SMART ENERGY SYSTEM
OPTIMISATION WITH RENEWABLES

Pernille M. Overbye, Head of department, Ramboll Energy

RAMBOLL

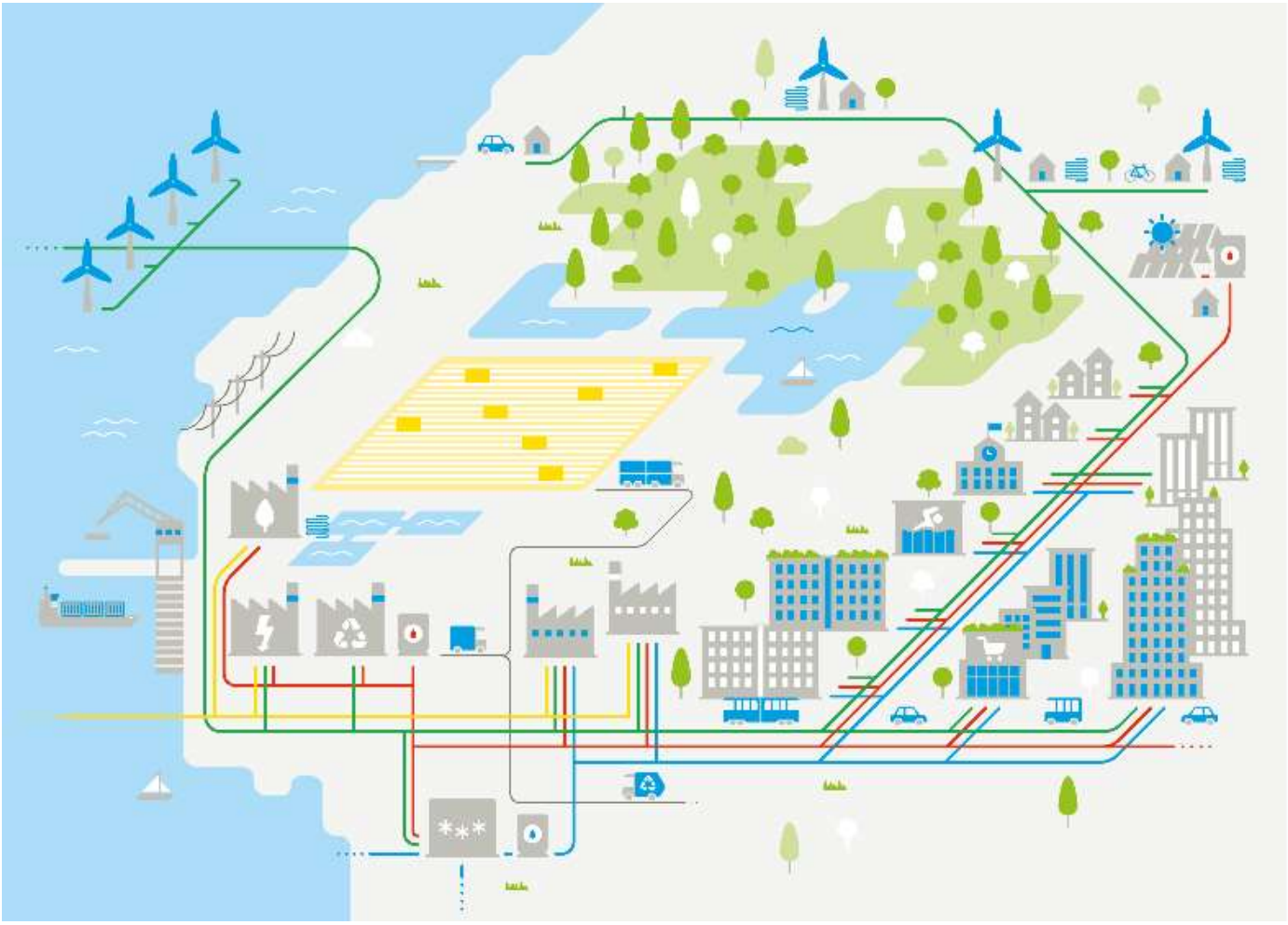
PERNILLE M. OVERBYE - BACKGROUND

- B.Sc. Mechanical Engineering Copenhagen & M.Sc. Thermal Energy Cranfield University UK

