



# DEVELOPING INNOVATIVE BUSINESS MODELS FOR REDUCING RETURN TEMPERATURES IN DISTRICT HEATING SYSTEMS: APPROACH AND FIRST RESULTS

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# OUTLINE

- Research motivation
- Approach of the Austrian project T2LowEx
- First results:
  - Secondary-side measures to reduce return temperatures
  - Cost-benefit analysis
  - Key elements of innovative business models
- Observations and next activities

# RESEARCH MOTIVATION

## WHY NEW BUSINESS MODELS?



- **Need for lower operating temperatures in existing systems:**
  - Well-known technical, economical, and environmental advantages
  - Key enablers for decarbonization (increased efficiency and share of renewable)

# RESEARCH MOTIVATION

## WHY NEW BUSINESS MODELS?

- **Need for lower operating temperatures in existing DH systems**
- **DH operators have poor/no margin to act on the return temperature:**
  - Return T is consequence of secondary side behavior → Reasons for (unexpected) high return T are difficult to diagnostic for the network operator
  - Countermeasures are difficult to implement: person supposed to act and/or to bear the investment (building owner) often different than person profiting from lower return T (operator)



Need for new BM incentivizing secondary-side measures and network-friendly behaviors

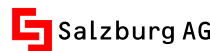
# T2LowEx – TRANSFORMATION TO LOW-EXERGY SYSTEMS

- **Funds:** Climate and Energy Funds
- **Programme:** Energieforschungsprogramm 2016
- **Project number:** 858747
- **Coordinator:** TU Vienna



- **Objectives:**
  - Systematical analysis of potential for reducing return temperatures in existing networks
  - Development of innovative business models incentivizing secondary-side measures for decreasing the return temperatures

