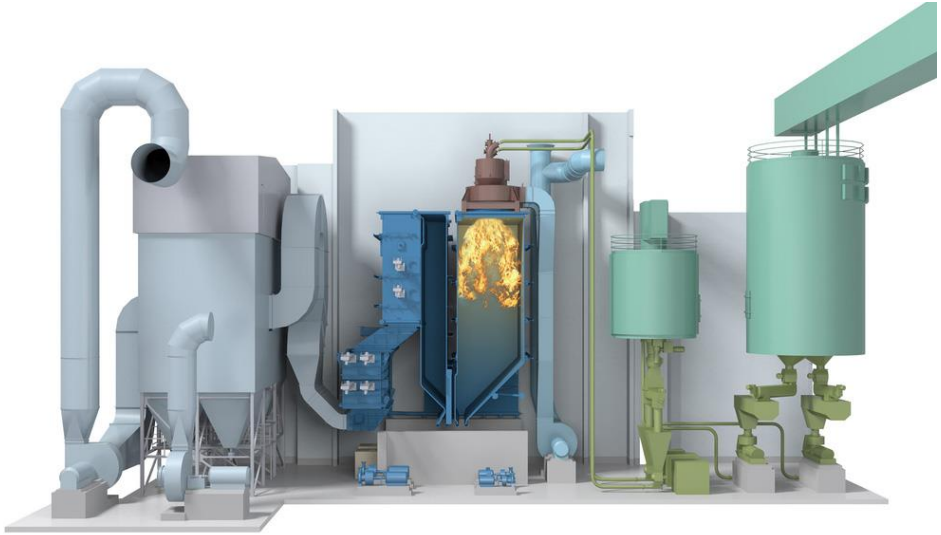
CO-FIRING OF WOOD PELLETS

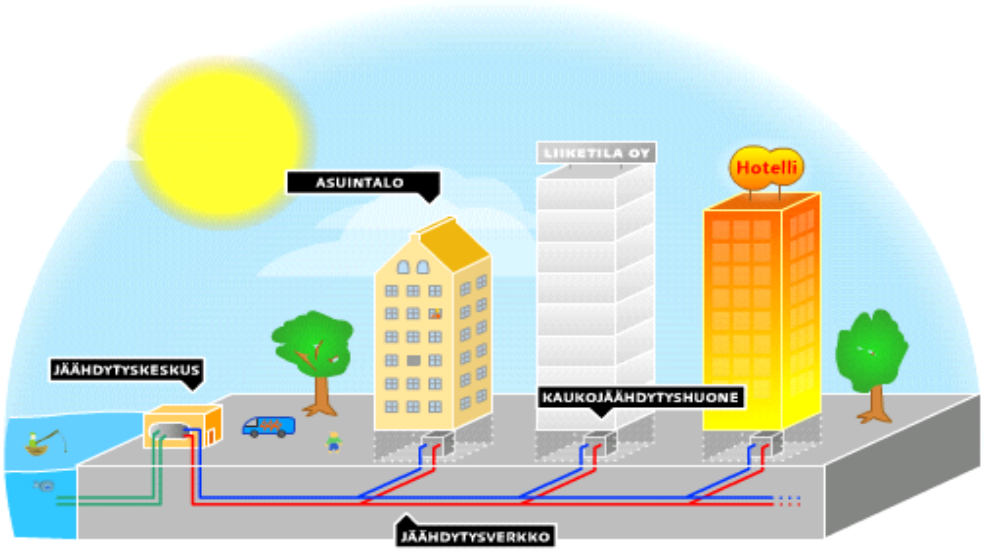
- Wood pellets have replaced 5-7% of coal
- Co-firing tests with many second generation wood pellets from different suppliers around the world
- Researching different ways to increase the share of pellets

