AIGUASOL

RECUPERACIÓN DE CALOR RESIDUAL EN LA INDUSTRIA

Alex Ivancic

Barcelona, 30/05/17

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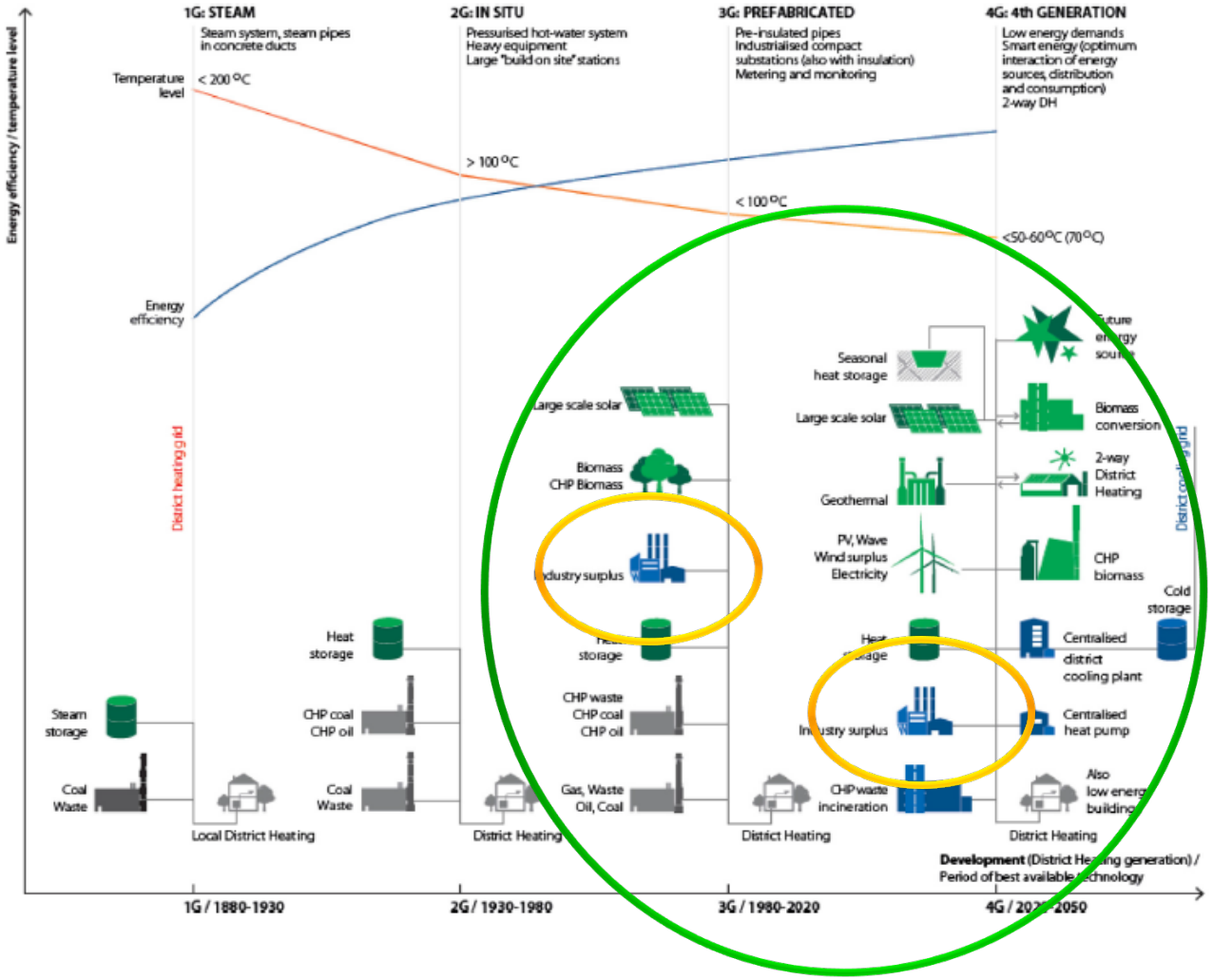

Commission of the European Communities

energy

Waste heat from industry for district heating

Report

EUR 8116 DE, EN, FR

Commission of the European Communities

energy

ECONOMIC DISTANCE

Recoverable Power (MW)	Number of Dwellings	Economic Distance (KM)
4		3
9		5
20		8
45		15
75		20
300		30

