The economic value of existing district heating grid infrastructure for the transition towards a carbon neutral heating system

Marcus Hummel, Andreas Müller ……. e-think energy research
Mostafa Fallahnejad, Lukas Kranzl …… TU Wien, Energy Economics Group

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Contents

AIM AND SCOPE

Research question

*"Which **economic value …***
*has an **existing** district heating **(DH) grid infrastructure …***
*for the **transition towards** …*
*a **carbon neutral heating system**?"*

"How could this be approximated?"

Scope of the analysis

Estimation of the value at the level of entire EU / country
Think about the implications for techno-economic modelling

PRIVATE-ECONOMIC VS. SOCIO-ECONOMIC PERSPECTIVE

How to determine the value of an existing grid?

Business economic view

- … via the market value
- Question: “What would a party pay for the grid at a certain point in time?”
- As there is no market for DH grids, this value has to be estimated
- Can be estimated via profitability
- Market value = Expectable monetary gains – expectable costs – expected profit [calculated over depreciation period]
- For our purpose the profitability is not a useful principle, because we do not consider monetary gains nor expected profit in this analysis

Socio-economic view

- … via the expectable cost savings compared to a fully new grid
- Question: “How much money could be saved as a grid is already there?”

LEVELISED COSTS OF HEAT DISTRIBUTION (LCOHD)

Levelized costs of heat distribution (LCOHD)

$$LCOHD = \frac{\sum_{t=1}^{n} \frac{I_t + M_t + F_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{E_t}{(1+r)^t}}$$

I … Investments into grid infrastructure (Planning, approval, construction)

M … Operation & Maintenance costs (control, repair)

F … Pumping costs

E … Heat delivered

n … lifetime

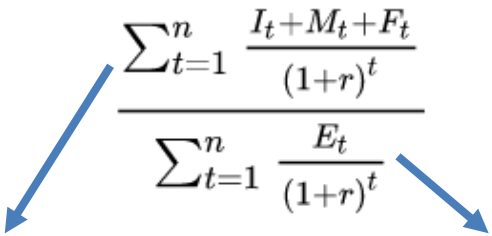
r … interest rate

POSSIBLE SITUATIONS
AND
ESTIMATED EFFECTS

Possible (simplified) situations

Abbreviation	Description
New	– A grid is built where no grid is currently in place
Exist-UnChanged	– A grid already exists and is used – It should be renewed after end of lifetime – No further extension should happen
Exist-Exp-SuffCap	– A grid already exists and is used – It should be extended – The capacity / size of the existing pipes are sufficient for the target state – Existing pipes should be renewed after end of lifetime
Exist-Exp-InsuffCap	– A grid already exists and is used – It should be extended – The capacity / size of the existing pipes are not sufficient for the target state – It should potentially be renewed before end of lifetime
Exist-NonCompl	– A grid already exists and is used – The grid is not compliant with the target state of the grid (e.g. steam grid)

Effects



Abbreviation	Effect on costs	Effect on delivered heat
New	– Initial investments	– It takes several years to increase heat delivery to target state
Exist-UnChanged	– Re-Investments at the end of lifetime	– Heat delivery already at target state
Exist-Exp-SuffCap	– Initial investments for expansion – Re-Investments for existing grid at the end of lifetime	– Heat delivery in existing grid at the target state – Heat delivery in extension takes time to increase
Exist-Exp-InsuffCap	– Initial investments for expansion – Re-Investments in existing grid before the end of lifetime	– Heat delivery in existing grid at the target state – Heat delivery in extension takes time to increase
Exist-NonCompl	– Re-Investments in existing grid before the end of lifetime	– Heat delivery already at target state

Investments vs. Re-Investments

Capital costs and construction costs …

- would be the same for the same system
- depend on the market prices, which might change over time