HELEN

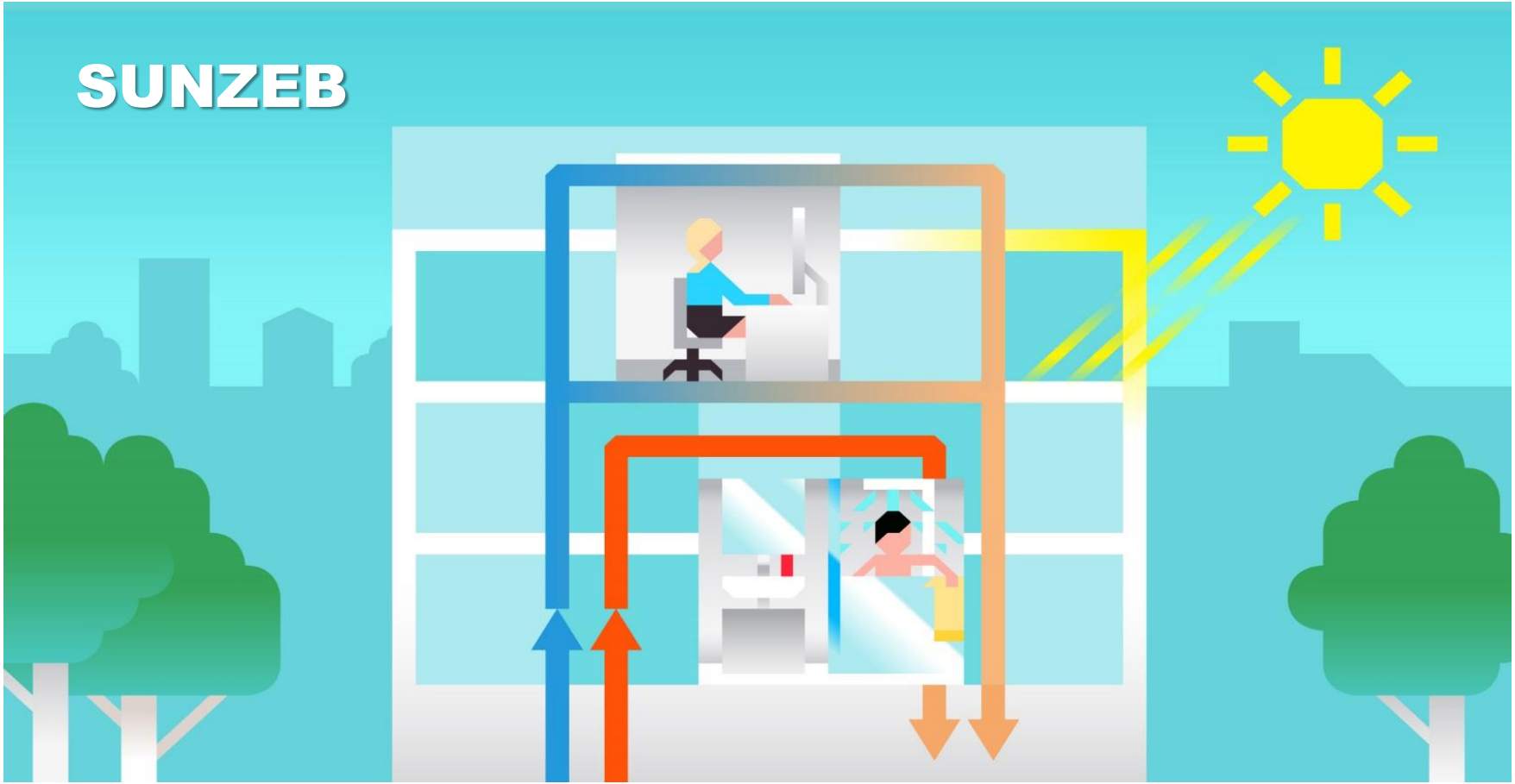
NEW WOOD PELLET DISTRICT HEATING PLANT

- In operation in the beginning of 2018 – replacing old heavy fuel oil boiler
- Fuel input is 99 MW
- Uses wood pellets and light fuel oil as backup fuel
- Uses existing pellet unloading station and silos




