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# **Swedish experiences on industrial waste heat recovery**

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## **Agenda:**

1. Industrial waste heat recovery for decades
2. What is the risk of industrial waste heat recovery terminating?

## Why am I here?

- Reuseheat project (urban waste heat recovery)
- TS2 Annex IEA DHC (4<sup>th</sup> generation DH technology)
- Vice chair of the DHC+ board
- Research on industrial waste heat recovery (with Sven Werner)



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# **1. Industrial waste heat recovery for decades**

# The context of early industrial waste heat recovery in Sweden

## 1950ies-1970ies: DH expansion (oil)

- 1950ies-60ies: meet the increasing demand for electricity (complement to hydropower)
- 1960ies-70ies: continued expansion to meet the demand of new construction (miljonprogrammet)

## Oil Crises (1973-74 and 1978-79)

- triggered a national energy policy (1975)
- switch to alternative fuels (wood, peat, coal, municipal waste, heat pumps, electric boilers and industrial waste heat)



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ÖRESUNDS  
KRAFT

1974.....



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**9% of the heat deliveries in Swedish DH networks come from industrial waste heat (highest volume in the world)**

**Theoretical potential for Sweden is 9.5 TWH which is double the existing deliveries...so there is room for more**



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## **2. What is the risk of industrial waste heat recovery terminating?**



## Known barriers for industrial waste heat recovery

- There is no district heating close to the waste heat source (given)
- The investment is not cost efficient
  - piping
  - advanced technical solution
  - low temperature of heat source
- Incentives (competes with biofuels and waste)
- The value of the investment is not certain
  - what is the value of the heat?
  - other investments compete for the investment funds
- Dependencies
  - heat delivery
  - transparency is necessary between the partners
- The risk of industrial closure (and heat delivery termination)

## **Swedish industrial waste heat cooperations**

- 1974-2014
- 107 cooperations (1786 operating years)
- Sources:
  - Svensk Fjärrvärme
  - SCB
  - Energimarknadsinspektionen
  - Interviews
  - Scientific articles
  - Press

## **Result 1: Cooperations pay off**

The literature provides a span of 1-7 years for payback on industrial waste heat recoveries

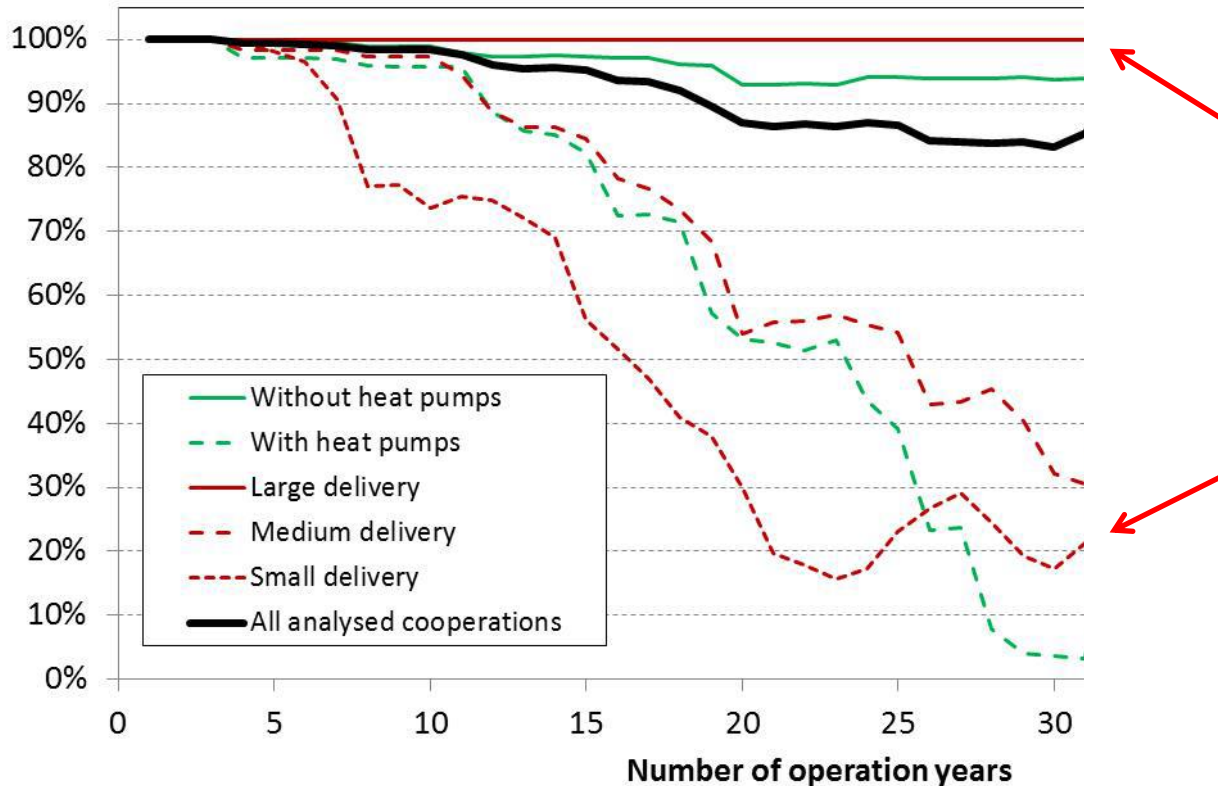
18 years of operational life (ongoing 2014)

