Synthesis of Swedish District Heating Research between 2013 to 2017

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AALBORG UNIVERSITY
DENMARK

What has happened in Sweden?

District heating: Mature market, technology locked in

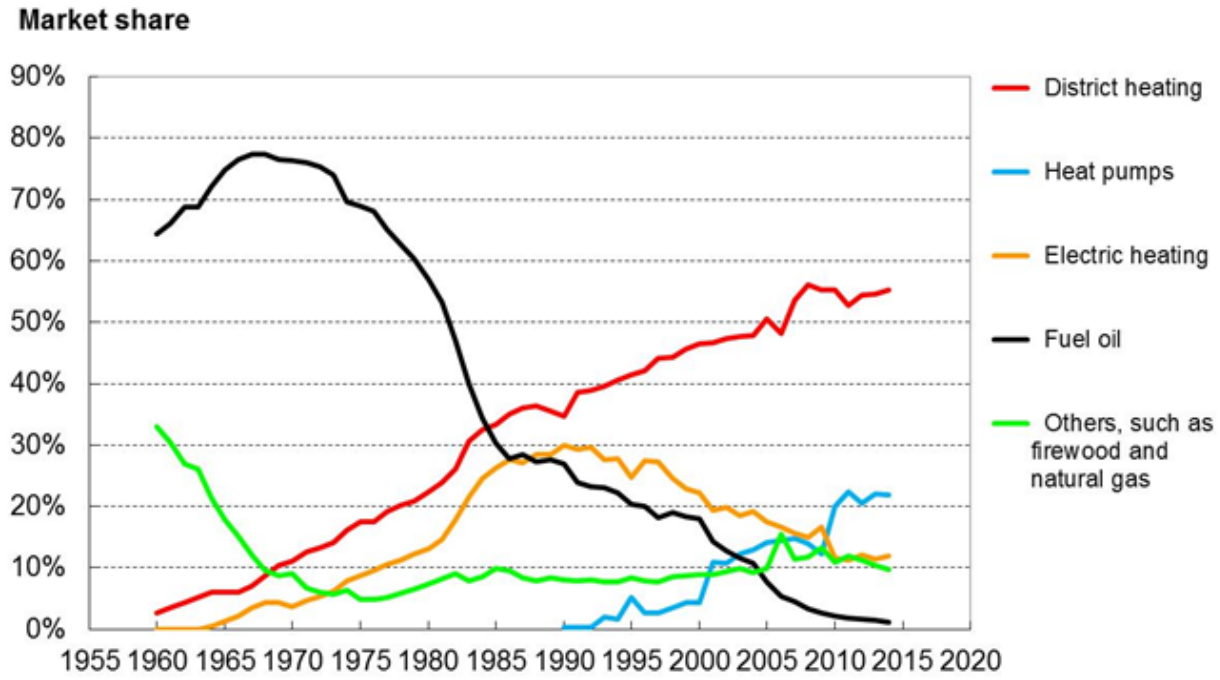

Figure 1: Market for heat supply to residential and commercial premises in Sweden between 1960 and 2014 divided in different heating alternatives (Source: Werner, 2017)