- 1992 -> 10 years living and working in the UK
- 2002 -> Ramboll Denmark & Energy – always within district energy
- 2005 – 2011 Building up district energy in the UK from Copenhagen
- 2011 – 2014 Head of department in Copenhagen – focus on our international projects
- 2014 – 2016 Managing Director Ramboll Inc. Canada District Energy
- 2017 – ???? Head of department – District Energy planning and infrastructure

RAMBOLL

OUR VISION IS TO CREATE LIVEABLE CITIES WITH SMART SOLUTIONS FOR THE CITIZENS



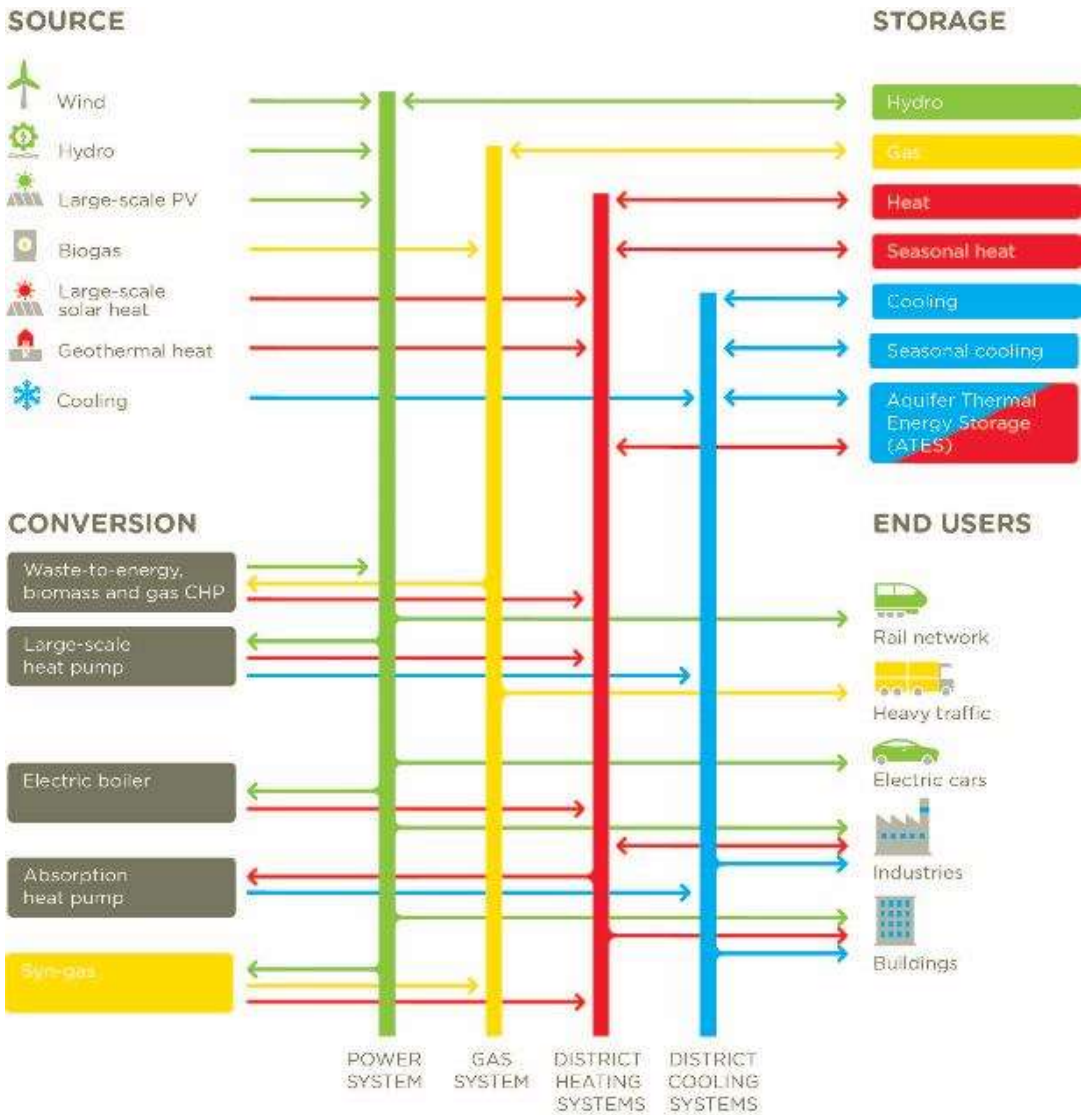
Surplus biomass for CHP plant
Surplus straw for CHP plant
Offshore wind farm
Large commercial / residential building
Small residential building
Harbour, unloading of biomass
Wastewater treatment, heat pump, biogas and sludge incineration
Solar heating plant and heat storage
Solar PV plant
Distant building w/solar PV
Outskirt building w/heat pump, solar PV and wind turbine
CHP plant fuelled by gas, straw, wood, city waste + heat storage
District heating/cooling plant – cold water storage
Industry with process energy and surplus heat
Electricity
District heating
District cooling
Gas