Published by the Directorate-General Energy

1982

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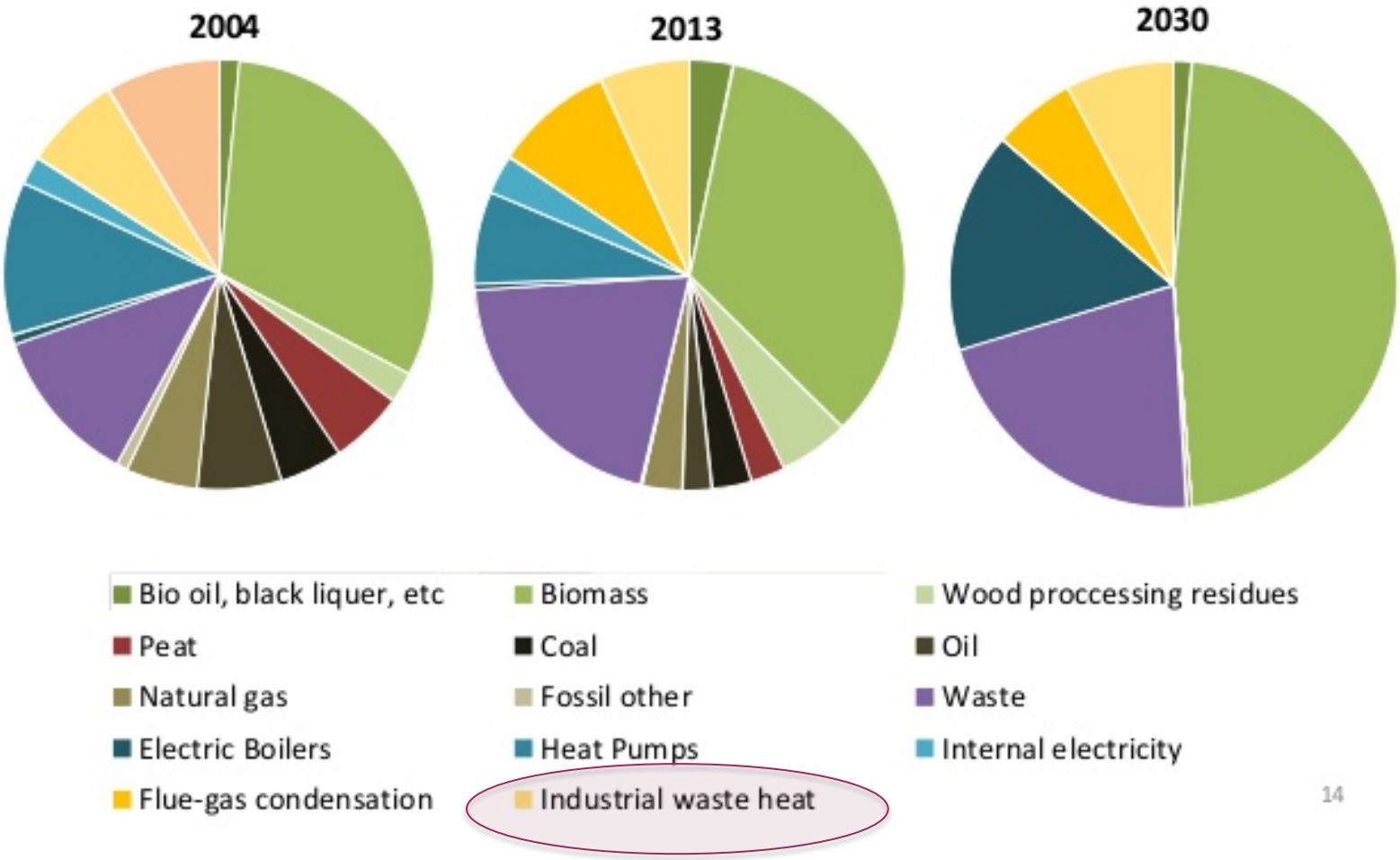
Energy mix for district heating

2004 and 2013 (statistics/Svensk Fjärrvärme)
2030 (results form TIMES-Sweden)



Source: Anna Krook Riekkola & Linda W{arell

Rotterdam Port and Region

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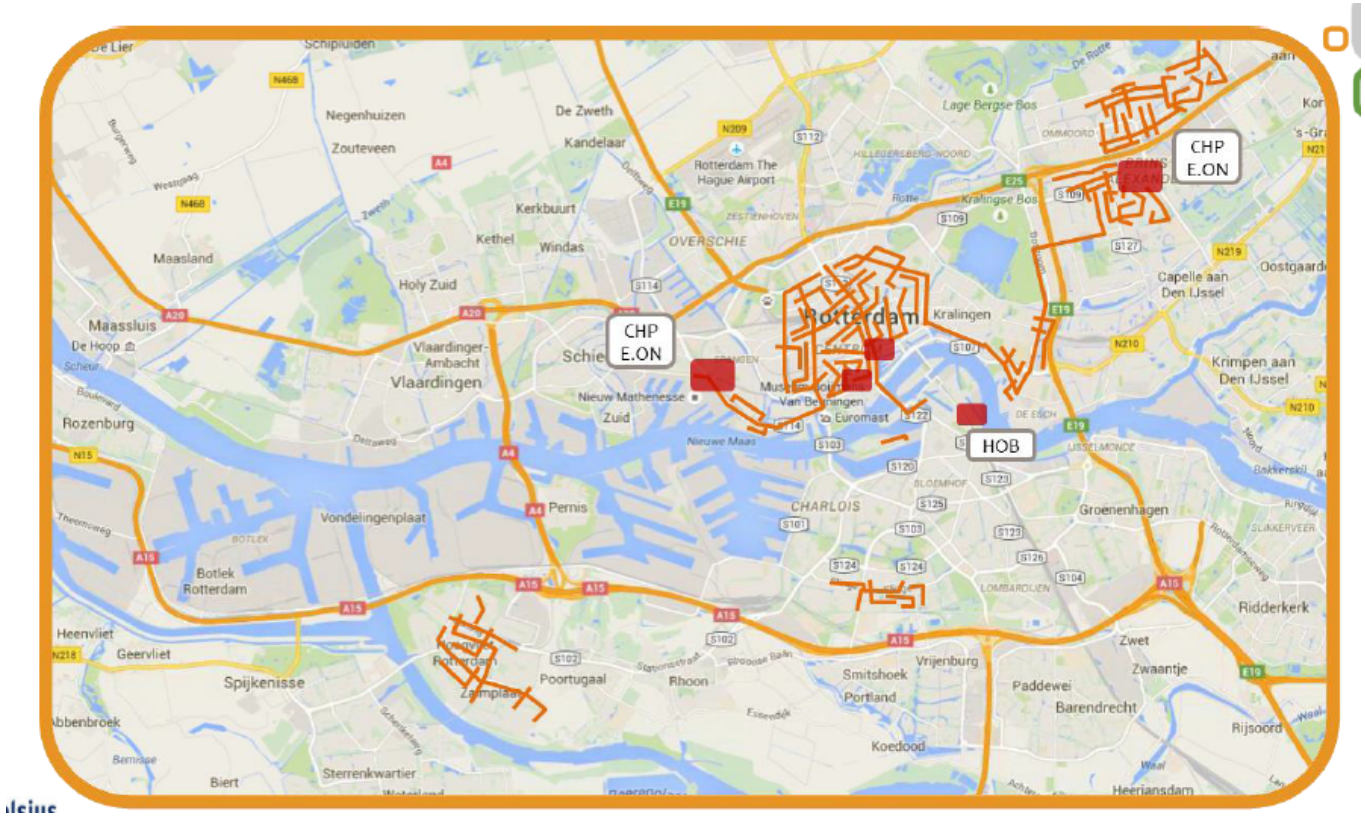