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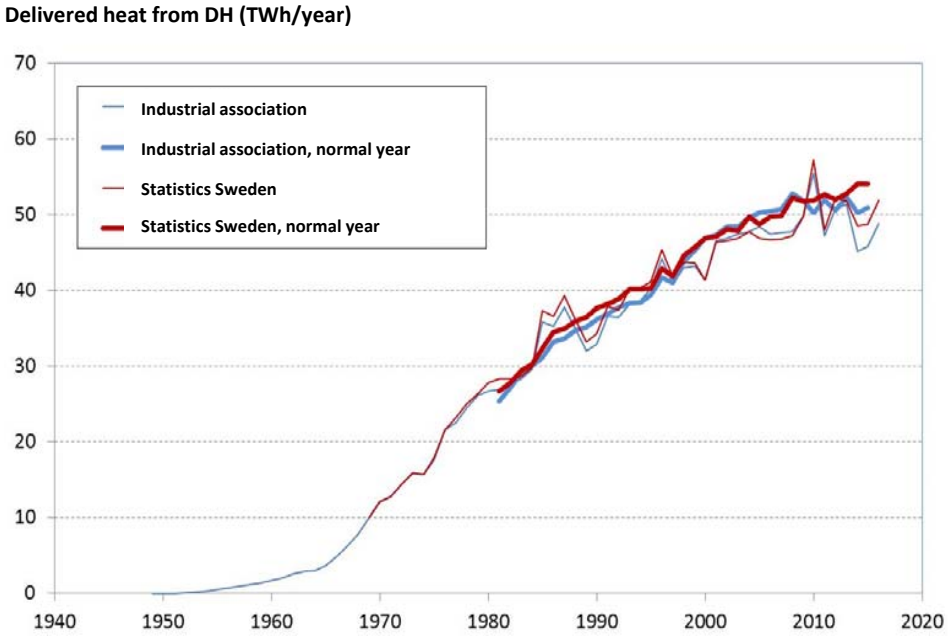


Figure 2: Market for heat supply to residential and commercial premises in Sweden between 1960 and 2014 divided in different heating alternatives (Source: Werner, 2017)

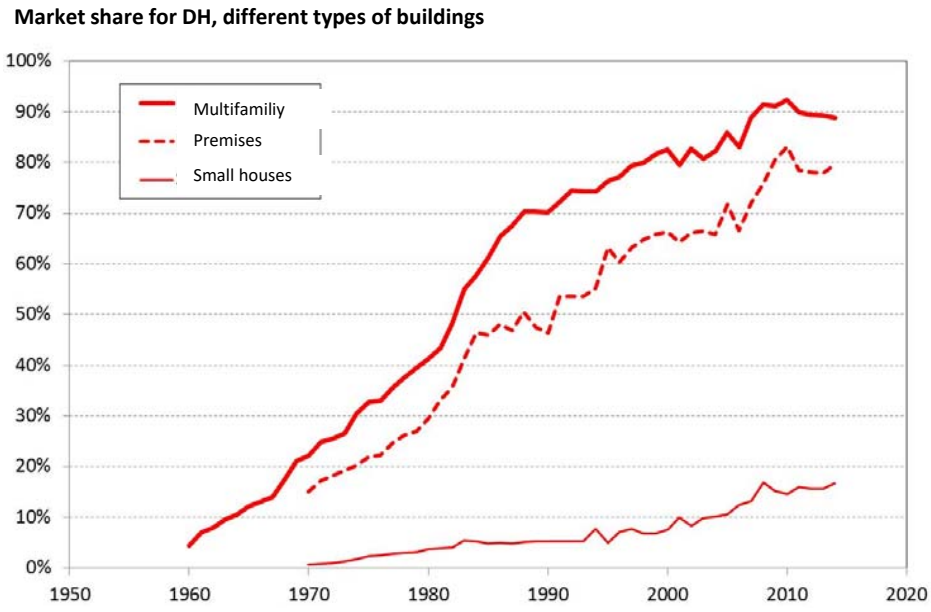


Figure 3: Market for heat supply to residential and commercial premises in Sweden between 1960 and 2014 divided in different heating alternatives (Source: Werner, 2017)

What has happened in Sweden?

Sweden has the highest share of renewable energy in Europe's energy system, of which district heating is an important part

District heating production is almost fossil free.