RAMBOLL

SMART ENERGY

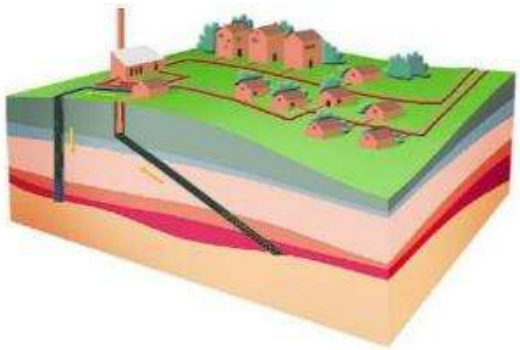
Ensuring an efficient and stable integration of fluctuating, renewable energy

- National power grid
- City-wide district heating grid
  - Storage for CHP and RES
- City district cooling grid
  - Storage and optimal cooling
- National natural gas grid
  - Storage, CHP and small houses
- Buildings and other end-users
  - Optimized building envelope
  - Low temperature heating
  - High temperature cooling
  - Micro DC grid electronics
  - Adjust consumption to dynamic prices



RAMBOLL

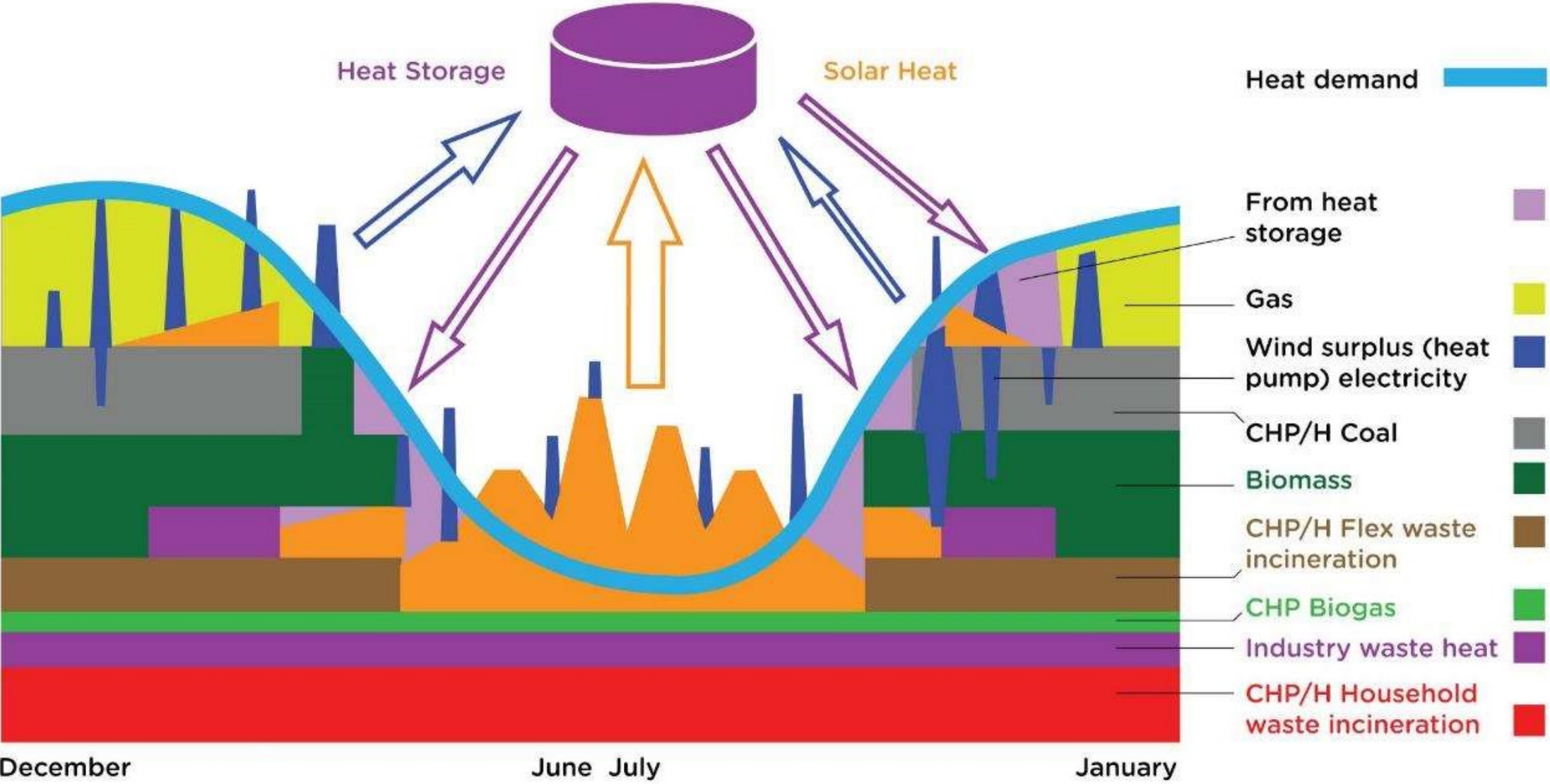
SUGGESTIONS FOR RENEWABLE HEAT SOURCES AND (SEASONAL) STORAGE



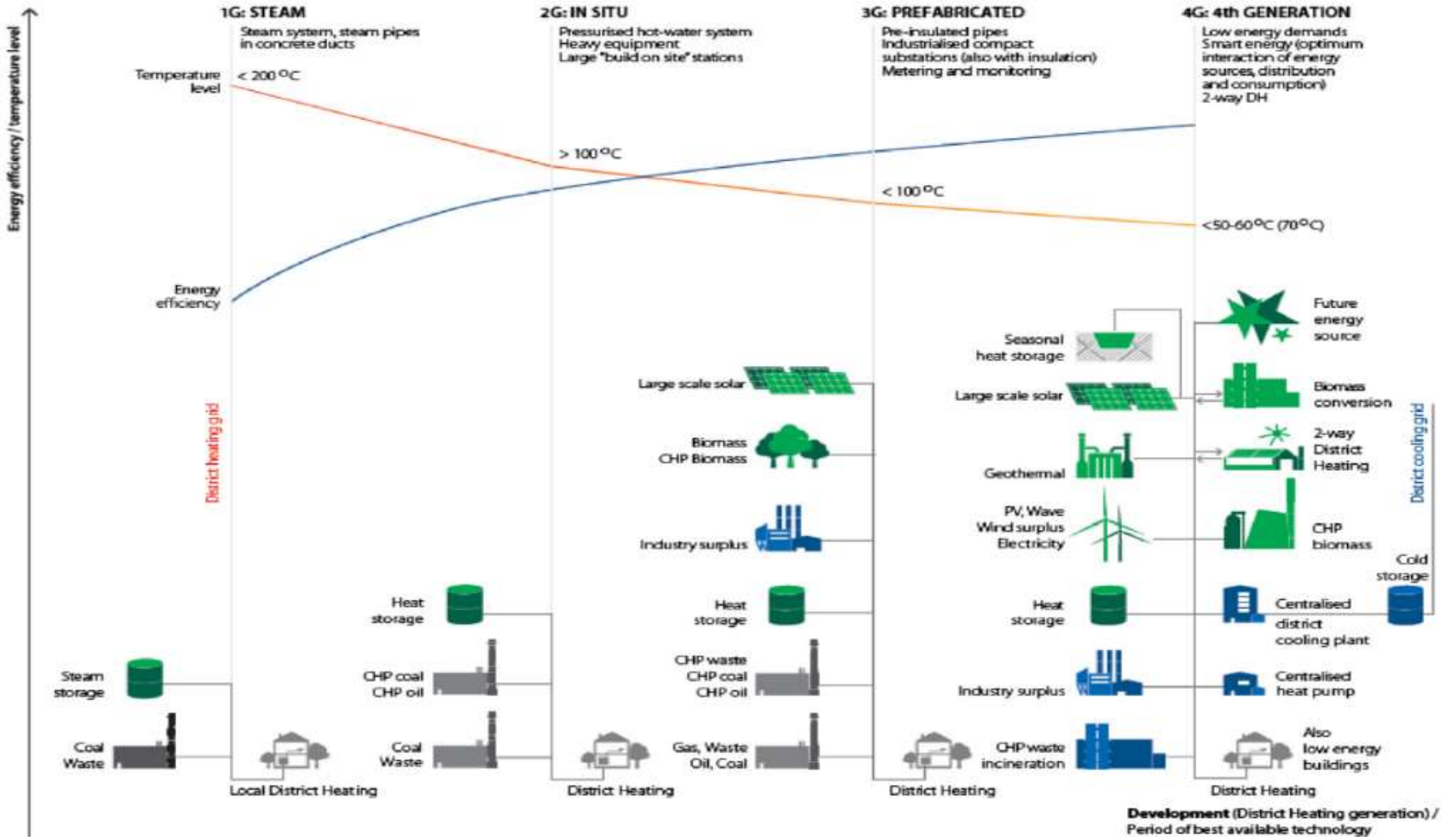
Individual solar heating
is 6 times more expensive than large scale