ASUINTALO
LIIKETILA OY
Hotelli
JÄÄHDYTYSKESKUS
KAUKOJÄÄHDYTYSHUONE
JÄÄHDYTYSVERKKO

SUNZEB

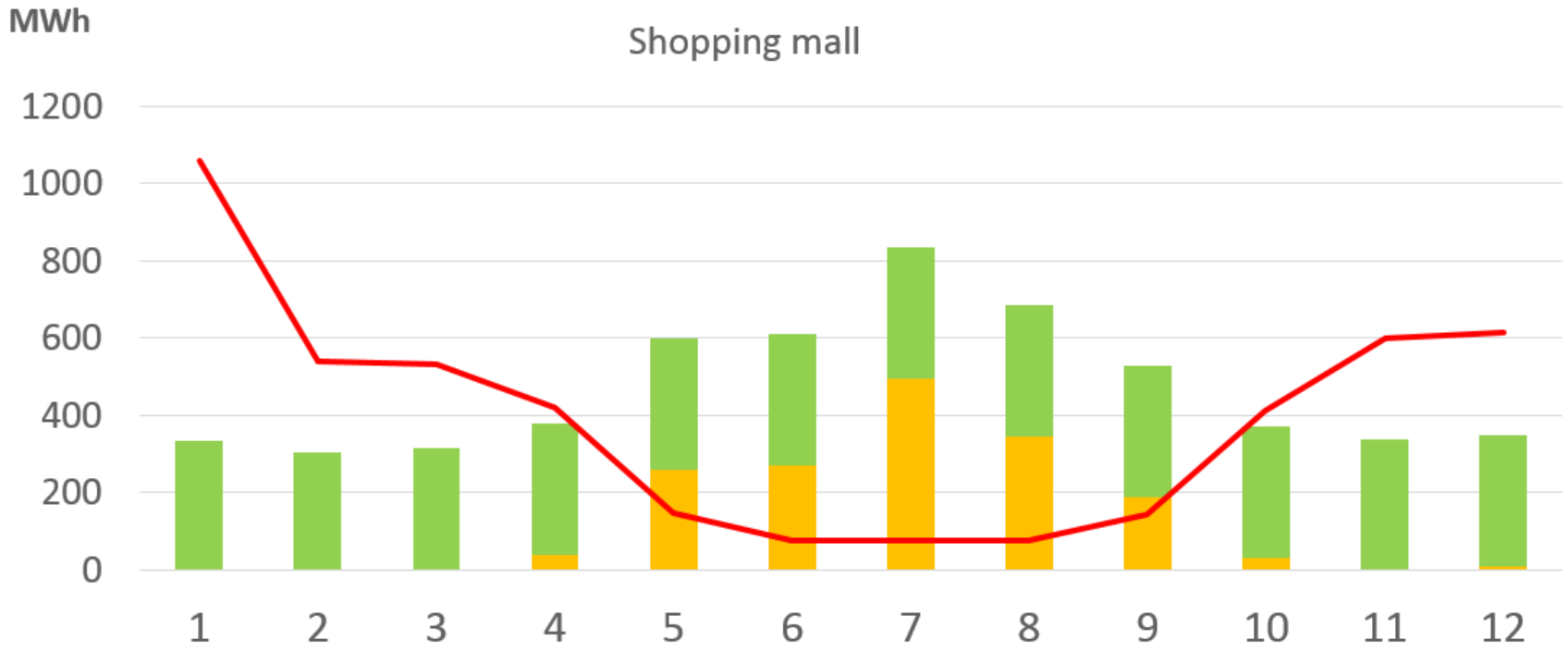


HELEN

HELEN

Summer (4 months)
CHC-heat: 43 000 000 kWh
≈ 220 000 m2/solar collector

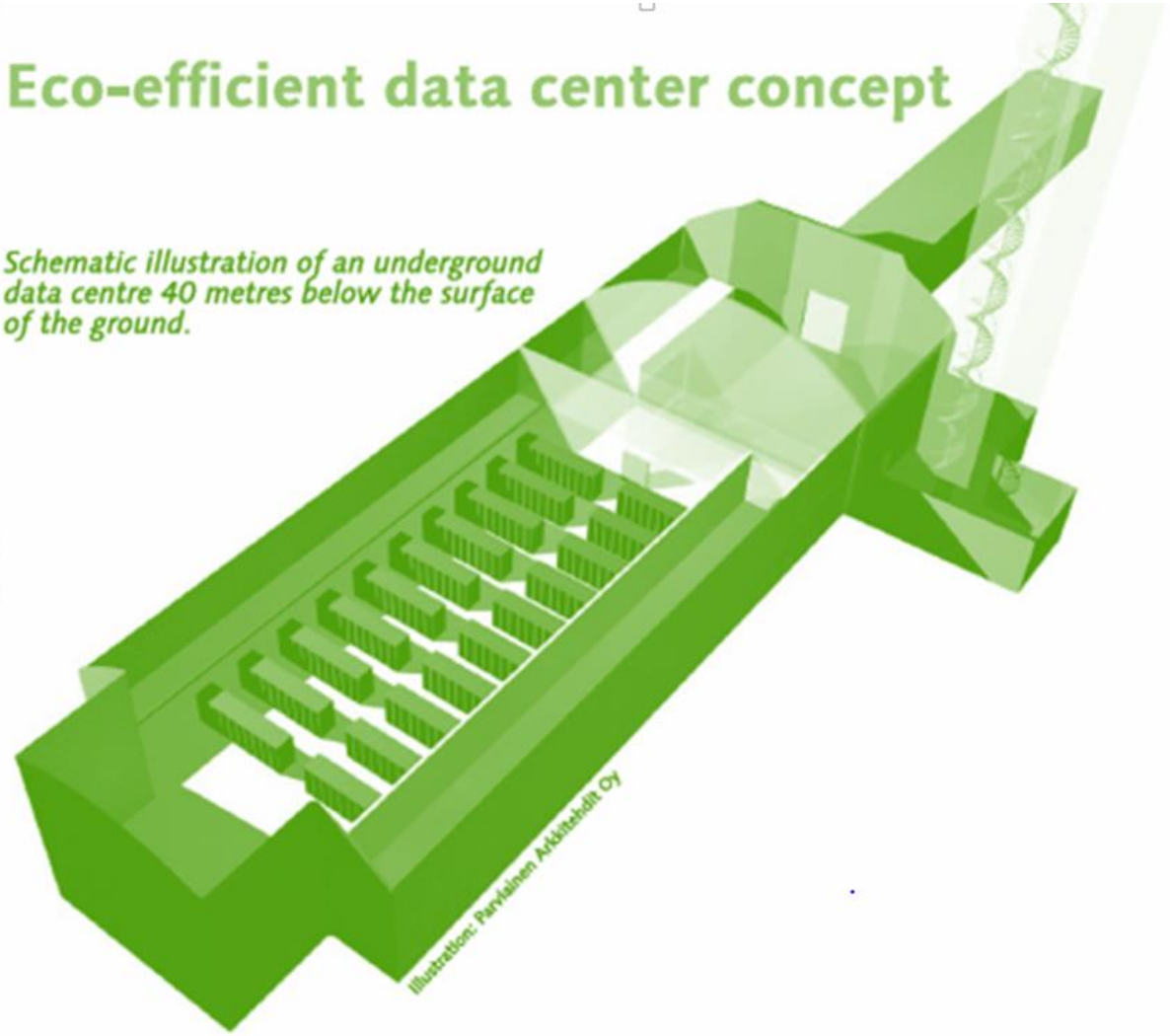
HELEN


MWh
Shopping mall
1200
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12

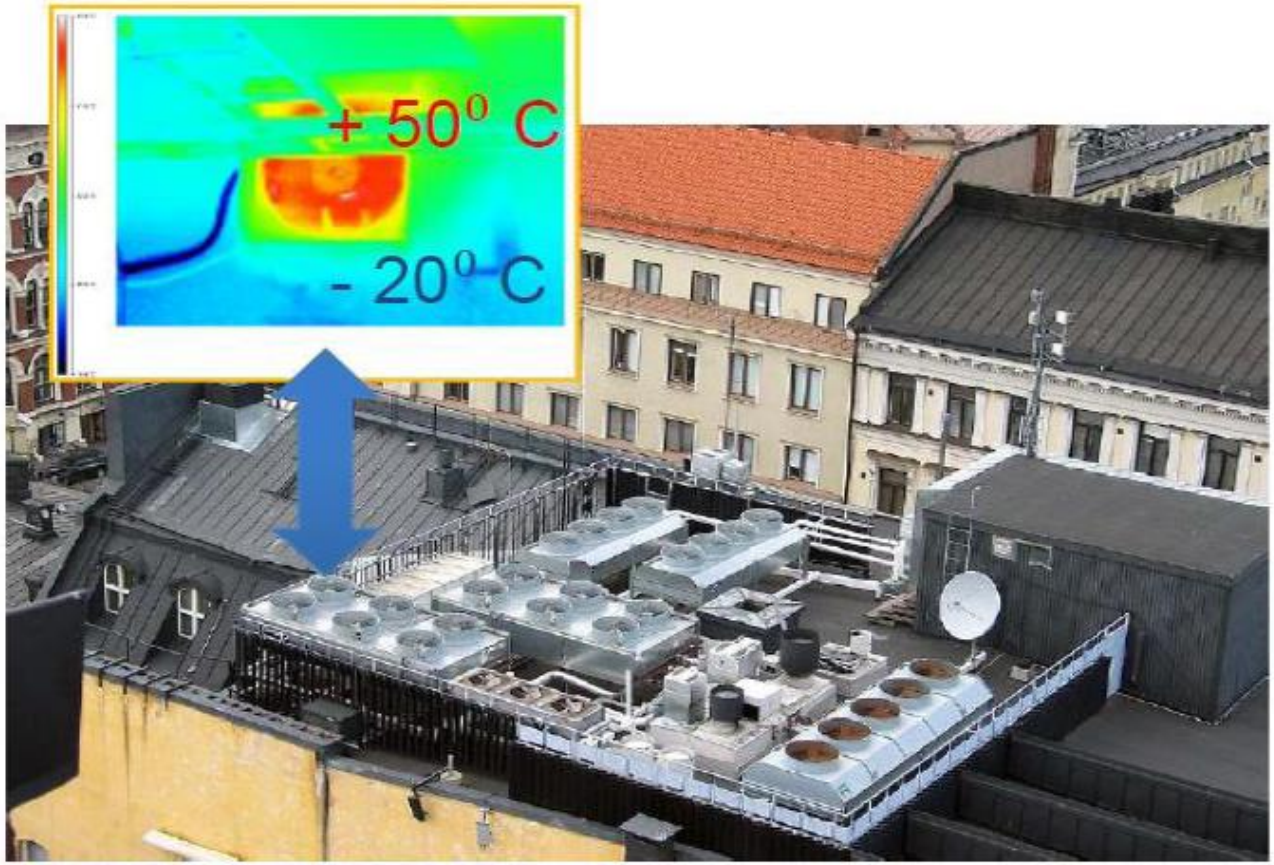
HELEN

Eco-efficient data center concept

Schematic illustration of an underground data centre 40 metres below the surface of the ground.



HELEN


+ 50° C
- 20° C

COMBINED HEATING AND COOLING

