Energy Efficiency in Industrial Surplus Heat

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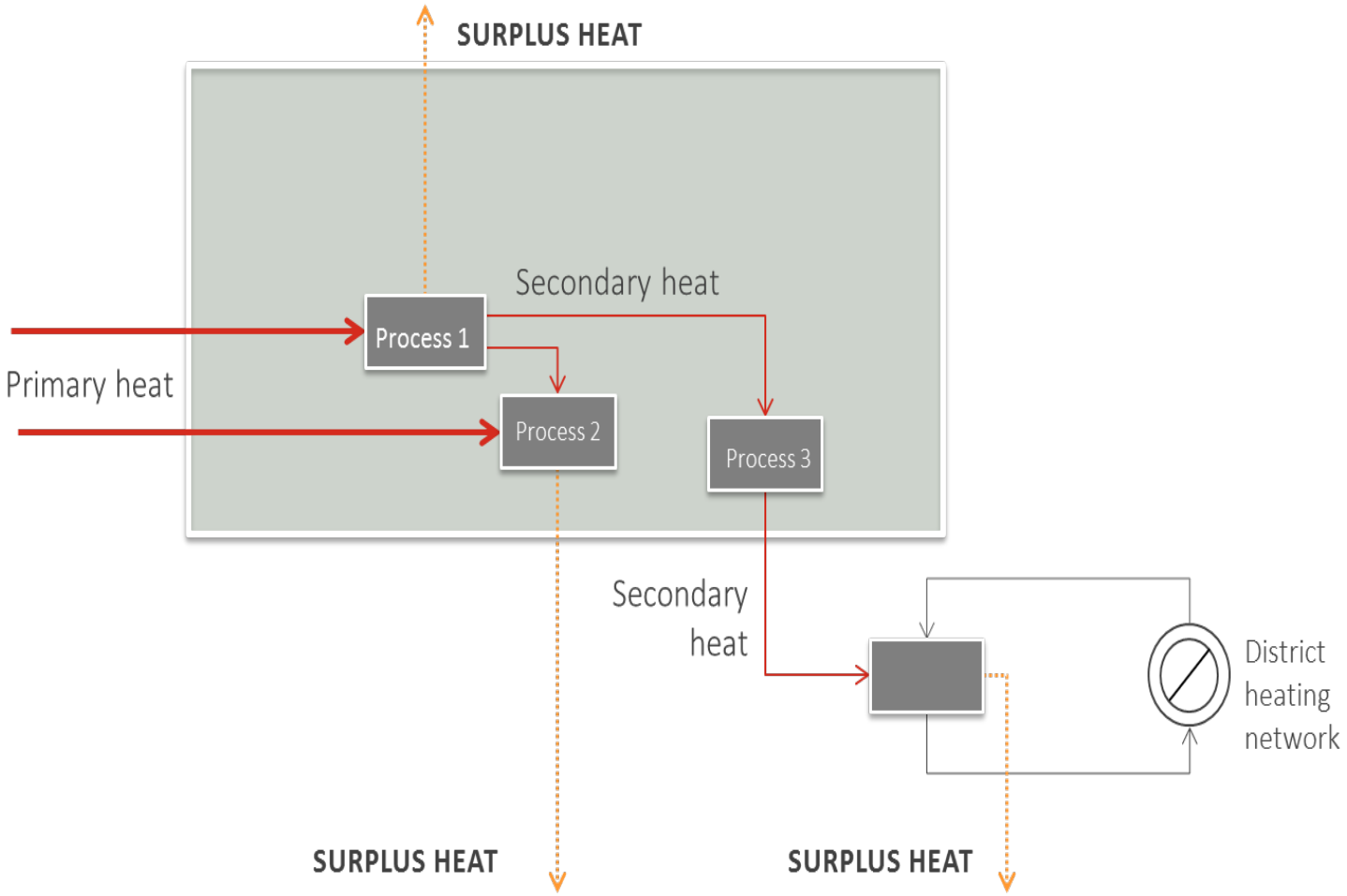
Motiva…

…is an expert company promoting efficient and sustainable use of energy and materials.