Source: Vouter Verhoeven, Warmtebedrijf Rotterdam

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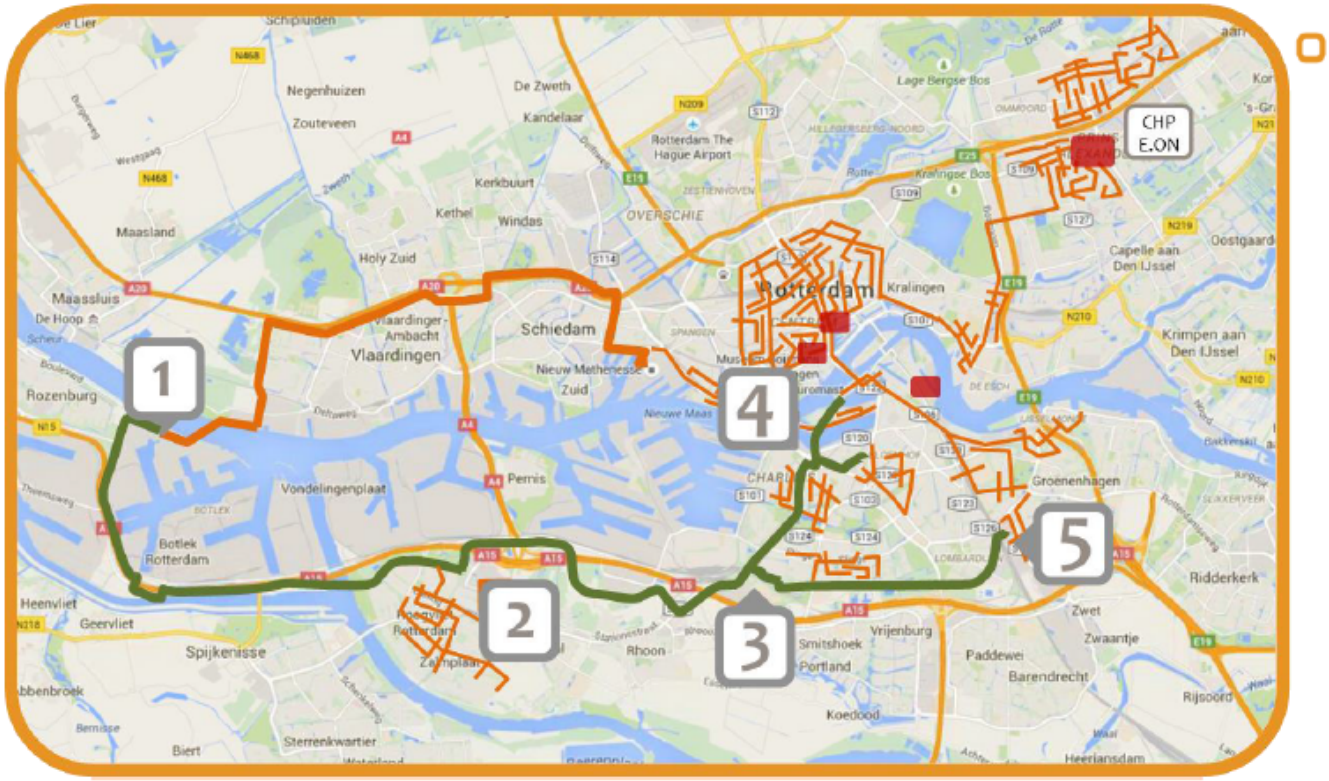

Source: Vouter Verhoeven, Warmtebedrijf Rotterdam

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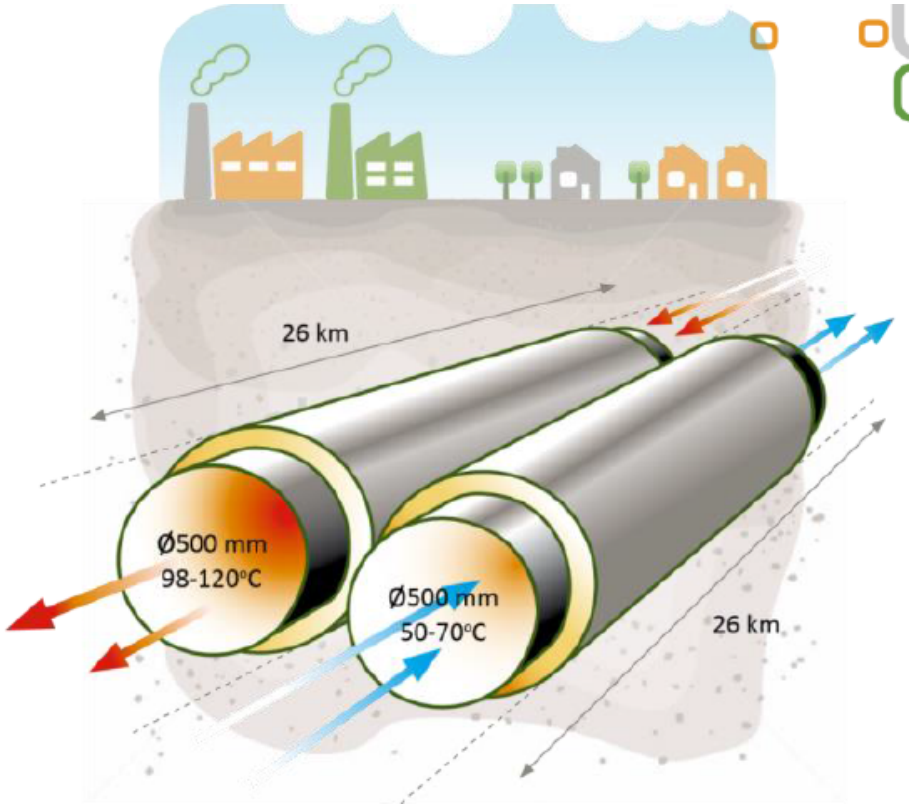
- 26 kilometers
- Investment € 100 mio
- Capacity 105 MWth
- Volume 1.500.000 GJ
- Sustainability > 50%