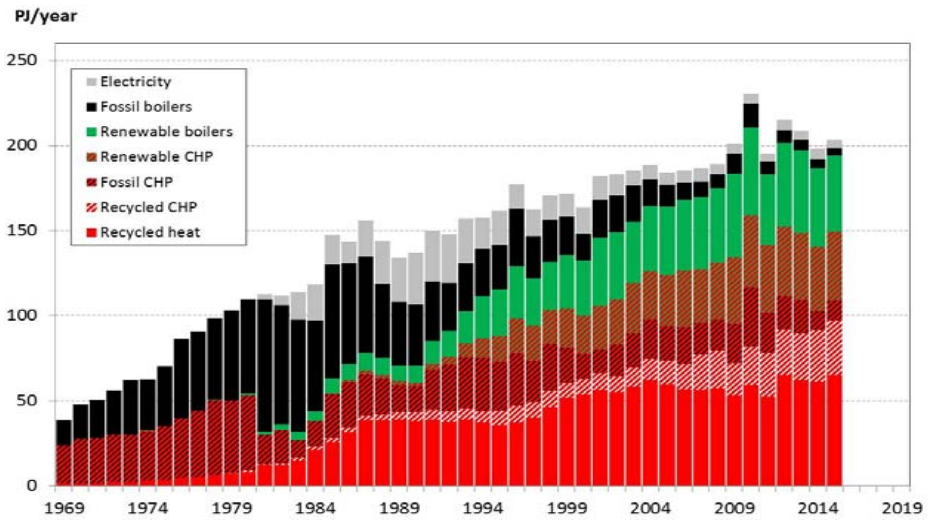


Figure 5: Heat supply to Swedish district heating systems between 1969 and 2015 according to seven fundamentally different ways of heating. (Source: Werner, 2017)

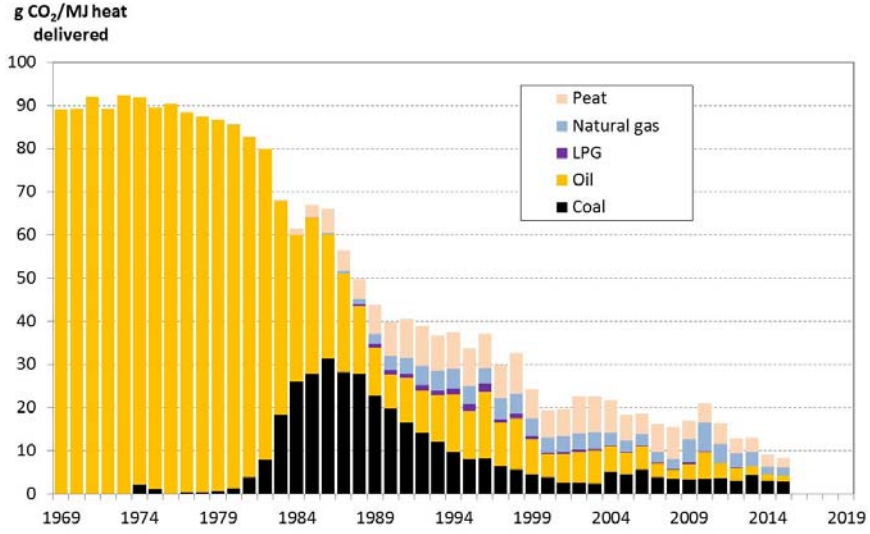


Figure 6. Specific carbon dioxide emissions from Swedish district heating systems between 1969 and 2015. (Source: Werner, 2017).

What has happened in Sweden?

District cooling: Newer market, only 38 suppliers, mainly industrial customers and office buildings