Underground water pit-storage

RAMBOLL

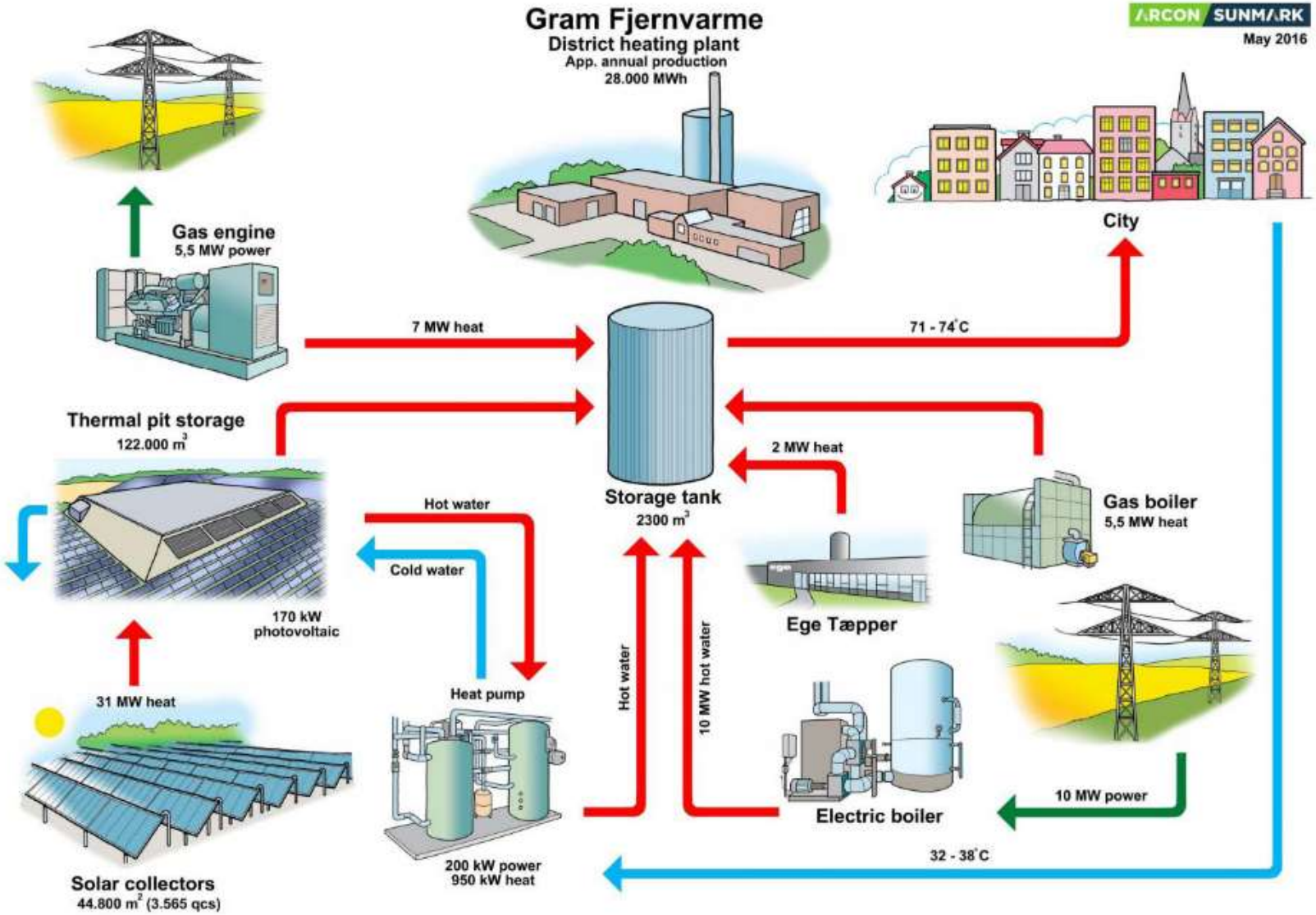

Heat Storage
Solar Heat
Heat demand
From heat storage
Gas
Wind surplus (heat pump) electricity
CHP/H Coal
Biomass
CHP/H Flex waste incineration
CHP Biogas
Industry waste heat
CHP/H Household waste incineration
December
June
July
January