Source: Vouter Verhoeven, Warmtebedrijf Rotterdam

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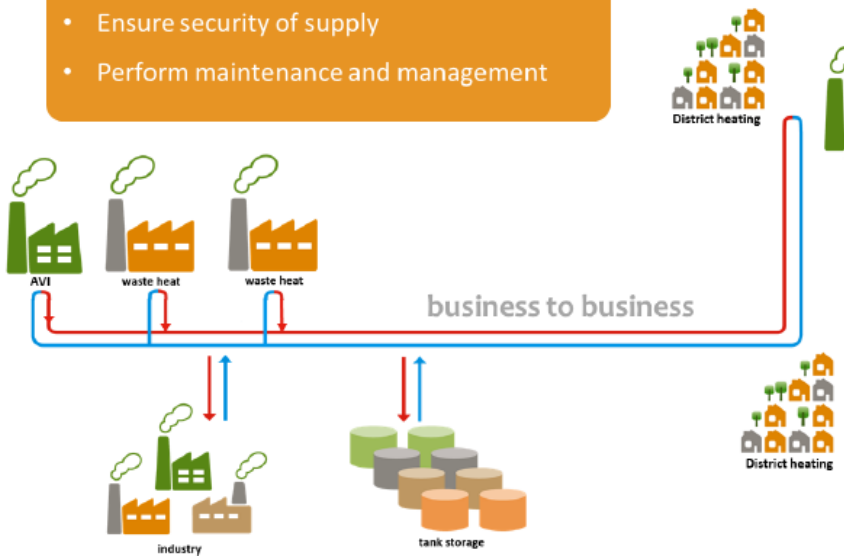
Warmtebedrijf Exploitatie NV

- Business development
- Closing commercial contracts
- Dispatching heat and electricity
- Optimization of heat supply

Warmtebedrijf Infra NV

- Invest in recovery of industrial waste heat, the heat transport network and delivery
- Ensure security of supply
- Perform maintenance and management



celsius

Source: Vouter Verhoeven, Warmtebedrijf Rotterdam

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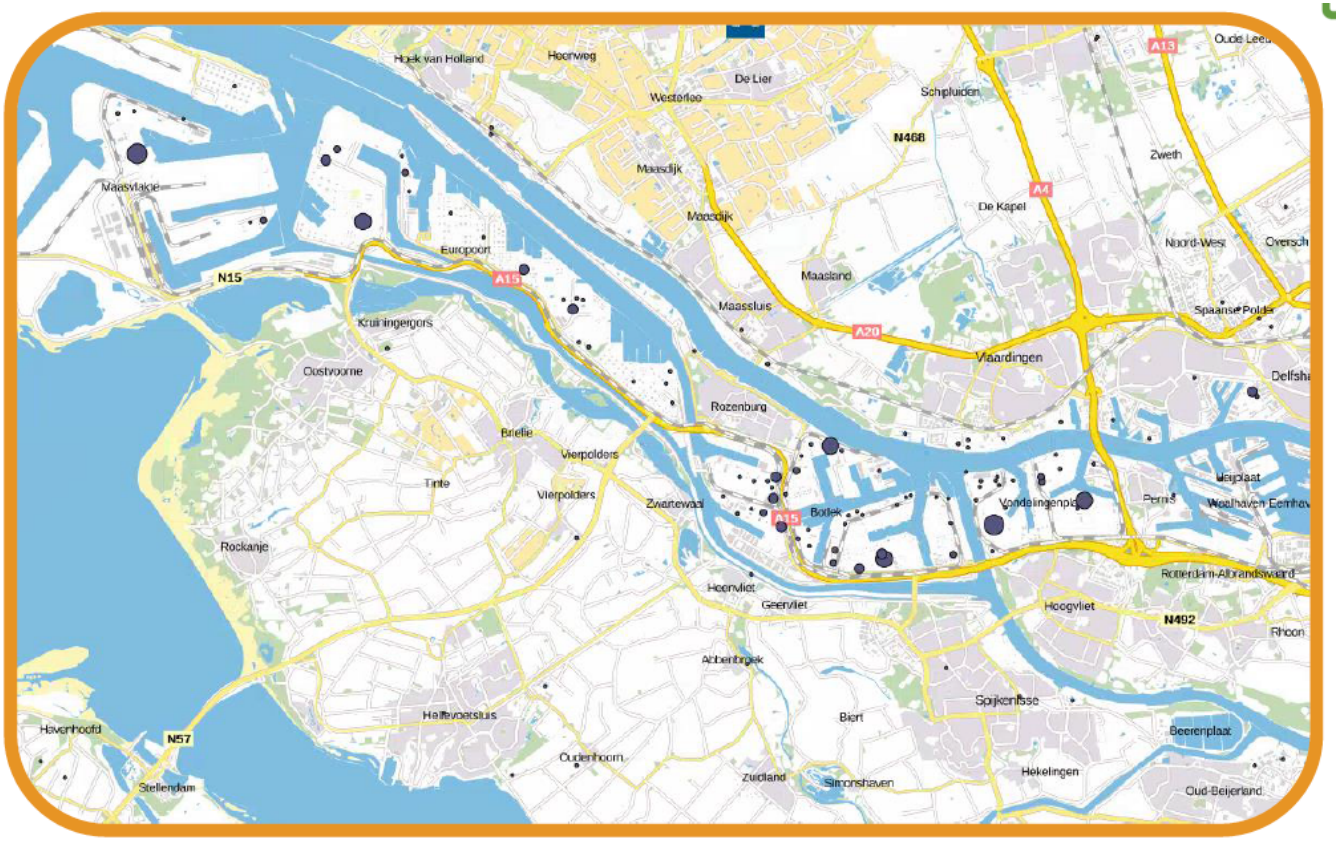