Motiva Oy

- Owned by the Finnish State (100%), in-house company
- Number of personnel app. 60
- Annual turnover app. 9 million €
- Operation began in 1993 as the Energy Information Centre
- Services: *Energy Efficiency Agreements, Energy audit and analysis activity, Renewable energy, Material efficiency, Influencing attitudes and consumer habits, Monitoring and impacts assessment…*

Definition of surplus heat



Introduction

- How to use surplus heat efficiently?

- Estimated *technical potential* of surplus heat in Finnish industry app.19 TWh/a, and the *economically feasible* amount app. 4-5 TWh/a (YIT 2010).

- Motiva carried out Energy Efficiency in Industrial Surplus Heat - project.
- The project was financed by the Ministry of Employment and the Economy (TEM), Finnish Energy Industries (ET), participating industrial companies, one community and equipment suppliers.

The main targets

The main targets of the project:

- Increase economical use of surplus heat and to improve the use of secondary heat in industry
- To promote the use of energy efficient technology and create new business activity
- To improve competitiveness of industrial companies
- To prepare companies to adopt to the energy efficiency directive (EED)
- To collect know-how and experience of surplus heat cases
- To improve methodology in industrial energy audits.

Project organization

The project was divided into three projects,

- Surplus heat analysis, main project
- Heat pump and ORC, technology project
- Drying of (bio)fuel, technology project.

Participants

- Ten industrial, energy intensive companies and one community
  - They picked their own problem to be solved at the beginning
- Six equipment suppliers
  - Their role was to bring their know-how and experience of installations
- Three consultants, who made the site visits, interviews etc. and wrote the reports.
- Motiva coordinating the project.