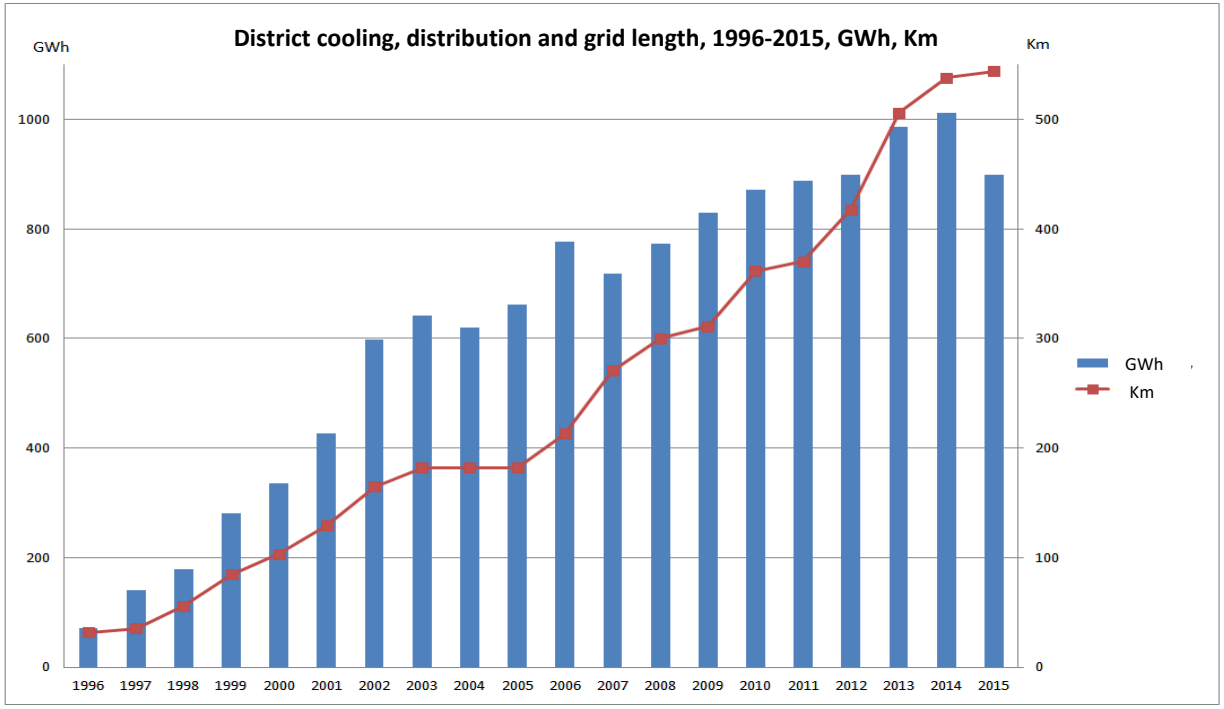


Figure 4: Cooling supply and network length in Sweden in 1996-2015. Source: Energy companies Sweden's website

Fjärrsyn – a Swedish research programme about district heating and cooling

- Started 2006 and finished 2017, three periods
- Turnover: 61 million SEK - about 1.5 million SEK per year
- Funding: 40/60 Swedish Energy Agency/The Swedish district heating industry
- The research program focus on:
  - **Technology** – mainly about the DH networks, but not so much about production/supply
  - **Market** - the district heating company, the heat market's functioning and how to get better knowledge of what customers expect from their district heating supplier.
  - **External issues** - system analyzes, instruments, system solutions for fuel supply, energy efficiency and energy conservation

Synthesis work

- Client: *Energiforsk* – operating agent for the research programme
- The synthesis covers the third research period between 2013-2017
- In total 34 projects and 37 project reports
- Three areas for analysis: Energy transition, customer perspective, and sustainability

Transition of energy system
- Sven Werner, Halmstad University

Customer perspective
- Kerstin Sernhed, Lund University

Sustainability
- Kristina Lygnerud, IVL Swedish Environmental Research Institute,

Contents in research projects

FJÄRRSYN

1) Energy demand:

- Energy measures
- Price models
- Digitizing
- New heat use

2) Recourses:

- Fuel access
- Energy system integration
- Environmental assessment

3) Cool supply

4) System:

- Heat storage
- System design
- Network integration
- Market rules

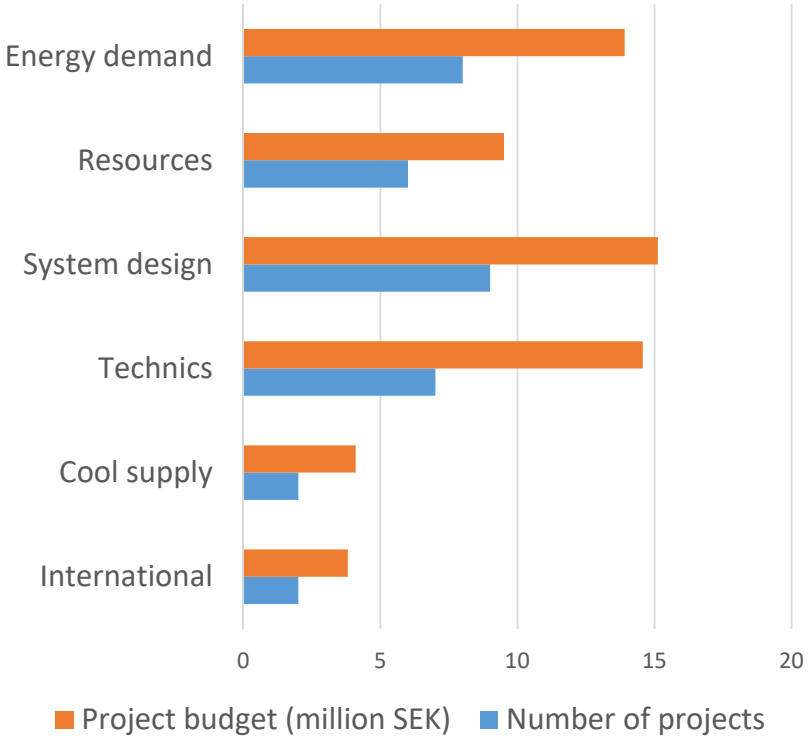
5) Technics:

- Technological development
- Quality assurance

6) International:

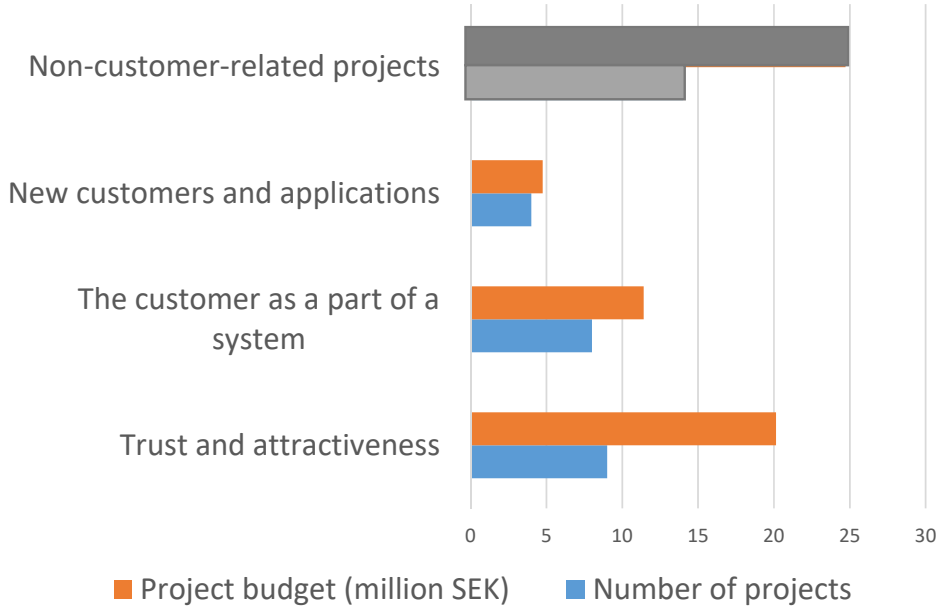
- Price levels
- DH research in China

Perspective: Transition of energy system



- System boundaries:
  - Extended system boundaries – leading to complex models
  - Polluter pays principle should be applied
- Future goals for DH?
  - What's beyond renewable?
- Time perspective
  - Reliance on current technology.
  - How do we build the system of tomorrow today?
- Swedish perspective
  - Only two percent of the world's district heating supplies are produced in Sweden…
  - Should there not be an interest in what happens elsewhere?