Source: Vouter Verhoeven, Warmtebedrijf Rotterdam

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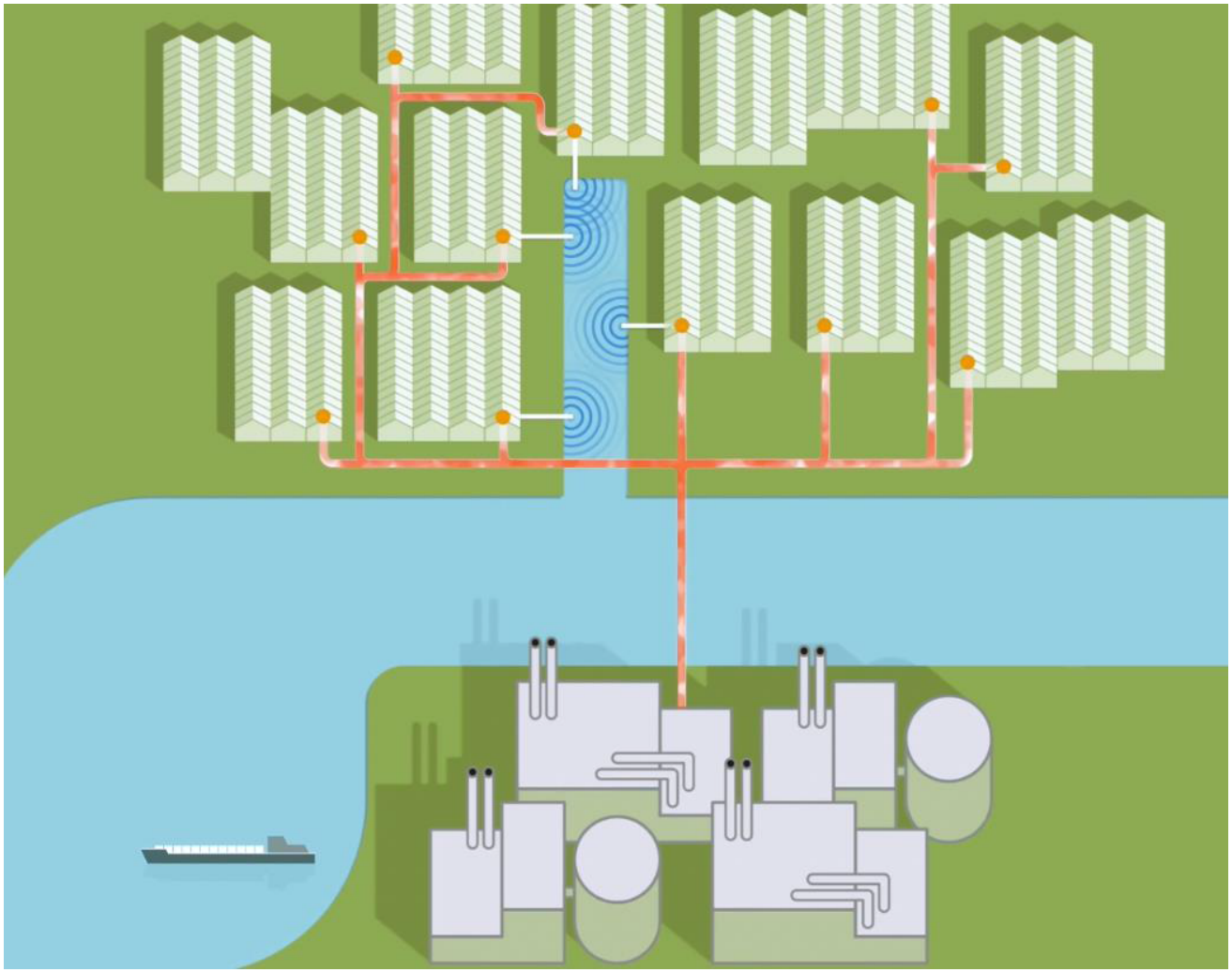

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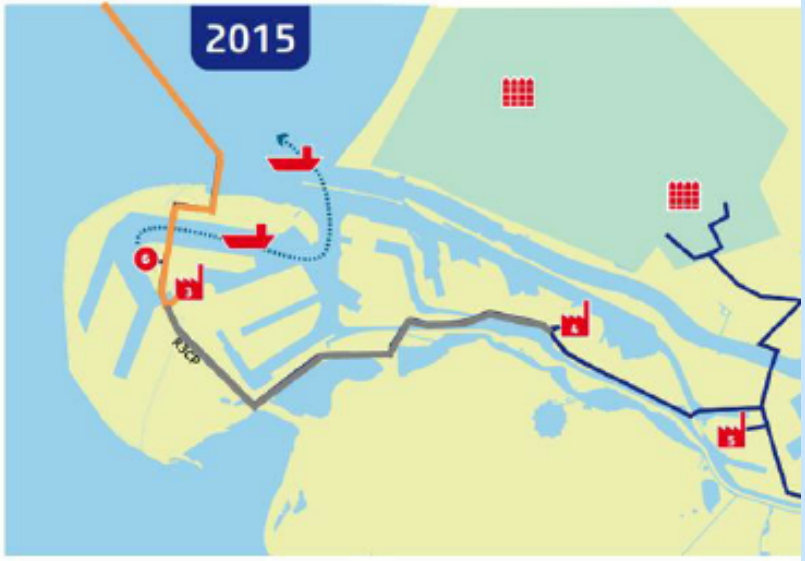