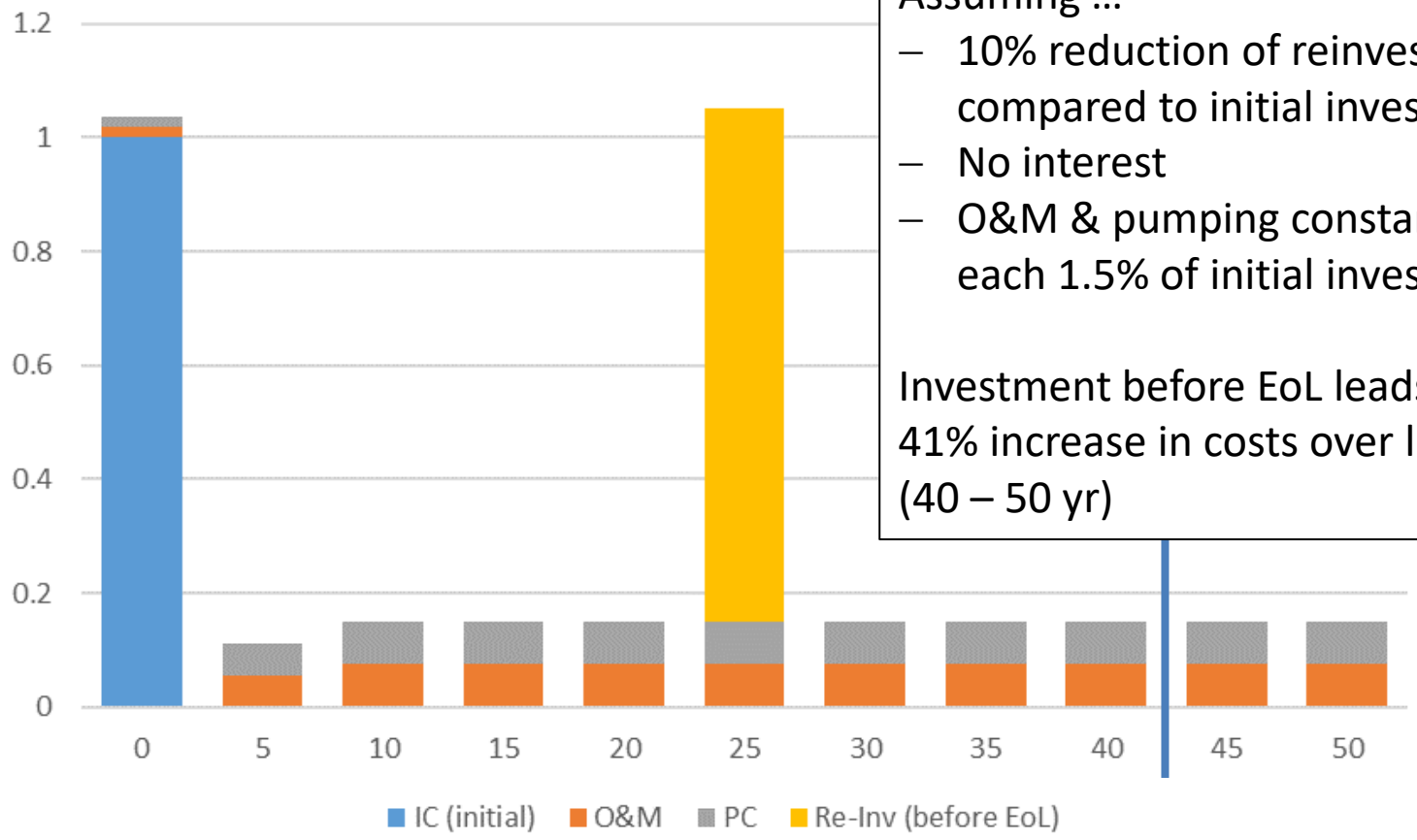
Other cost components …

- might be lower compared to initial investments due to …
  - less legal barriers / costs
  - underground is known and already worked
  - space is reserved
  - lower planning costs
- might be more equal the longer the initial investment is back

→ More important seems the timing of the investment

- Before the end of lifetime leads to higher LCOHD
- Postponed investment frees up funds for other investments

Effects on costs



Assuming …

- 10% reduction of reinvestment compared to initial investment
- No interest
- O&M & pumping constant and each 1.5% of initial invest