Project organization, continued

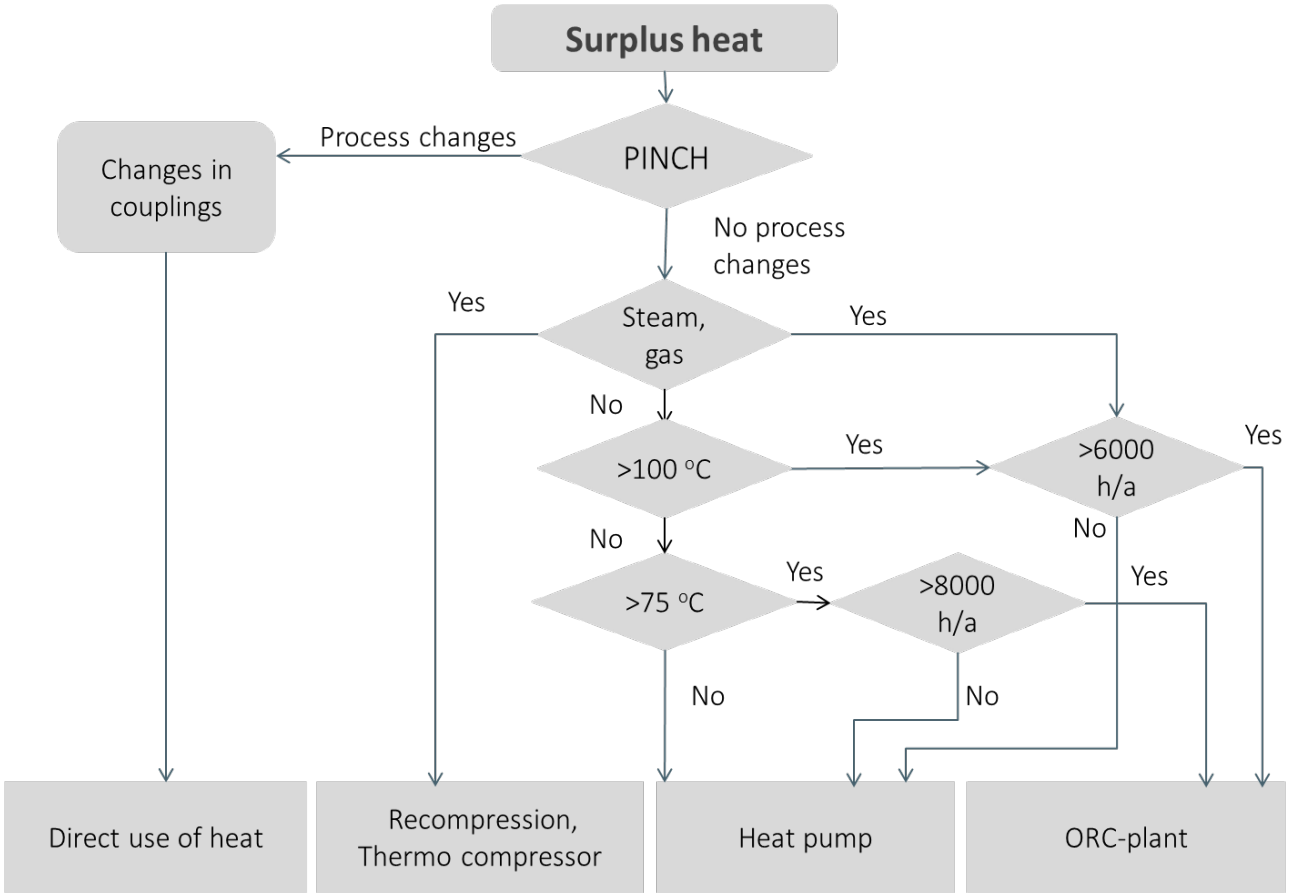
Workshops

- Ten workshops, some in plant sites.
- Companies (or consultants) presented their surplus energy case
- All topics and results were openly and thoroughly discussed
- Every case was reviewed several times during the project.

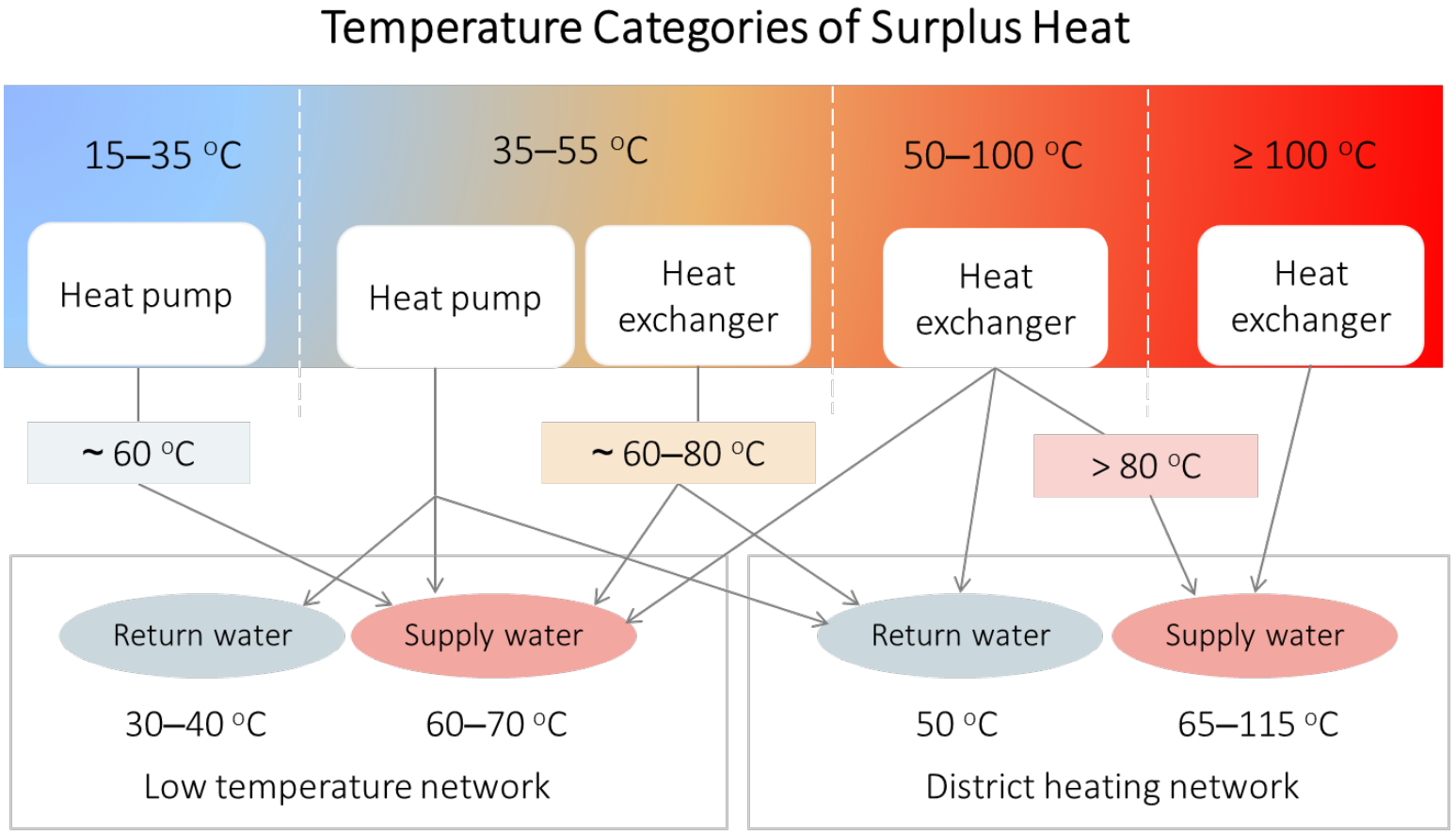
- Long term measurements were made in only 1-2 sites.

