High performance, smart district heating & cooling
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District Heating & Cooling: Today

- Supplies around 10% of heat consumption at EU level
- Widely diverging situation in the European Union’s Member States
  - market shares from 0% to close to 70%
- Widely different levels of development
  - from countries where heat networks are a natural and traditional part of the heating systems to countries where they are virtually unknown with no tradition
- Dominance of conventional systems with high temperature networks fitted to ”high-temperature” buildings and building heating system
- Dominance of fossil fuels (only around 20% of renewables) but widely different supply sources
- Widely different regulations and governance
  - from fully regulated to semi- and not regulated systems (e.g., prices, organisation, management)
- District cooling
  - less than 1% overall and developed only in a handful of cities
- No European framework
- Regulation in most Member States is underdeveloped (regulatory gaps)
  - e.g. consumer protection, performance information (efficiency and renewables, planning, business models, relationship with building codes, etc.
- Expertise in design and technology is limited and concentrated in a few countries
- Consumer awareness of this heating solution is low in most EU countries
Percentage of the population served by district heating (2013)

Source: Commission services using data supplied by Euroheat and Power
Share of energy carrier in DHS in 2012

Source: Commission services using Fraunhofer and alia, Heating and cooling data mapping ... ENER/C2/2014/641
District Heat Primary Supply Sources in EU28 2012 (606 TWh)

Source: Commission services using Fraunhofer and alia, Heating and cooling data mapping ... ENER/C2/2014/641
Towards the future
The start: EU Heating and Cooling Strategy

✓ Recognised that heating and cooling was a distinct policy area that needed to be integrated into the EU the energy policy framework on its own.

✓ It established that
  ▪ heating and cooling was a big (the biggest) part of the EU energy consumption ≥ 50%
  ▪ was based largely on fossil fuels and
  ▪ largely inefficient both in terms of production (supply) and in terms of consumption (demand)

✓ This allowed for the first time to look at the EU thermal energy production and consumption together in a holistic way and identify synergies within the sector and with other energy sectors (electricity, waste heat & cold, buildings)

✓ It called for making heating and cooling both more renewable based and energy efficient in production (supply) and consumption (demand e.g. in building)

✓ It set the goal to decarbonise buildings in the EU by 2050
The start (cont)

EU Heating and cooling strategy proposed tools & solutions:

- a) district heating & cooling (efficient, renewable based, high performance and smart) and cogeneration
- b) smart energy systems (digitalisation) able to benefit from demand response, energy storage, smart meters and heating systems/appliances
- c) linking heating & cooling with electricity to allow a greater integration of variable renewable electricity (e.g. wind and solar that are already on par in cost with new fossil fuel generation) by offering balancing and optimisation for both renewable electricity and heat
- d) linking industrial waste heat sources with buildings through heat networks to save primary energy
- e) refurbishment of existing building stocks to make demand more efficient
- f) deploy renewable and efficient heat and cold supply in buildings to replace old and inefficient, fossil based systems
- g) help industry to do the same as for buildings
- g) unleash innovation, research and development
- h) step up education, training, best practice exchange and information to educate consumers, companies and public authorities and ensure sufficient skilled professionals
- i) reflect these objectives in the Clean Energy Package that overhauls the EU electricity, energy efficiency, building and renewable frameworks
Heating and cooling is 50% of EU's final energy consumption.

EU TOTAL

- Heating and cooling: 50%
- Rest: 50%

EU Industry: 45%
EU Tertiary: 37%
EU Residential: 18%

Buildings consumes ≈ 60% of heating and cooling, industry consumes most of the rest.
EU heating and cooling sector: Most of it is fossil fuel

Natural gas is the dominant fuel
Used inefficiently in buildings … also in industry
Produced in heating appliances (≈90%) and in district systems (≈10%) ... many of which are old and inefficient ...
Follow-up actions


- **Intensified implementation** of the current legislation (e.g. Article 19 of the EED on split incentives).

- **New non-legislative actions** (e.g. industrial round tables for energy industries).

- **Intensification of current non-legislative actions** (e.g. Skills, SET plan, Covenant of Mayors, etc.).
The Clean Energy Package
Why do we need it?

