

Benefits of Remote Reading in Maintenance of District Heating Energy Meters and Possibilities of Remote Reading in New Services for District Heating

EXECUTIVE SUMMARY

TABLE OF CONTENTS:

1	Background of the project.....	2
2	Maintaining the Accuracy of Metering Equipment	2
	2.1.1 Heat energy consumption data and other measurements in maintaining the accuracy of heat meters	3
	2.1.2 Inspection when removing the meter from a client.....	4
	2.1.3 Remote reading and laboratory tests and field tests.....	5
3	District heating services.....	5
4	Audit of the contract heat capacity or contract flow rate.....	5
5	Remote reading in operations of district heating company.....	6
6	Conclusion	7



1 BACKGROUND OF THE PROJECT

This project has been implemented to find out the possibilities there are in remote reading in the field of district heating. This report will describe the possibilities related to remote reading and try to show what kind of development will be needed.

This research project had four main topics:

- Is it possible to use remote reading in maintenance of heat metering equipment, especially in maintaining the accuracy of meters
- Are there possibilities to create new services for district heating companies and customer with remote reading
- Is it possible to improve contract and tariff information about heat usage of customer with remote reading
- Are there any benefits of remote reading in district heating heat production and heat delivery i.e. the business of district heating company

The first two are the most important parts of this report.

Many district heating companies in Finland have started to use remote reading for collecting heat consumption data from customer for billing purposes. The share of remote reading in billing is increasing rapidly. Other kind of use of transferred data is quite limited. In fact there are lots of possibilities in organising different kinds of services or in handling alarms etc.

There is a need for further research in many cases, but remote reading seems to be solid basis for many different solutions.

2 MAINTAINING THE ACCURACY OF METERING EQUIPMENT

In measurement of district heating energy consumption there are three different parts:

- Flow meter for water flow rate measurement
- Temperature measurement of supply and return temperatures of district heating water to calculate temperature difference of district heating water
- Calculation of consumed heat energy according temperature difference and water flow rate

Calculation of energy consumption:

$$Q = c_p \int_{t_0}^{t_1} q_m \Delta T dt \quad (1)$$

Where:

Q = Heat energy consumption

c_p = Specific heat capacity of district heating water



q_m = District heating mass flow

ΔT = District heating water temperature difference

t_0 = Time, start

t_1 = Time, end

Control and maintenance of heat meters should aim to ensure the accuracy of metering equipment. The acceptable accuracy limits will be set according legal requirements and terms of heat delivery contracts. This is important during the whole operating lifetime of the heat meter. It will be the benefit of the customer as well as district heating company.

Traditionally district heating companies have not used remote reading for heat meter maintenance. Only usage of measurements have been analysing the billing data and monthly average cooling of district heating water.

2.1.1 Heat energy consumption data and other measurements in maintaining the accuracy of heat meters

Remote reading can be used in transferring the consumption data and other measurement from customer to district heating company. Monthly billing data can be used some how to control and evaluate the accuracy of the heat meter. Other meter reading schedule like hourly readings or even continuous data transfer are also possible if the analysis system can utilise the data.

Remote reading makes the meter reading more accurate. The data is always correct and the reading happens at right time.

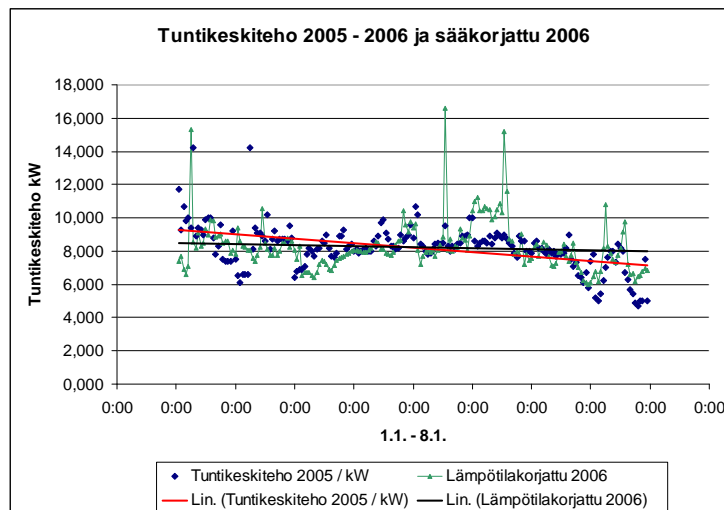


Figure 1: One hour district heat consumptions in 2005 and 2006

Measured one hour consumption data can be used for example to estimate the condition and long term ageing of heat meters. Analysis according one hour measurements will be much more accurate than using monthly data. There will be more need to research and develop the analysis methods and the algorithms.