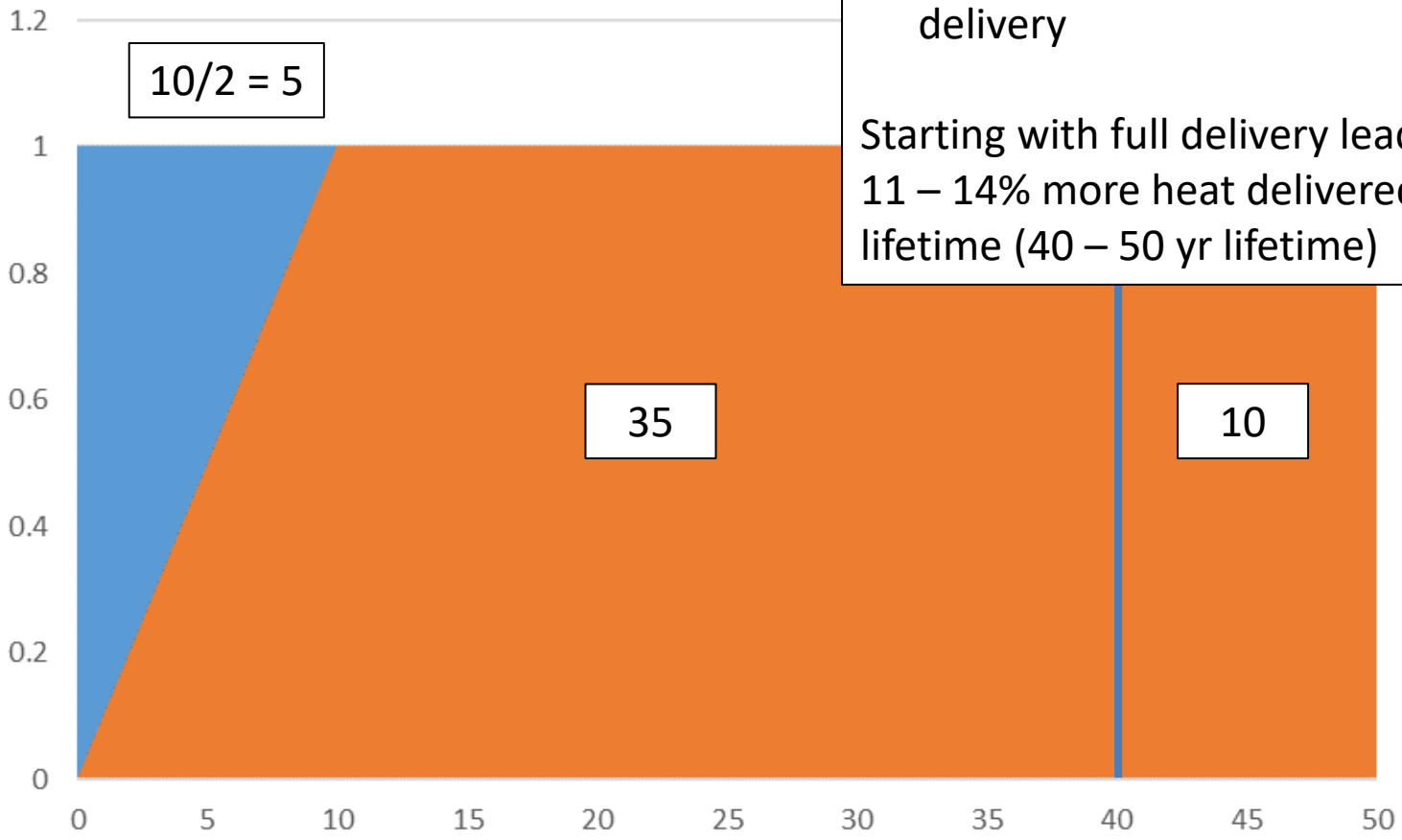
Investment before EoL leads to 36 – 41% increase in costs over lifetime (40 – 50 yr)

Effects on heat delivery

Assuming …

- 10 years to come to full heat delivery

Starting with full delivery leads to 11 – 14% more heat delivered over lifetime (40 – 50 yr lifetime)



CONCLUSIONS AND OUTLOOK

Conclusions

General conclusions

- Cases with positive economic value (–> decreased transition costs) :
  - Existing grids to be used unchanged lead to significantly higher heat delivery over lifetime at probably very similar costs compared to new grids
  - Existing grids to be used for longer times unchanged free up funds for other investments in the transitions towards carbon neutral heating system
- Cases without positive economic value (–> no decreased transition costs):
  - Existing grids that are not compliant with carbon neutral heating systems
  - These grids are far away from the end of their lifetime