13 years of operational life (terminated before 2014)



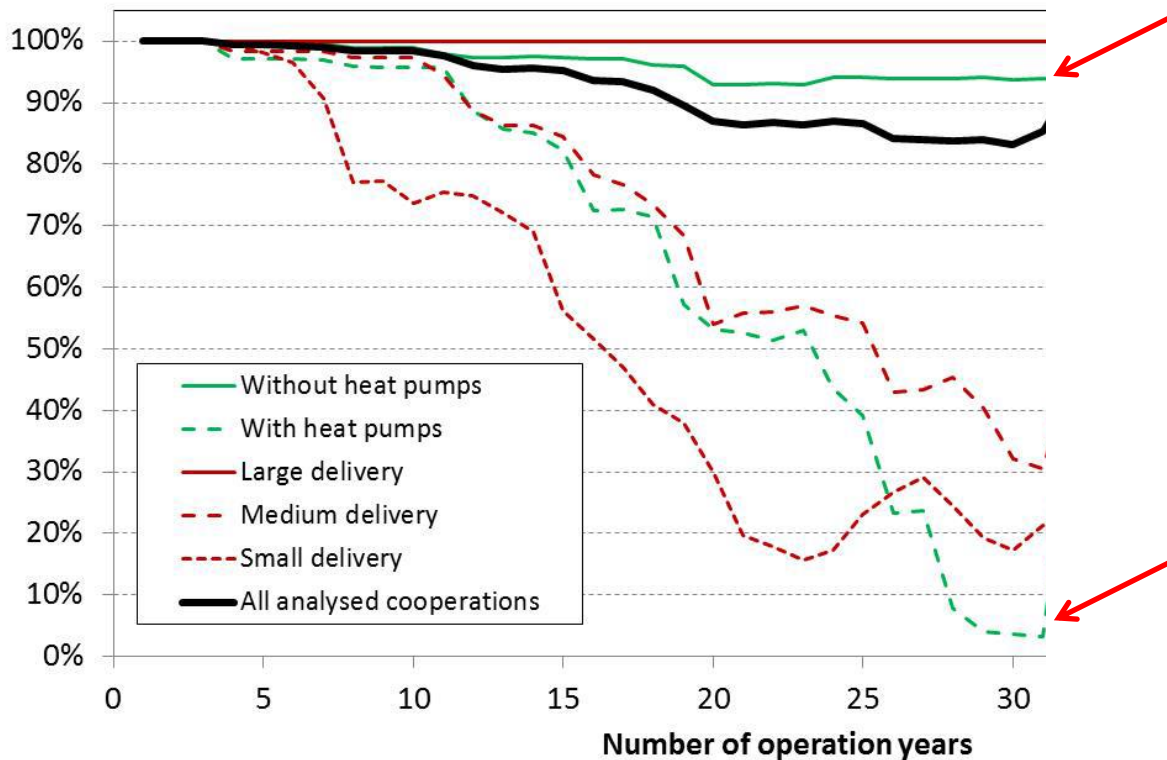
## Result 2: Large cooperations have longest operational life