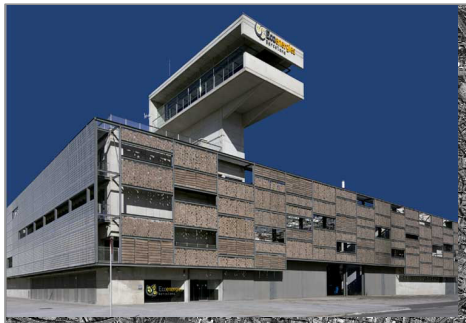
1 Shell Pernis
2 E.ON-ROCA
3 E.ON CO_2-Catcher (CATO-2 pilot project)
3 ROAD
4 Abengoa
5 Air Liquide
6 CO_2 Hub CINTRA
ROAD pipeline
OCAP pipeline (existing)
Connecting pipeline

Ondergrondse CO_2-opslag
CO_2-transport (pijpleiding)
Plan CO_2-transport (pijpleiding)
Levering CO_2 aan kassen
Plan levering CO_2 aan kassen

Leveringsgebieden OCAP
1 Westland
2 B-driehoek
3 Zuidplaspolder

Noordzee
IJmuiden
Haarlem
Zandvoort
Amsterd
Hoofddorp
Aalsmeer
Leiden
Alphen aan den Rijn
Den Haag
Zoetermeer
Pijnwijk
Bodegraven
Waddinxveen
Gouda
Delft
Maasvlakte
Europoort
Capelle aan den IJssel
Rotterdam
Hoogvliet
Barendrecht
Moerdijk