THE ENERGY SYSTEM OF TOMORROW WILL LOOK DIFFERENTLY

2030
50% of electricity to come from renewables

2050
Electricity completely carbon free

Thanks to the EU - ambitious energy and climate commitments

With leadership comes responsibility

Unique opportunity to modernise our economy and to

boost competitiveness

create the growth and jobs we need
THE CLEAN ENERGY PACKAGE: KEY OBJECTIVES

LEADING THE ENERGY TRANSITION - CREATING VALUE FOR CITIZENS AND BUSINESS

- Putting energy efficiency first
- Demonstrating global leadership in renewables
- Delivering a fair deal for consumers
The Clean Energy Package: Key Objectives

October 2014: European Council Agreement on Climate and Energy Objectives 2030

- 20% Greenhouse Gas Emissions
- 20% Renewable Energy
- 20% Energy Efficiency

≤ - 40% Greenhouse Gas Emissions
≥ 27% Renewable Energy
≥ 27% Energy Efficiency

Global Leadership

Commission's 10 Priorities – Ambition to Become Global Leader in Renewables
KEY ELEMENTS OF THE PACKAGE

A SET OF COHERENT MEASURES

"In essence the new package is about tapping our green growth potential across the board"
Commissioner Miguel Arias Cañete (2016)

**Energy Efficiency**

**Renewables**
(Revised Renewable Energy Directive)

**Energy Union Governance**

**New Electricity Market Design**
(including Risk Preparedness)

**Energy prices and costs report**
ENSURING A HOLISTIC APPROACH ACROSS POLICY AREAS

The new market design will be the foundation of the 2030 framework (short term markets, flexibility) and ensure RES generators can earn a high fraction of their revenues via the market.

With the governance initiative underpinning the process across the 5 Energy Union dimensions

But also Energy Efficiency, Energy Performance of Buildings, Risk preparedness, the ETS and non-ETS proposals...
GOVERNANCE OF THE PACKAGE

Energy Union Governance Regulation

Integrated PLANNING

Integrated REPORTING

EC MONITORING of collective progress

EC RECOMMENDATIONS & MEASURES for delivery

Regional cooperation

Energy Efficiency Directive


Renewable Directive

Electricity Regulation & Directive

Risk Preparedness Regulation

2030 TARGETS

Progress reports on implementation of the integrated national energy and climate plans

State of the Energy Union

Target achievement

Development and implementation of the integrated national energy and climate plans
The Clean Energy Package: an enabling framework for 2030 and beyond

Recast Renewable Energy Directive – key highlights
- Framework for renewable heating and cooling
- Market framework for district heating and cooling
- District heating/cooling potential to provide balancing, demand response and storage services
- Waste heat and cold as supply source
- Bio-sustainability criteria for biomass and biomass fuels used in heating & cooling
- Renewable self-consumption (prosumers) and renewable energy communities

- Long-term (2050) renovation strategies for highly efficient and decarbonised buildings to guide investment decisions
- Energy performance of buildings to take into account renewable energy in/on buildings and supplied through energy carriers (e.g. district heating and electricity networks)

Energy Efficiency Directive – key highlights
- Renewable energy in/on buildings and primary energy saving through district heating/cooling can count towards the national end-use energy saving requirements

Electricity market design to make market fit for renewable energy – key highlights
- Flexibility: balancing, demand response, storage and other system (ancillary) services integrated
- Active consumers and energy communities
RENEWABLE ENERGY

2020

- 20 % RES share overall
- National binding targets for RES
- Specific target for RES-Transport

2030

- At least 27 % RES share
- Binding at EU level
- No national or sector specific targets
NEW RENEWABLE ENERGY DIRECTIVE

- Increasing Renewable Electricity
- Decarbonising Heating & Cooling and Transport
- Removing administrative barriers
- Strengthening EU sustainability criteria
- Empowering consumers
- Target achievement

Reaching >27% RES in 2030
STATE OF PLAY - PROGRESS TOWARDS NATIONAL 2020 TARGETS

Based on 2016 Interim Progress Report - Oeko-Institute
Progress on renewable electricity – EU level

EU-28 renewable electricity production by source (source: EUROSTAT, Öko-Institut)
RES-E: Where are we and where do we need to go?

RES-E share of total electricity
Progress on RES-H&C – EU level

EU-28 renewable heating and cooling production by source
source: EUROSTAT, Öko-Institut

CLEAN ENERGY FOR ALL EUROPEANS
Why act at EU-level?

- ≈ 50% energy consumption
- 18% RES today => 27% in 2030
- 68% of the EU's gas imports
- Risk of missing target if no action
ADDRESSING THE UNTAPPED POTENTIAL OF HEATING & COOLING

**WHAT**

- Endeavour by Member States to increase the share of renewable energy in heating and cooling supply, by 1 percentage point per year until 2030.
- Consumer information on district systems' energy performance and renewable shares
- Access rights to local district heating and cooling systems for producers of renewables heating and cooling and waste energy from industry

**WHY**

- High untapped potential: a major contribution of the sector is crucial for a cost-optimal target achievement
- Strategic sector for energy security: 75% of European homes are heated (or cooled) with fossil fuels & 68% of the EU's gas import
- Risk of missing the target in the absence of action
- Need to provide visibility and certainty to investors