  → might lead to increased costs of transition

  → might hinder / postpone the transition

Conclusions for EU-wide modelling

- Although important for detailed modelling, on the basis of existing data it is not possible to estimate the share of the existing grid infrastructure that will be usable in a carbon free heating system
- Rough estimation of age distribution of existing grids and timing of investments
- Rough estimation of current shares of heat delivery in existing grids

Act!onHeat

H2020 project recently started

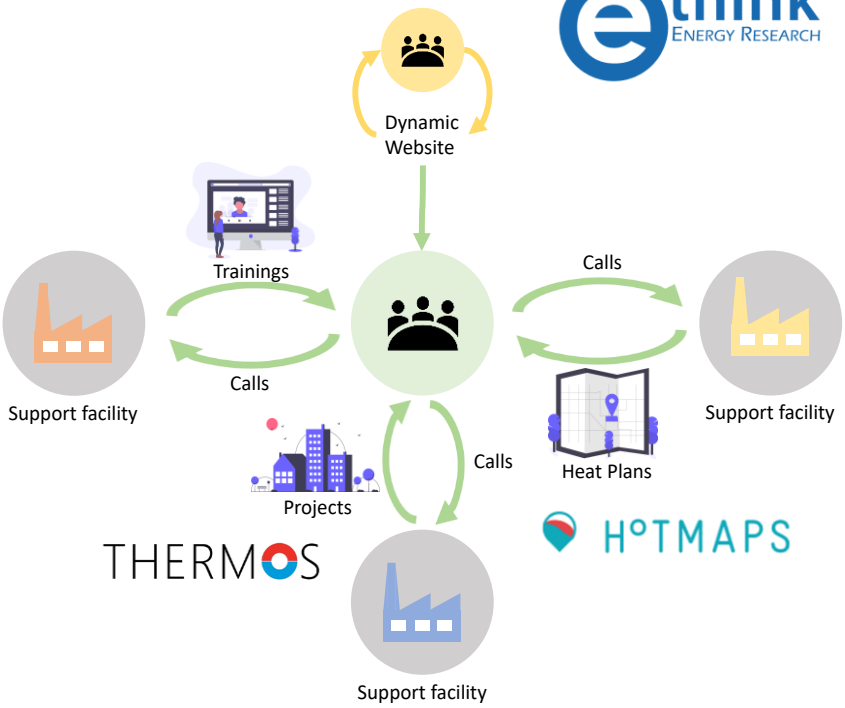
Goal is to assist in heat and network planning at regional and local level

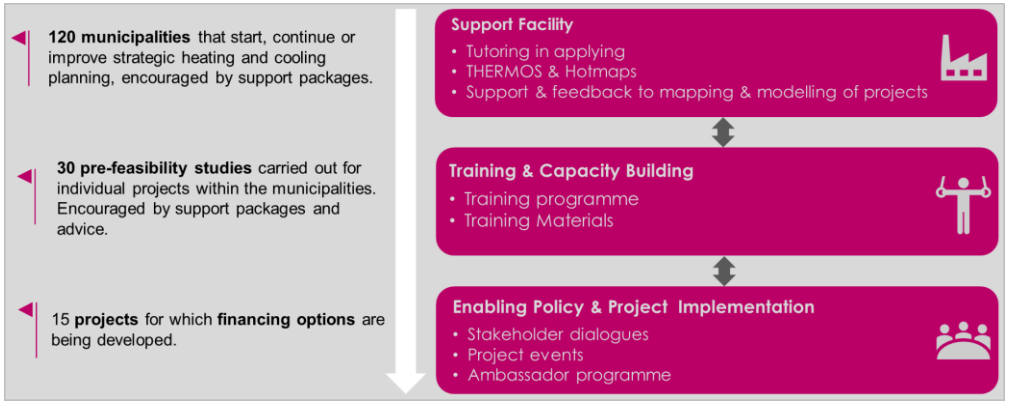
Primary target group: local authorities, energy agencies, (city) planner, utilities and consultants

Call for applications to start early next year

hummel@e-think.ac.at

Ali.Aydemir@isi.fraunhofer.de





THANK YOU FOR YOUR ATTENTION!