***The first step was to check that all current processes and heat recovery systems are working properly*!**

Possibilities to use surplus heat



Temperature Categories of Surplus Heat



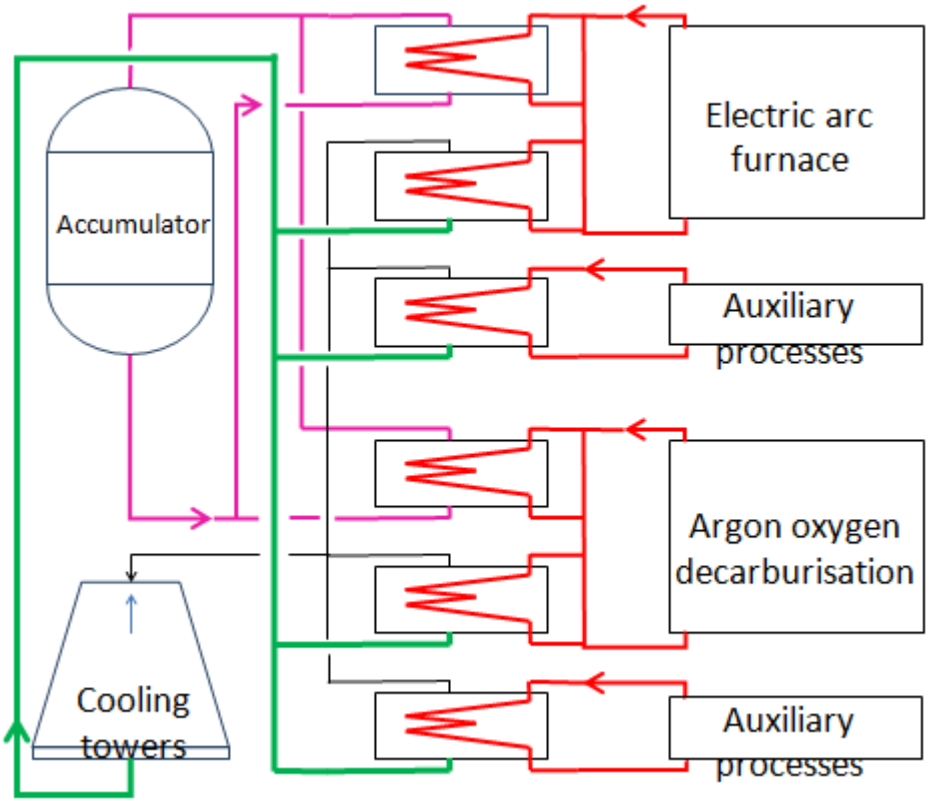
Example, metal industry

Surplus heat

- Accumulator for DH was not working properly, app. 92 °C
- Cooling towers were used instead.