- **Duration:** April 2017 – March 2021



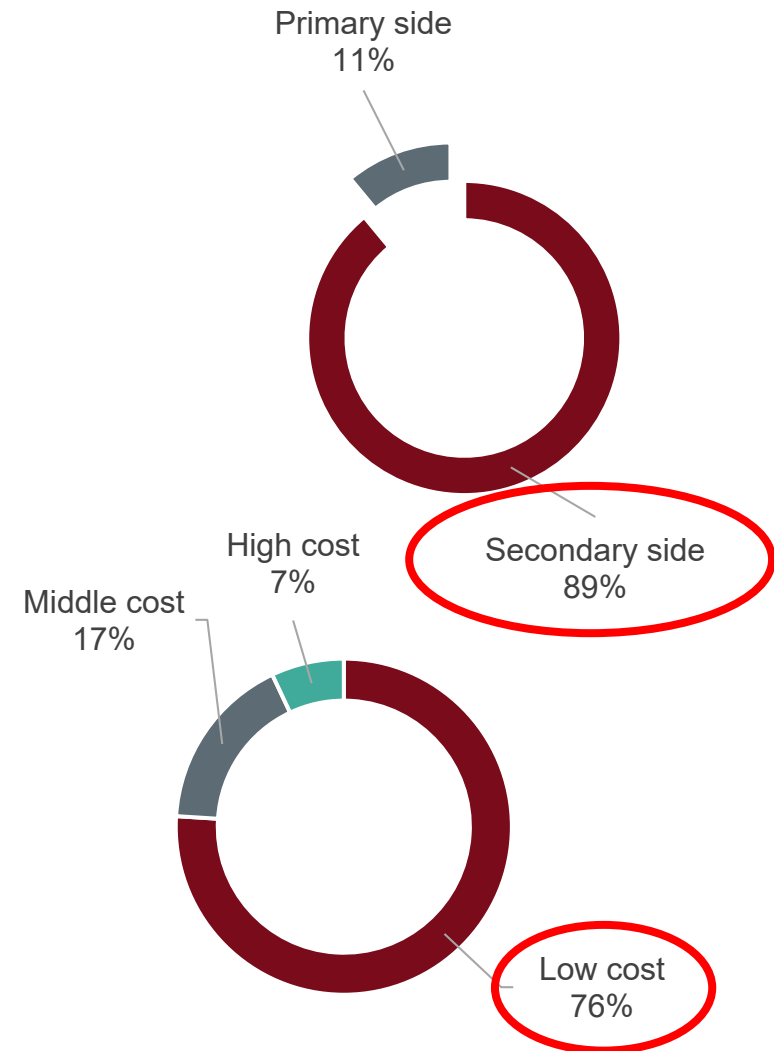
# DEVELOPMENT OF NEW BM APPROACH

- Techno-economic evaluation real-data analysis to identify costs and benefits of measures to reduce return T
- Analysis of Austrian DH framework: PESTLE (Politic, Economic, Socio-cultural, Technologic, Legal, Environmental)
- Literature review of BM (including other countries and power sector)
- Stakeholders' mapping and engagement: workshops and interviews
- Development of new BM and SWOT analysis

Target of BM: sharing the created value among the players in a way incentivizing virtuous behaviours

# TECHNO-ECONOMIC EVALUATION REAL-DATA ANALYSIS

- Operating data from 2 urban and 3 rural DH systems
- **113 substations with return T higher than expected**
- **Most of the faults on secondary-side:** design, installation, operation, equipment failures
- Most countermeasures require low investment / low personnel involvement:
  - De-aerate the substation
  - Remove bypasses / wrong connections
  - Correct customer's behavior
  - Tune the substation CTRL
  - Replace the primary (substation) valve
  - Hydraulic balance

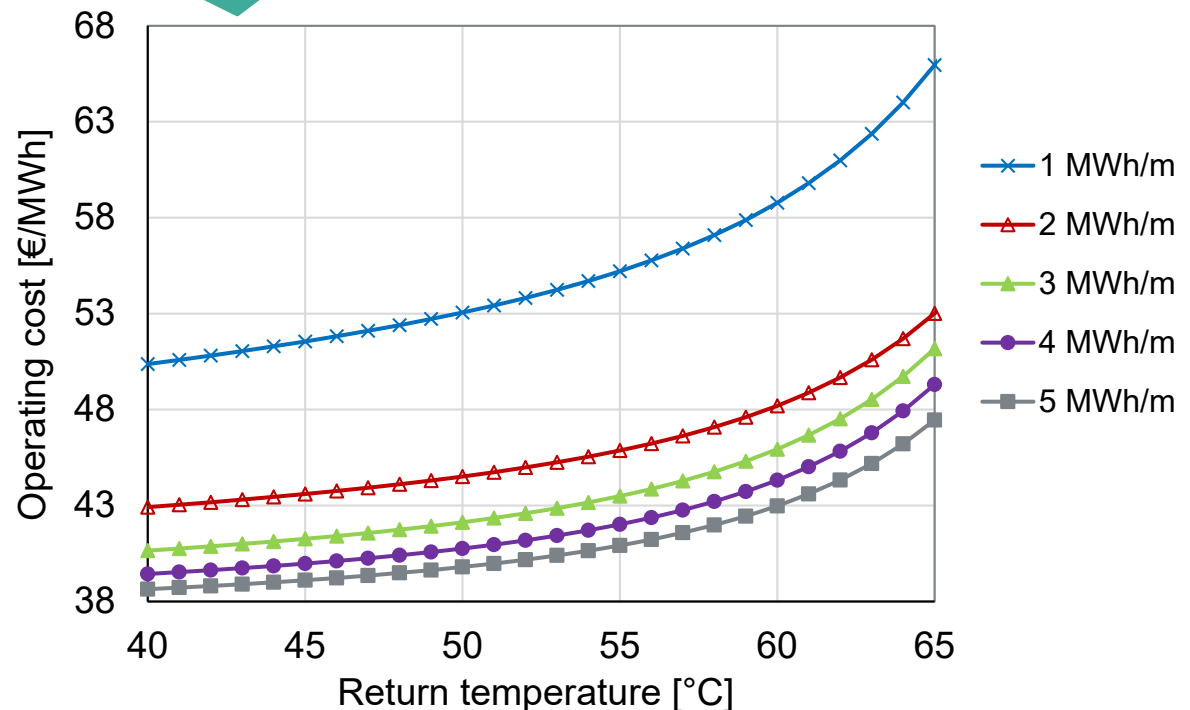


# TECHNO-ECONOMIC EVALUATION EFFECTS OF LOWER RETURN T

Tool under development for calculating the effects on:

- **Production plants:** increased electricity from steam-based CHP units, increased efficiency of solar thermal, geothermal, flue-gas condensation, waste heat integration, changed COP of heat pumps depending on the hydraulic integration
- **Distribution network:** (power), more flexibility
- **Buildings:** less noisy fl
- **Possible indirect effects:** measures are taken (e.g. sources)

Example assuming supply at 85 °C → savings from 0.10 to 1.10 €/ (°C·MWh)





# BUSINESS MODELS CHALLENGES AND TARGETS IN DH

## Challenges of Austrian DH:

- Current BM are unable to efficiently involve citizens in the transition towards low T (even motivated)
- Cases of mistrust from the users: DH perceived as limiting the freedom of decision and thermal independency
- Cases of higher costs than independent heating

## Targets of innovative BM:

- Making customers aware of their key-role in determining operating costs and energy efficiency
- Allowing customers more action on the bill (new tariff structure - transparent and with predictable costs, tariff for prosumers...)
- Reduce the costs of the whole chain and share the created value in a fair way incentivizing virtuous behaviours
- Allow innovative financing and participation forms

# BUSINESS MODELS

## BEST-PRACTICE REVIEW

International success stories of BM encouraging grid-friendly behaviours:

- Good and close customer relationship including periodic surveys on installations and instructions about performance improvements / savings
- Involvement of local authorities (social and environmental drivers) in regulation, granting, financing (e.g. as guarantor for loans)
- Citizens' participation through non-profit cooperatives (community-owned, collective, crowdfunding)
- Technology providers' participation
- Flexible tariff incentivizing load shifting
- Tariff with flow component or bonus-malus based on return T

# NEW BM FIRST RESULTS FOR AUSTRIAN DH

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<b>New key-partners</b>	Industries and data centers with waste heat, contractors, local authorities.
<b>New key-activities</b>	Implementation of efficient fault detection systems. Periodical audits at customer installations, counseling for customers with suboptimal plants or wrong behavior. Also, counseling for (the largest) heat users to provide tailor-made incentives. Training of planners and installers.
<b>New key-resources</b>	New financing mechanisms: leasing, participation of customers/citizens and of technology providers, insurances, funds, loans with (public) third guarantor.
<b>New services</b>	Energy saving contracts, possibility of return-line connection (e.g. for floor heating) with reduced tariff.
<b>New communication channels</b>	Social media, communities, apps with possibility of surveys, customers' feedback, market monitoring.
<b>New tariff systems</b>	Bonus-malus, flow component, flexible tariff, eco-tariff, prosumer tariff. Complete transparency and predictable costs requested.

# SUMMARY

- Several “low-hanging fruits” in reducing return T
- Opportunities for lower return T are very frequently on the customer’s side
- Main challenges:
  - Reasons for inefficiencies are difficult to localize/identify by the operator
  - Low customers’ awareness, missing knowledge causes lack of motivation for fault removal
  - Investment / profit dilemma
  - Even more complicated in presence of additional parties (rental houses, intermedium contracts...)
- Prerequisites of successful innovative BM:
  - Customer-oriented communication
  - Use of new financing tools
  - Fair sharing of the created value to incentivize virtuous behaviors

## NEXT STEPS

- Define exact players and roles in agreement with DH operators
- SWOT analysis of the BM
- Consider possible advantages by implementing digital technologies:
  - More efficient fault detection and diagnosis
  - Give the users a more concrete and real-time perception of their behavior: positive and negative effects on costs and energy efficiency
  - Operation optimization
  - Flexible (hour depending) tariff for consumers and prosumers



# THANK YOU!

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