Proportion of remaining industrial heat recoveries by operation years



## Result 3: Solutions without heat pumps (high temp.) are more viable

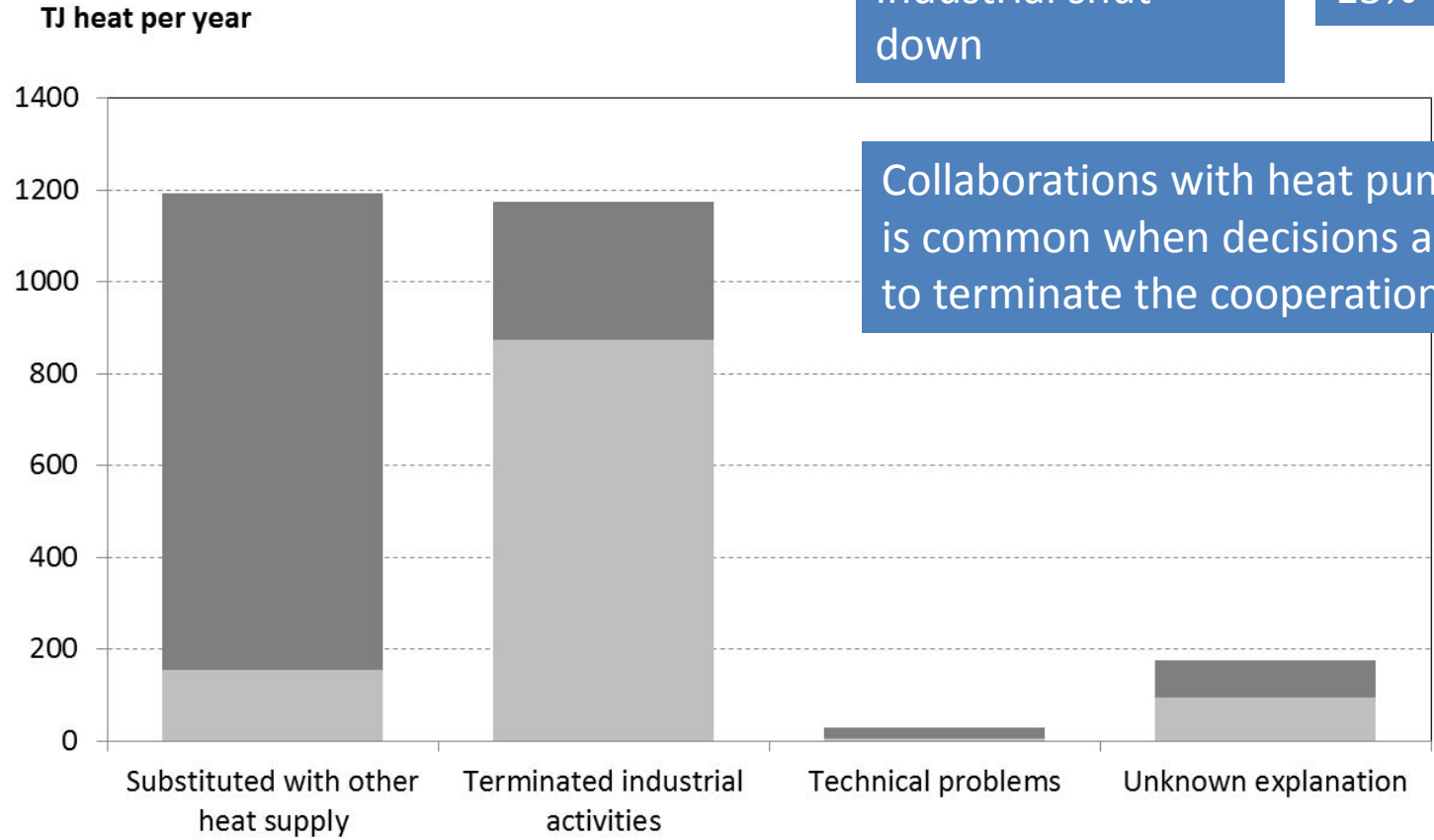
Proportion of remaining industrial heat recoveries by operation years



# Result 4: Two main reasons for why cooperations terminate

Business decision 10%

Industrial shut down 13%



Collaborations with heat pump is common when decisions are made to terminate the cooperation

## **Reflections**

Sources of risk to consider in the investment calculations

- Heat volumes
- Electricity price
- Industrial closure

**...a first take on quantifying risk of industrial waste heat recovery...to be continued**



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