Solution

- Using *control panel* temperature raised up to design level 120/110 °C
- Savings potential app. 40 GWh/a.



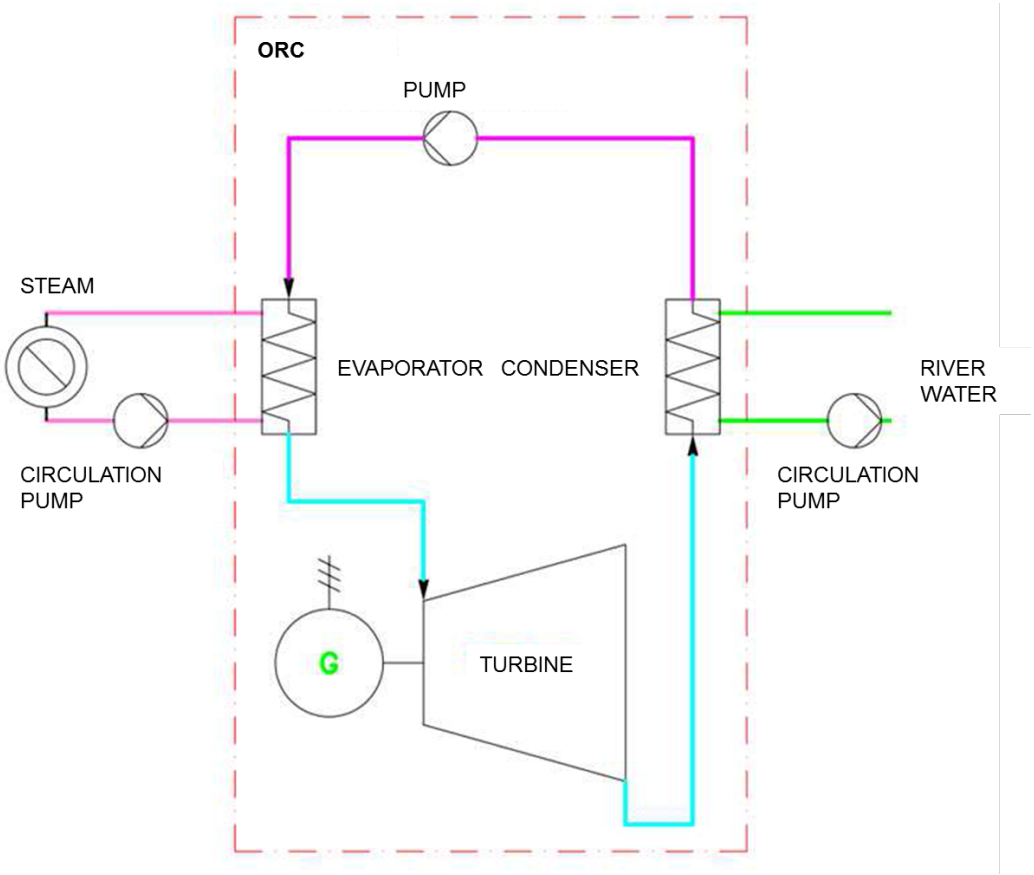
Example, power plant

Surplus heat

- Auxiliary condensers are used in order to keep the power plant running at the minimum load (production disruption or summer time).