Perspective: Customer perspective



- **Attractivness:**
  - Environmental values, visualization and control, indoor air quality, pricing and individual metering and billing, prosumers
  - …Is this enough to counteract customers' sense of lock in?
- **New customers and applications:**
  - New applications for district heating (new industrial use), making use of cheap heat (heat driven cooling, seasonal heat storage).
  - … Just concepts or useful applications?
- **Customers role in an energy efficient system**
  - More customer data, energy measures in buildings and district heating systems, technical conditions for prosumers
  - …What about customer behavior and preferences? What happens beyond the meter?

Steps for customer trust

"Fulfill common standards and codes of conduct"

Comply

- Swedish DH law and customer trust

"Be open about its activities, its objectives, results and impacts"

Present

- Methods for environmental assessments
- Increased acceptance for energy recovery

"Take a customer perspective on the relationship, support the other party's business"

Influence

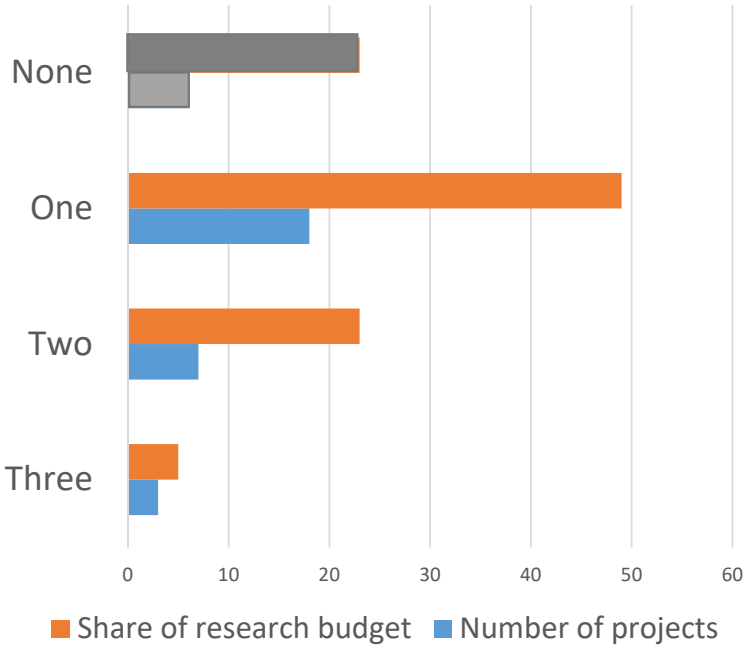
- Obstacles and opportunities for expansion of district cooling
- Customer's perspective on DH price models
- The impact of energy efficiency on indoor environment

"Inviting customers and stakeholders to influence the district heating business, co-produce value"

Involve

- DH-driven water purification in industry
- Green IT innovations for district heating

Perspective: Sustainability



- Ecological impact:
  - The results relate to carbon dioxide emissions
  - …not pollutants to air, soil and water
- Competitiveness:
  - Focuses on increasing production and distribution efficiency.
  - … but less focus on instruments and sustainable consumption
- Security of supply:
  - Security of supply is the least researched area within sustainability, life length of pipes, regional heat grids are some examples.
  - …less on vulnerability, dependency on other systems (i.e electricity)

Aggregated results from Fjärrsyn, stage 3

- District heating is an effective supply solution with a longer future perspective
- The role of district heating beyond fossil freedom is unclear
- Now the customer perspective is somewhat more present in district heating research
- A wide research base creates good conditions for implementing research results
- District heating has become an internationally recognized research subject

Identified gaps

- What does the changing market conditions mean for district heating in the long term?
- What different targets for district heating do different stakeholders have?
- What are the benefits of district heating from a broader societal perspective?
- What system boundaries should apply when district heating is analyzed?
- What district heating technologies will be applicable to new buildings in the coming decades?

Recommendations

1. A clear future vision and target image for the Swedish district heating should be developed
2. The research should focus more on societal values of district heating
3. More focus on future conditions and market conditions
4. Clearer requirements for analysis models with regard to usability and support among stakeholders

Thank you for listening!

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