- Heat sources
  - Purified sewage water
  - District cooling network
  - Sea water
- Total output is 90 MW of District Heating and 60 MW of District Cooling
- Katri Vala’s heat pump plant is the largest in the world to produce District Heating and Cooling at the same process and using Purified sewage water as a heat source

HELEN

THERMAL STORAGES

Thermal storage + Heat pump unit 15 MW cooling / 22 MW heating. Total output 50 MW of cooling

HELEN

BETTER SERVICE AND FEWER EMISSIONS WITH NEW SOLUTIONS

HELEN

HOW TO KEEP THE CITY WARM IN THE FUTURE?

ENERGY EFFICIENCY

BIOMASS

- Wood pellets, wood chips, recycled wood
- Bio-oil
- Biogas
- Other sidestreams in the city

EXCESS HEAT

- New excess heat sources
- More efficient utilisation

TECHNOLOGIES

- Expanding District Cooling
- Geothermal
- Seawater heat pump
- CHP, CHC
- Combined heat and product (AD-biogas, gasifier, bioliquids etc)
- Solar heat

SOLUTIONS

- Level off consumption peaks
- Demand response services for businesses and homes
- Solutions to reduce energy consumption, level off consumption peaks
- Services for efficient energy use by customers

THERMAL STORAGES


HELEN