The European Commission’s science and knowledge service

Joint Research Centre
Industrial waste heat in H&C strategy and in EU Directives

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Scientific officer, Petten, 2 December 2019
Introduction

• Waste heat in H&C strategy
• Waste heat in energy efficiency and renewable energy directives
EU H&C strategy - overview

- Published in 2016
- Objectives were to make sector smarter, more efficient and sustainable, reduce emissions etc.
  - Make renovating buildings easier
  - Replace old equipment
  - Increase share of renewables
  - Reuse of energy waste from industry
  - Involve consumers
EU H&C strategy – waste heat from industry

• A lot of waste energy is dissipated unused in air and water. Possible solutions:
  • Direct feed via district heating system
  • Cooling via cogeneration and absorption chillers that transform heat into cold
Example sectors

Iron and steel (HT)
Glass (HT)
Cement, lime (HT)
Chemical plants (MT, HT)
Textile (LT, MT, HT)
Pulp and paper (LT, MT)
Food, drink and milk (LT, MT)
Etc.
Other: IT server halls, commercial centers
Directives – Energy Efficiency Directive

• Article 14 – assess energy efficiency potential in heating and cooling sector
  • map sources and demand
  • CHP, heat pumps, other renewables, etc.
• industrial installations with thermal input exceeding 20 MW generating
Directives – Renewable energy directive

• Link to EED in RED II
• 1.3% of renewable heating and cooling should be added annually in most MSs from 2020 to 2030
• In district heating systems MSs should endeavor 1% increase of renewable sources
• Waste heat may be counted to this target up to 40% of the average annual increase
• Internal processes should be optimised before option to send waste heat to district heating network is explored
Examples of barriers

Structural – e.g. long distance between source and demand, or temporal mismatch

Financial – large investment cost; long-term commitment needed

Waste heat supply not core business of industries
Any questions?
You can find me at @jopcarlsson and johan.carlsson@ec.europa.eu
VEOLIA ENERGIA POZNAŃ

Heat Recovery from air compressors to district heating: a unique Veolia project in Poland
Veolia solution: heat recovery from VW air compressors to the local DHN

- VW is an existing customer connected to the heating network:
  - 10 MW
  - 33,000 GJ / year
- 2014: replacement of the factory compressors with new ones, equipped with a heat recovery system:
  - 3 compressors; 1.8 MWt;
  - temp. 90/40 °C

Key numbers

New project on the scale of Central and Eastern Europe
Veolia solution - scheme

Heat recovery: 17,000,000 dm³ H₂O/year

SAVINGS: 1,200 CO₂/year
12,000 GJ/year

DHNSubstation of heat recovery to DHN
**Volkswagen:**
- recovery modules
- 2 substations
- 2xDN150 mm network, L = 600 m

CAPEX ca. 2,0 MPLN

**Veolia:**
- substation of cooperation with the heating network
- 2xDN150 mm network, L = 150 m
- CAPEX approx. 0.6 MPLN

**Project implementation**

![Diagram showing project timeline and milestones]
Benefits of the Project

For VW

- Reduction of CO2 emissions by about 1,200 t / a
- Water savings from the cooling process: 17 M liters per year
- Savings of PLN 500,000 / year
- Effective use of waste heat (heat demand of approx. 30 residential buildings)

For Veolia

- Ensuring a long lasting customer relation and opening the door for further cooperation
- An innovative project implemented by a team of Veolia's engineers
- A case with high replicability potential
Odnawiamy zasoby świata VEOLIA
Challenges when Planning & Developing Industrial Waste Heat DHC

John O’Shea
Energy Systems Analyst
Codema – Dublin’s Energy Agency
Rundown

- Background / Context
- Challenges
- Pilot Project
  - TDHS
Why should Ireland develop DHC?

- Heat: 37%
- Transport: 42%
- Electricity: 21%
- Energy: 21%

Progress to 2020 Targets:
- RES-E: 75% (40% target)
- RES-H: 58% (12% target)
- RES-T: 74% (10% target)
Why should we develop DHC in NWE?

"All in bottom 5! A little better, but still very low DHC!"

Source: Eurostat
What is 4th Generation DHC?