Solution

- ORC-plant, 1,9 MW_e
- Savings app. 2 GWh/a
  => not feasible

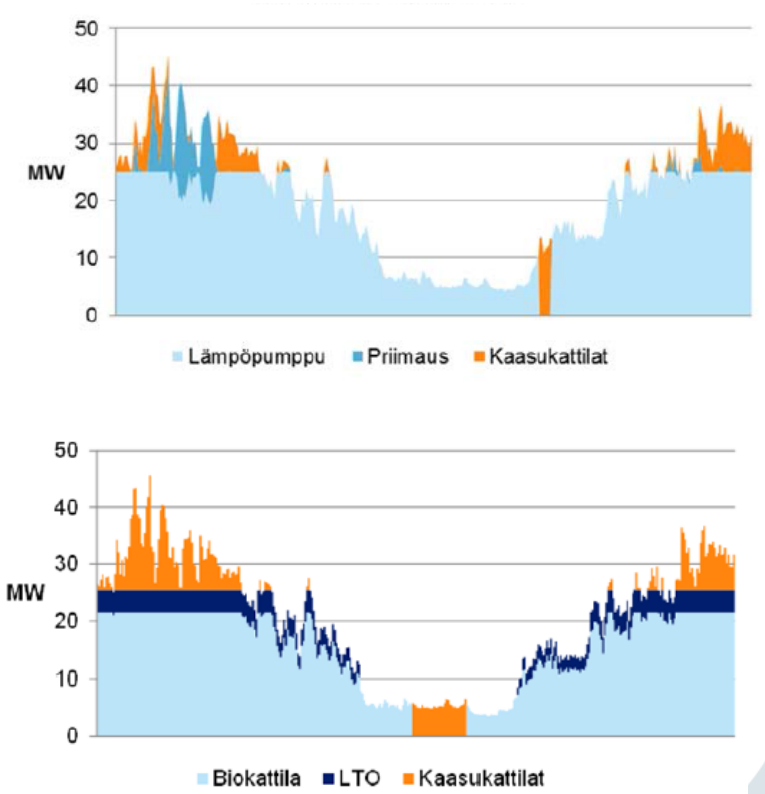


Example, district heating

Community District Heating

- Used natural gas as fuel, expensive
- Heat load app. 25 MW, 180 GWh/a

- Two heat sources
  - Industrial sewage water (pulp & paper) + heat pump
    - 3x8 MW heat pumps
  - Biomass
    - 15 MW boiler
    - Heat recovery



Example, drying of (bio)fuel

- Technology on drying of (bio)fuel
- Drying methods by surplus heat
  - Also by conventional methods
- Advantages of drying
  - Better heat value
  - Better efficiency of the boiler
  - Improved control
  - Less mass flow (burning air and flue gas)
  - Better use of biomass
  - Less need for cleaning…

Obstacles in utilizing surplus heat

The obstacles in surplus heat utilization can be divided in to four categories:

- Economic feasibility
  - Short payback time, uncertain future
- Lack of proper technology or unreliability of technology
  - *Improvement in heat pump and ORC technology*
- Lack of proper heat sinks
  - distance, thermal power, simultaneousness, duration etc.)
- Obstacles in legislature/politics or public opinion
  - Public opinion more in favor than before, especially when selling surplus heat to community…

Audit guide

- One of Motiva's main targets was create an audit guide how deal with surplus heat.
- Guide is aimed to the
  - industrial companies with surplus energy
  - maintenance service companies
  - energy auditors.
- The guide gives advice
  - how to approach the target systematically
  - how to recognize heat sources and sinks
  - list the pros and cons
  - estimate the feasibility of the investment.

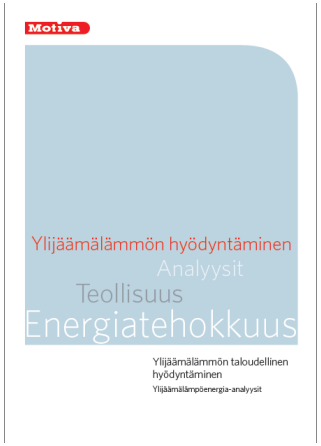
Benefits

- During this project surplus *heat sources* that were found and dealt with represent more than *850 GWh/a*.
  - Most of the findings were economically feasible, only the *ORC-surveys* turned out not to be economically feasible at the moment. One of the main reasons is that CHP is so common in Finland.
- All Finnish industrial companies can adopt the *systematic approach*, principles, ideas etc. presented in the three reports, including audit guide (in Finnish).
- *Special attention* to surplus heat should be paid *in planning* new plants and renovating old plants!
- The energy auditors are encouraged to adapt the audit guide lines in their energy audits.

What next?

- Spread the word of the benefits to companies
  - Communication
- Feedback from the field
- Implementations, applications, etc.
- Focus on small and medium-sized companies…
- **Focus on measurements!**

- http://www.motiva.fi/julkaisut/teollisuus



More information

www.motiva.fi/en