**HOW**

- Proportionality and flexibility for Member States when implementing the options
- Limited administrative burden (particularly when combined with Energy Efficiency measures)
New framework for renewable heating & cooling

Renewables in the HC sector (new Article 23)

- A yearly 1ppt increase in renewables shall be endeavoured and respective measures and policies to be put in place

The heating and cooling sector should contribute to the EU renewable energy target in proportion to its size

District heating & cooling (new Article 24)

- Access of renewable (and waste energy) suppliers to the system
- Consumers right to switch to renewable suppliers
- Consumer rights to disconnect for their own renewable supply
- Information on energy performance and renewable heat to consumers

Administrative procedures (revised Article 15)

- RES-HC/DHC in planning & buildings
- Minimum levels of RES in buildings
EMPOWERING CITIZENS AND COMMUNITIES

A EU-level framework for renewable self-consumption in which citizens are at the core

✓ Renewable self-consumers to be allowed to generate, store, sell and consume their own electricity
✓ Renewable self-consumers in multifamily houses to be allowed to generate, store, sell and consume their electricity jointly
✓ Specific provisions for energy communities
Increasing the share of low carbon and renewable fuels in transport through an EU blending mandate for transport fuel suppliers
NEW ELECTRICITY MARKET DESIGN

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2050
Electricity completely carbon free

Today
Increasingly decentralized power generation

2021-2030
Investment needs 47 bn/Year (47% network)

Technological and political developments require an overhaul of the market rules
PURPOSES OF THE NEW ELECTRICITY MARKET DESIGN

Boost wholesale market flexibility and provide clear price signals to facilitate the continuing penetration of renewable energies and ensure investments.

Enable active consumer participation and ensure that consumers are protected and benefit from progress in energy technologies.

Promote regional cooperation and provide a true European dimension to security of supply.
CLEAN ENERGY FOR ALL EUROPEANS

ENERGY EFFICIENCY

EU 28 - 30% Primary Energy Consumption Target

Primary energy consumption in Mt of oil equivalent (Mtoe)

- 20% target 2020 (1483 Mtoe)
- 30% target 2030 (1211 Mtoe)
- PRIMES REF2007 (1887 Mtoe in 2030)
- PRIMES REF2016 (1436 Mtoe in 2030)
- PRIMES GaCo30

#EnergyUnion
How heat networks are fitting in all of this?

District heating & cooling in the future energy system
HEAT NETWORKS: POTENTIAL TO BECOME ENABLERS OF THE ENERGY TRANSITION AND A KEY ELEMENT OF THE FUTURE LOW-CARBON, SMART, SUSTAINABLE ENERGY SYSTEM

High-performance, smart district heating and cooling is an evolutive backbone of a balanced energy transition that can be supplied with a very broad range of renewable and recycled energies and are the perfect match with energy efficient buildings. They allow high level optimisation of the use of resources and good individualised quality; they thus contribute to security and resilience of supply, emissions reduction and effectively address affordability and energy poverty.

Heat networks are many things:

- They can use many different supply sources; an endless mix of combinations (solar thermal, geothermal, bioenergy, renewable electricity, excess heat and cold, ambient heat through heat pumps and direct uses) – They are adaptable!
- They can integrate smart technologies for optimisation, primary energy saving, consumer control/comfort; they can be linked to and interact with the electric grids
- They can store energy, including variable renewable electricity; they can use stored energy
- They can participate in electricity grid balancing, demand response and system/ancillary services
- They can be adapted to low energy buildings and various settlement types (high building/heat density and low building/heat density)
- They are scalable from large systems serving entire cities and districts or just a few buildings and small villages (small and micro-systems)
CHALLENGES

A radical transformation of the EU energy system is under way.

- District networks can offer already a lot of innovative and new solutions and can become an important element of the new emerging smart energy system.
- The innovative solutions for renewables, energy efficiency, flexibility, storage, the integration and tailored made combination of various supply sources, technologies and smartness should become mainstream in district energy.
- Integration with high-efficiency, low-energy buildings and low-carbon sustainable communities is essential.

Further challenges:

- Continue R&D&I
- Keep cost-effectiveness and consumer satisfaction in focus
- Diffuse technologies, solutions and know-how in all stages of heat network development (e.g. planning, project development, operation)
- Innovative and effective financing solutions (map investment needs)
- Keep develop linkages with other elements of the energy system (electricity, storage, fuels)
- Address regulatory gaps and develop tailored business models

The Clean Energy Package with its various elements and as a coherent framework enables addressing the challenges and tasks and provides the opportunity for district heating and cooling to become an important building block of the EU future energy system.
THANK YOU!

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