FUEL AND TECHNOLOGY OPTIONS



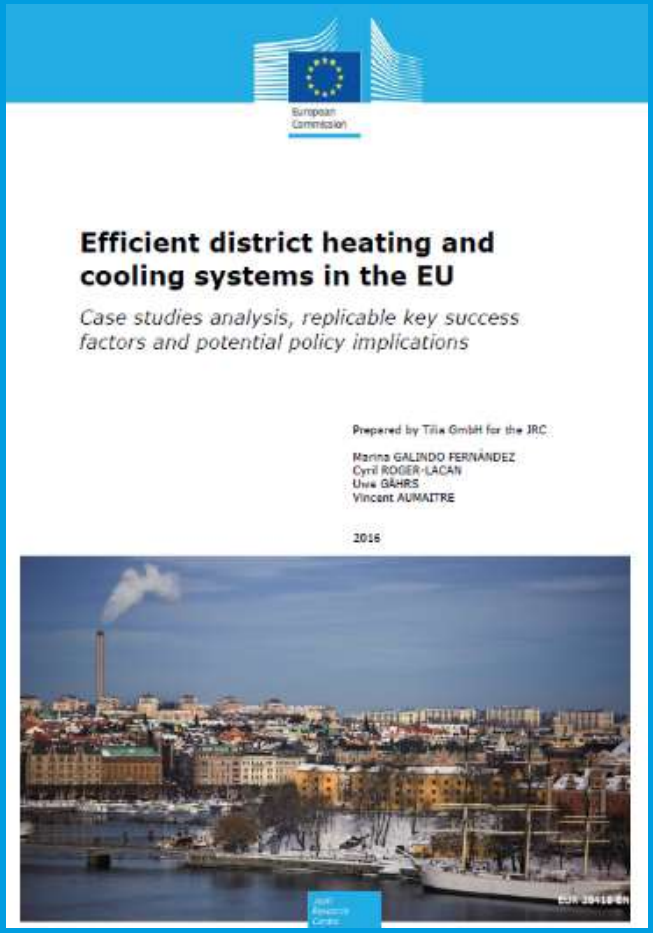
RAMBOLL

THE FUTURE DISTRICT HEATING – IS HERE NOW



RAMBOLL

GRAM CONSUMER-OWNED DISTRICT HEATING SYSTEM