- **Low Temp Sources**
  - Environmental Heat Sources (e.g., river, water, geothermal)
  - CHP Plants Powered by Biofuels
  - Large Scale Thermal Storage
  - Large Scale Heat Pumps

- **Low Temp Demands**
  - Data Centres
  - Commercial Refrigeration
  - Large Civic Buildings
  - Hospitals
  - Residential
  - Hotels and Retail

- **Interreg North-West Europe HeatNet NWE**
  - European Regional Development Fund

- **A+** Energy Efficiency Rating
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Integrated Heat & Electricity Markets = Smart Energy System

- CHP Plants Powered by Biofuels
- Large Scale Thermal Storage
- Large Scale Heat Pumps
- Wind Turbines
- Solar Energy
The Vision
DHC – Not just for heating

- Industrial Waste Heat – increasing plant efficiency
- Thermal Storage – Cheap Energy Storage for Large Scale Demand side Response
- Customer Safety – no onsite combustion or fuels
- Low-carbon & lower local air pollution
- Integrate more Renewable Electricity – Large scale Heat Pumps & Electric Boilers & RE CHP
- Less Fossil Fuel Imports – increased security of supply
- Low-cost heat – utilises waste and renewable sources of heat
- New market – new local employment
Energy Planning – Evidence Base Challenge

Heat Demand

Heat Supply

Constraints (physical, timing, political)
Heat Sources
17 Heat Source Types Investigated – Approx. 70 different data sources used

Commercial:
- Flue gas heat recovery
- Process heat recovery
- CHP excess heat
- Existing Biomass
- Commercial/Industrial Cooling with Heat Offtake (e.g. Data Centres, Cold stores)

Infrastructural:
- Electrical power plants (CCGT, OCGT, EfW)
- Electrical transformer substations
- Landfill biogas
- Landfill waste heat
- WWTW biogas
- WWTW waste heat
- Sewer waste heat (EPA Licence data)

Environmental:
- Air (ASHP)
- Surface water (HP)
- Ground (GSHP) – SEAI suitability map
- Deep Geothermal
- Mine water
Heat Sources

Enough industrial sources to heat 250,000 homes
Heat Demand

57% of Heat Demand in Ireland could be covered by DH

https://www.districtenergy.ie/heat-atlas
Physical Obstacles

These obstacles include: Infrastructure, Historical & architectural heritage sites, Habitat, Rivers & lakes.
DH provides < 0.8% of heat demand in Ireland

Industrial waste heat = 0% of heat supplied to DH in Ireland
Where to Start Bridging the Gap

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Challenges for DHC Company/Municipality

- No tradition of DHC – lack of knowledge (across all sectors - academia, public bodies, semi-state utility companies & customers)
- No municipal utilities - all delivered by national level bodies
- No evidence base for decision making & low autonomy levels
- All energy policy & regulations controlled at national level – difficult to change
- Current energy policy never designed with DHC in mind – creates unintended barriers
- No long-term planning – energy plans changed with changing political parties
- No national level Heat Plan (although there are transport & electricity plans)

….BUT things are changing! 😊
Barriers & Challenges
Common Across North-West Europe

- Regulatory
- Political
- Policy
- Customer Risk
- High upfront capital costs
- Organisational
- Legal
- Technology
- Physical Constraints
- Using Local Authority powers
- Getting local politicians on board
- Using Public Buildings as anchor customers
- Timing, Facilitation, connecting stakeholders
- Low-cost loans/investment, Shared trenching costs with other infrastructure
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The Opportunity for Waste Heat Producers

• Provide free cooling

• Act as a heat sink for CHP plants

• Potential to generate extra revenue from heat which currently has no value

• Reduce the space requirement and capital costs of on-site heating and cooling plant

• Where applicable DHC can also provide low-cost, low-carbon heating on site to provide hot water, space heating, process heating or pre-heating etc.

• Potential to reduce capacity charges for electricity and gas
Challenges for Waste Heat Producers

• Disruption to production – financial implications
• Reluctance to be an early adopter “guinea pig”.
• Engagement in EE
• Trust regarding payback, IRR etc. – especially if calculation is performed by the supplier and no expertise to verify these internally
• Availability of capex – competition for investment internally with processing equipment etc.
• Knowledge, awareness or time to fully investigate options
• Access
• Reluctance to take on the role of heat supplier – ensuring security of supply
• Impact on quality of product or service
Tallaght District Heating Scheme

Source: Data Centre Waste Heat
Data Centre Waste Heat
Large Scale Heat Pump
Electricity
Large Scale Peak Boilers
Fuel

Local Authority Buildings
New Housing
College Campus
Commercial & Retail
Public Buildings
TDHS Specific Benefits

• Utilises waste heat that currently has no value

• Provides cooling as well as heating (high combined efficiency)

• Integrates elec and heat networks – allows balancing of the grid, greater utilization of RE

• Has high potential for replication due to the growing number of data centres

• Contributes to South Dublins CO2 (~1,400 tCO2) and EE targets

• Provides low-cost, low-carbon heat to residents in the Tallaght area

• Reduction in fossil fuel use by up to 99%
Thank you!