Barcelona: waste energy usage



Ecoenergies Barcelona

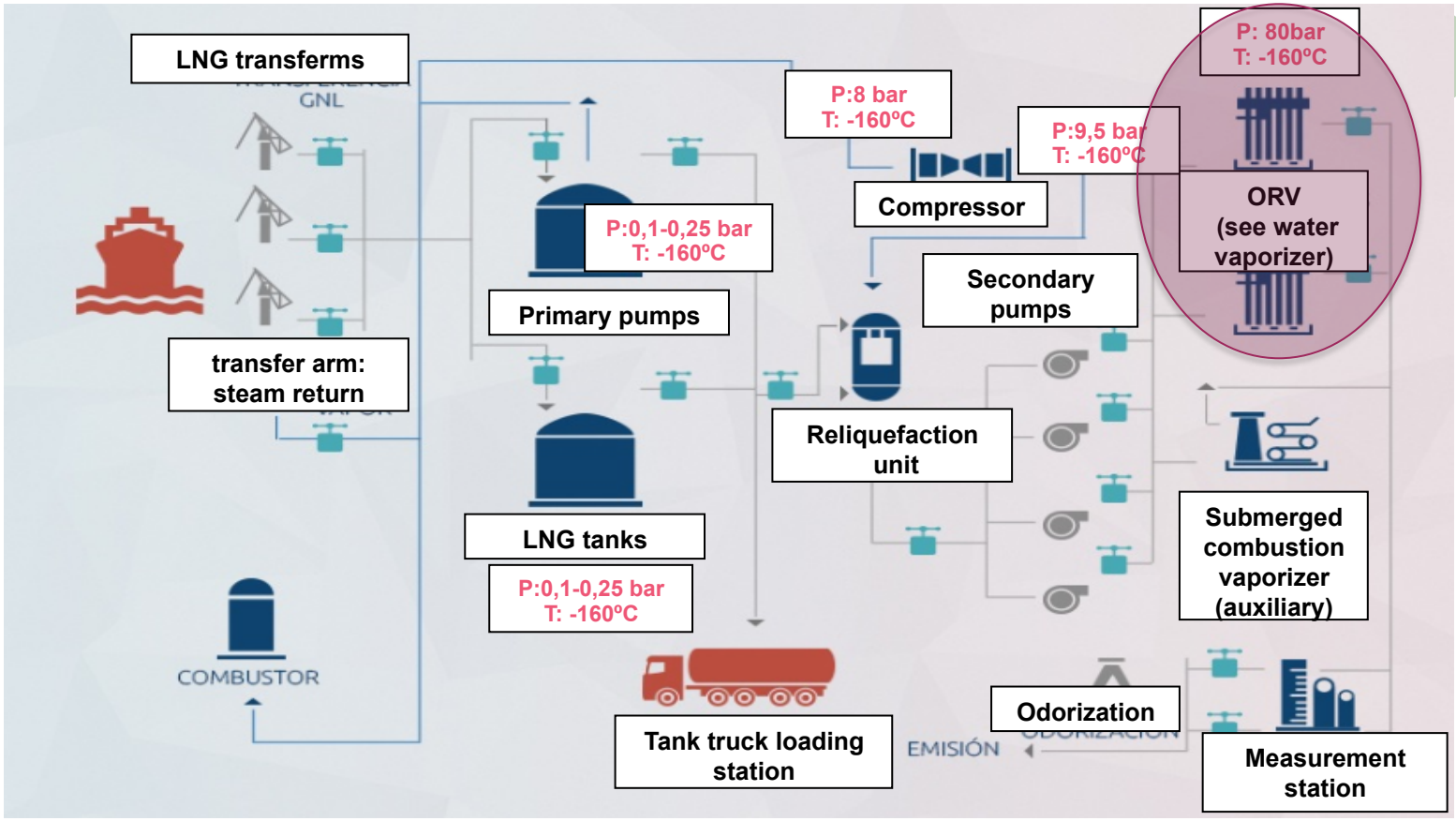
districlima

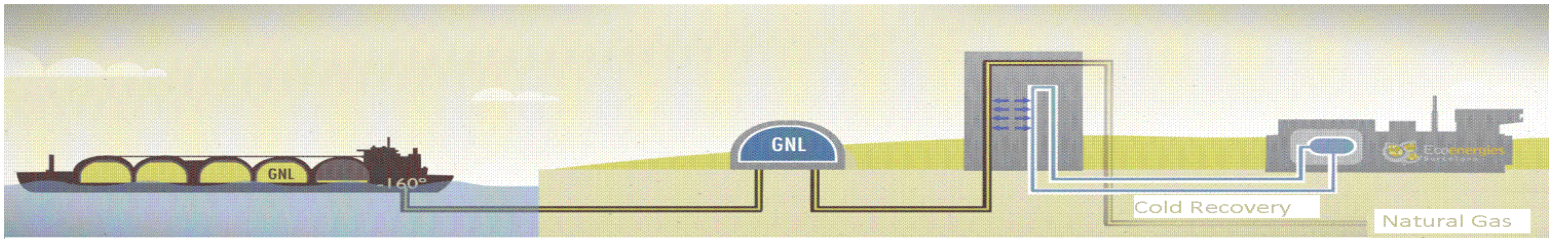
USW / WASTE HEAT

WASTE COOLNES

HEAT/BIOMASS

LNG Regasification Process





Main idea of the project

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- Regasification of liquified natural gas (LNG), gives off substantial amounts of cold (LNG stored at around -162ºC + phase change)
- All this energy is currently rejected to the sea.
- Waste cold recovery from Liquified Natural Gas (LNG) in regasification plants and its transformation into useful energy forms
- Nowadays, waste cold is not recovered in any of the 37 LNG regasification plants of Europe

Valuable energy for number of applications

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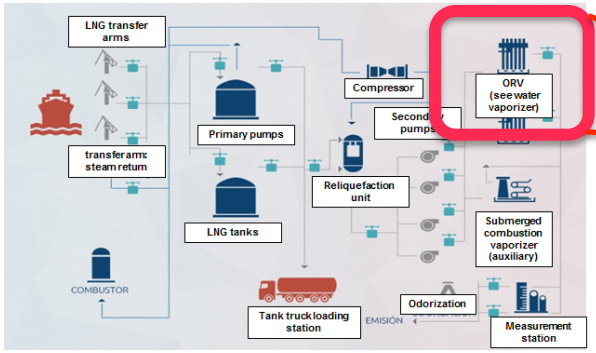
- Food industry
- Pharmaceutical industry
- Industrial cooling: petrochemical plants, power plants and steel, etc, etc
- Data Centers
- Industrial Gases production
- Space cooling of buildings

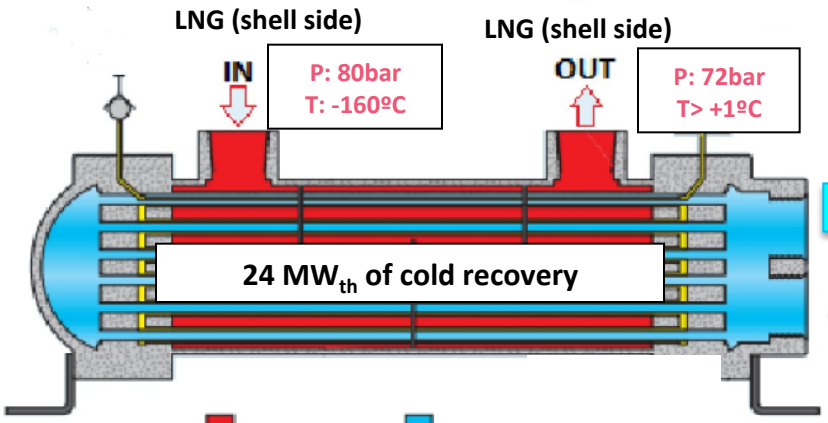
Project Concept



STV evaporator (Shell & Tube) in substitution of an ORV in order to recover the cold generated in the transformation of LNG to NG.

SHELL & TUBE VAPORIZER

To Measurement point station (Regasification plant)

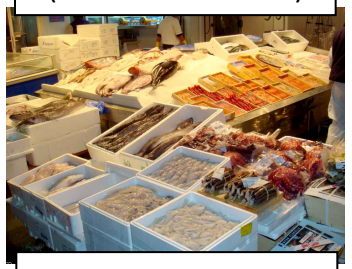


CO_2 outlet (tube side)

DRY ICE STORAGE

T: -15/-30ºC

MERCABARNA (Wholesale market)



High cooling demand

CO_2 inlet (tube side)

CO_2 as cold carrier fluid:
The system allows to provide the necessary energy to be used for food conservation and frozen rooms (almost) without the use of primary energies.

ICE STORAGE (300 MWh)

Key elements:
LNG Evaporator and Storage

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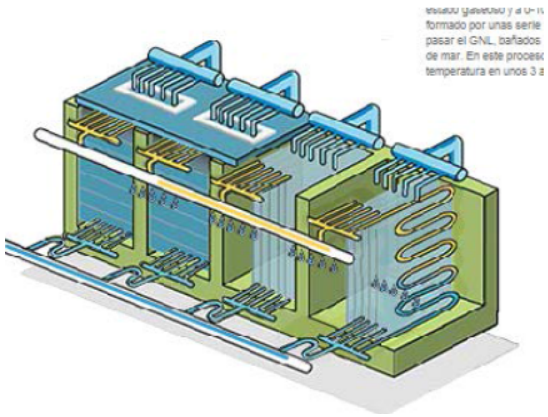
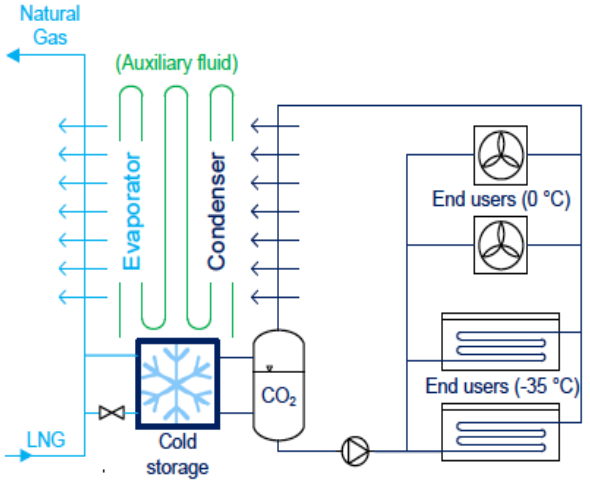
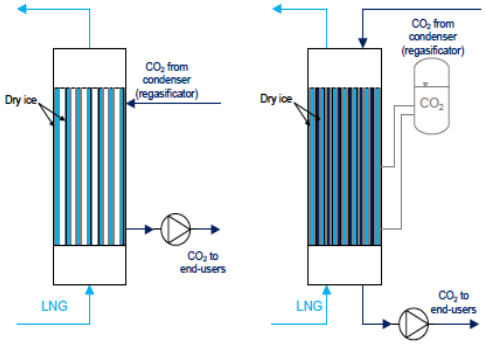




CO_2 as a PCM storage on negative temperatures:

Dry ice formation and melting , phase change storage on -55 ºC.