CASE 2 IN JRC STUDY REPORT ON EFFICIENT DH&C IN EU



European Commission

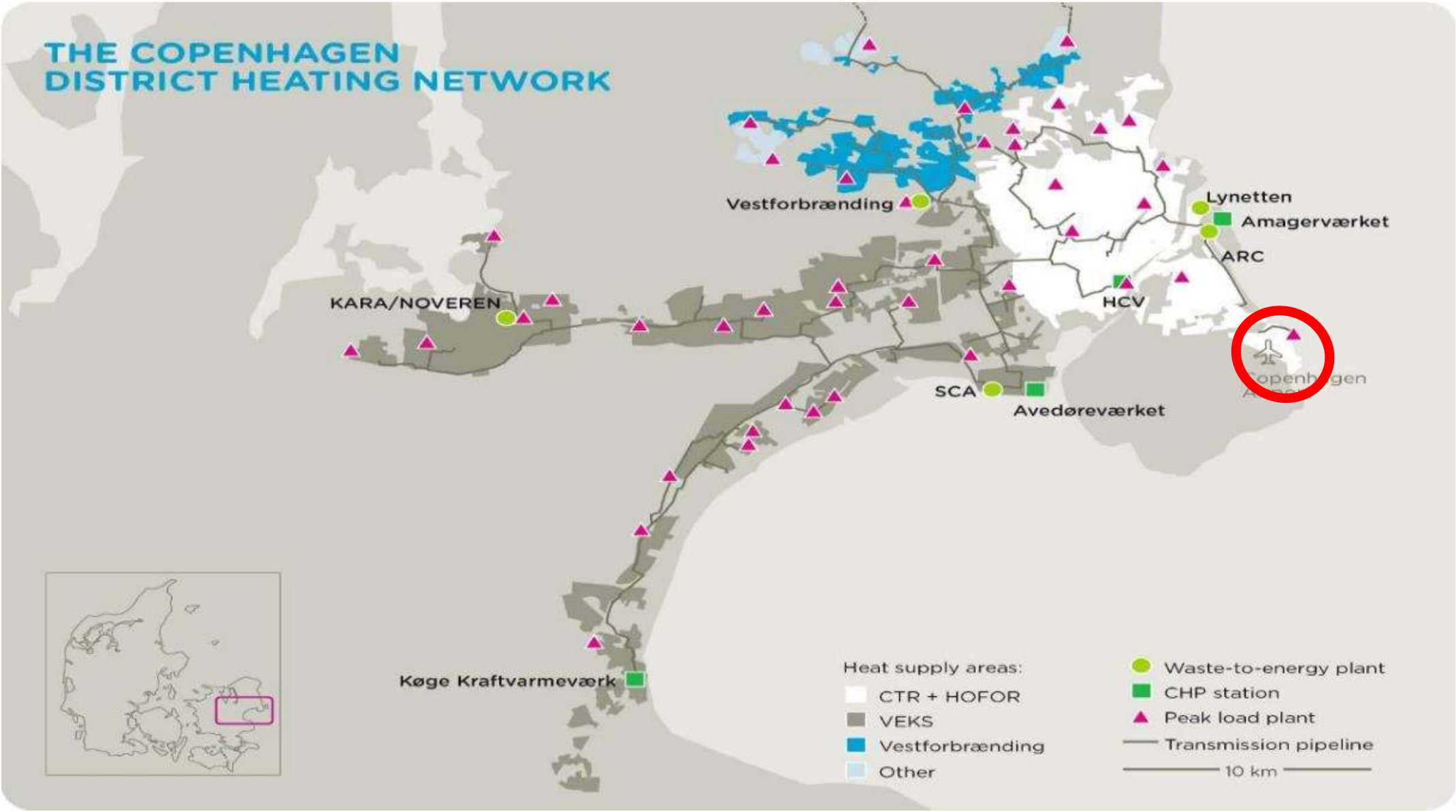
Efficient district heating and cooling systems in the EU

Case studies analysis, replicable key success factors and potential policy implications

Prepared by Tilia GmbH for the JRC

Marina GALINDO FERNÁNDEZ
Cyril ROGER-LACAN
Uwe GÄHRS
Vincent AUMAITRE

2016


THE COPENHAGEN
DISTRICT HEATING NETWORK
Vestforbrænding
Lynetten
Amagerværket
ARC
HCV
KARA/NOVEREN
SCA
Avedøreværket
Copenhagen
Køge Kraftvarmeværk
Heat supply areas:
CTR + HOFOR
VEKS
Vestforbrænding
Other
Waste-to-energy plant
CHP station
Peak load plant
Transmission pipeline
10 km

GREATER COPENHAGEN DISTRICT HEATING SYSTEM
CASE 1 IN JRC STUDY REPORT ON EFFICIENT DH&C IN EU

European Commission

Efficient district heating and cooling systems in the EU

Case studies analysis, replicable key success factors and potential policy implications

Prepared by Tilia GmbH for the JRC

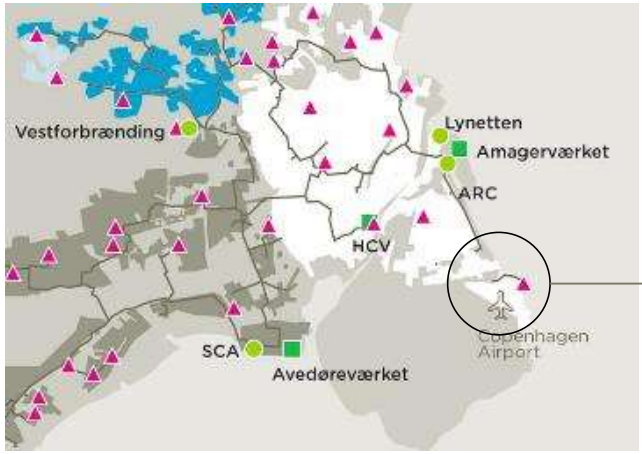
Marina GALINDO FERNÁNDEZ
Cyril ROGER-LACAN
Uwe GÄHRS
Vincent AUMAITRE

2016

CASE:
Heat Pump for heating and cooling

RAMBOLL

HEAT PUMP FOR DISTRICT HEATING AND COOLING TAARNBY, COPENHAGEN, DENMARK



Visualization: Ramboll

4 COP heat

3 COP cool

RAMBOLL

IN CONCLUSION

- It is important to focus on **integrated solutions,** including building envelope, building installations, district heating and power system

- **District heating** is a natural part of the urban infrastructure in modern cities

- District heating is a **precondition** for efficient, flexible and cost-effective use of renewable energy and CHP for urban heating, recovered low-temperature heat (industries, wastewater, etc.) and not least waste-to-energy and wind

- **District cooling** is a natural part of the urban infrastructure in districts with sufficient cooling load

- A stable energy policy since 1976, municipal planning and a tradition for **co-operation in the society** have been important preconditions for CO_2 emission reductions in Denmark

RAMBOLL

WORKING TOGETHER IN BELGIUM

ingenium

RAMBOLL

THANK YOU

PMO@RAMBOLL.COM
+45 51 61 84 60