Barriers and opportunities

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Main barriers identified

- Lack of boost/motivation. Gas market is fully regulated
- Application of waste cold not always evident near the regasification plants
- Lack of demonstration projects
- Technology constrain: need for a high critical mass on demand

Great Opportunities

- 37 LNG regasification plants in Europe, which represents ≈20% of world capacity
- Developing solutions for further industrial symbiosis within industrial parks – circular economy

BCN Local Potential

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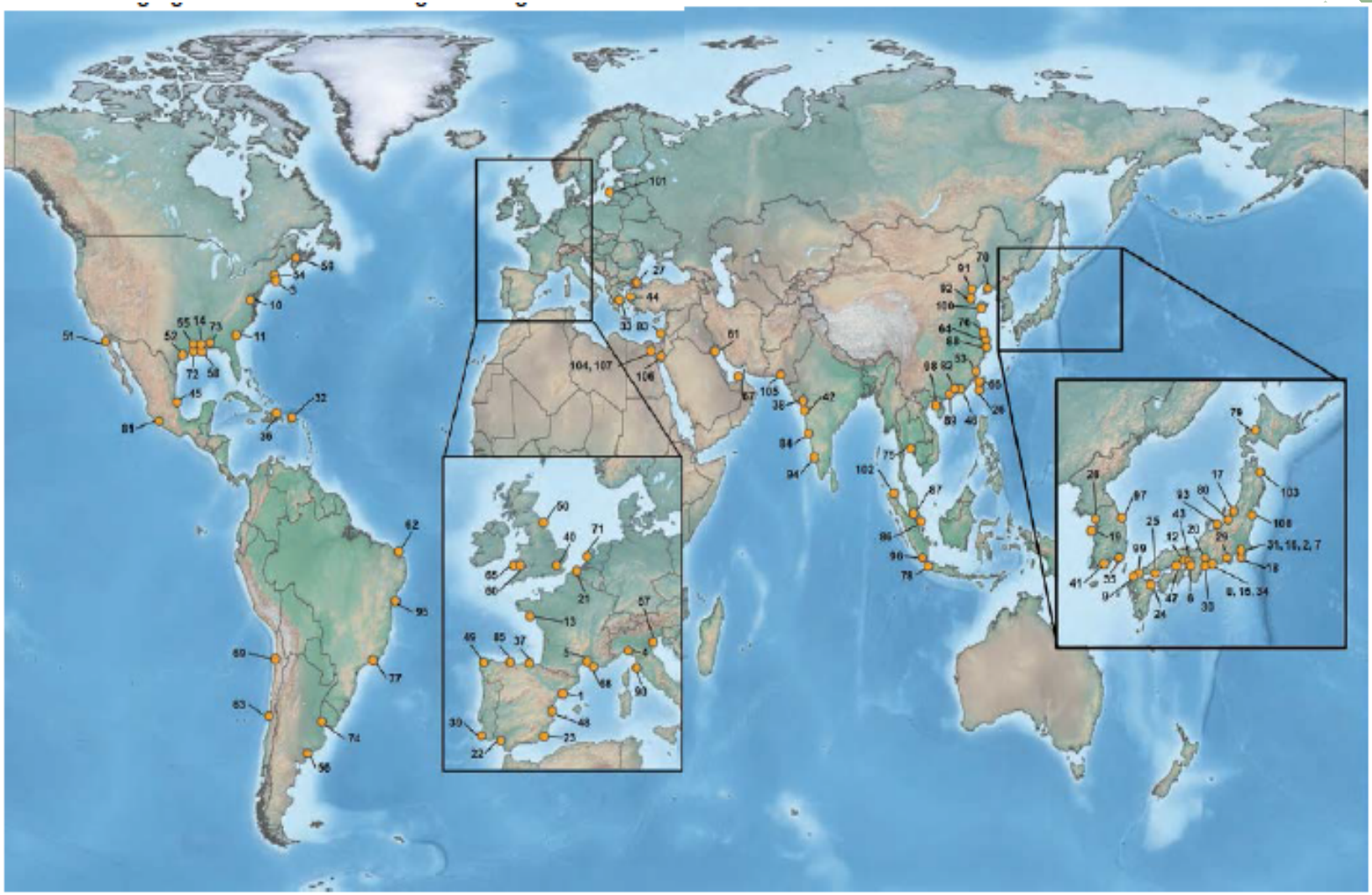
Presently foreseen // Full potential

- 24 MW LNG waste energy recovery
- 162 GWh/year of useful cold // 665 GWh/year
- 104 GWh/year primary energy savings // 459 GWh/year
- equivalent to 0,7% of total electrical energy consumption of Barcelona // 3%
- 16.500 ton/year CO2 emissions reduction //73.123 tonCO2/year

Replicability



EU (untapped)
Energy recovery potential

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- **4,5 TWh/year of high commercial value cooling**,
- **1,5 times** higher than all the cooling provided through existing district cooling networks at present.
- **5,4% of total cooling** consumption on buildings and industry together**.**

- Savings roughly **1,5 TWh/year of electricity** ,
- reduction of **4,4 TWh/year primary** energy consumption
- **649.500 ton/year** of CO2 emissions

CONGRESS EUROHEAT & POWER Glasgow 2017

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