In figure 2 is presented measurement data of a meter which error increase from 0 to 6 %. Error has been made manually by copying the data and changing the copied values.

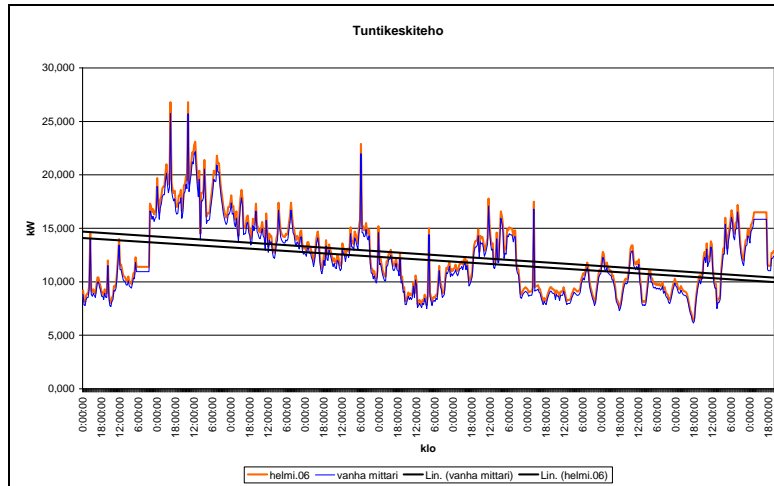


Figure 2: Example of the increase of the meter error

In the previous figure the original data and changed data are in same coordination. It is now easier to see the difference between original meter and the meter with increasing error. It is not easy to find even that big error (- 6%). The trend lines show the difference also and they might help to find the error. The problem is which kind of algorithm can be used to analyse the data.

2.1.2 Inspection when removing the meter from a client

Remote reading can be used to analyse the heat meters removed from customers. All removed meters should be inspected with some acceptable method. Traditionally it has been done in a laboratory or using some kind of transportable calibration or testing equipment before removal. There might be a possibility to utilise consumption data of old heat meter and new calibrated heat meter. It requires enough and accurate data from customer both before and after the change of the heat meter. The consumption data can be either monthly data or based on hourly information. Remote reading will help to collect data. The data comes faster, it is more accurate and the time information is more reliable while using remote reading.

In next figure is presented the hourly data before and after meter removal.

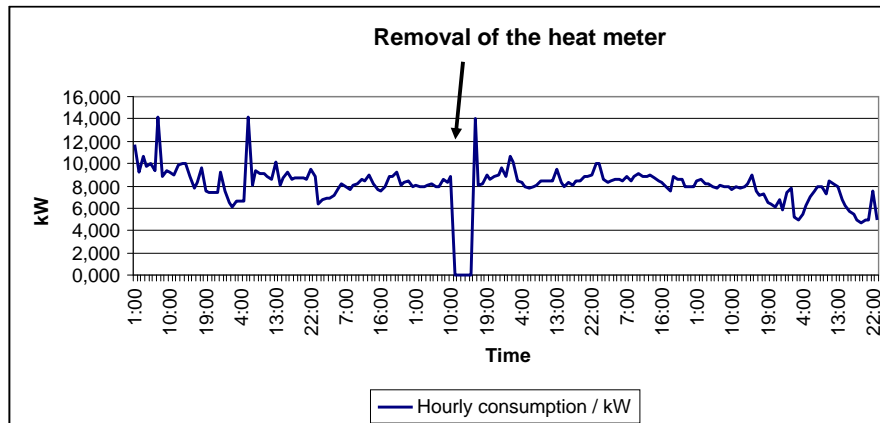


Figure 3: Hourly data before and after meter removal

In the figure can be seen that consumption is zero during the change of the heat meter. After the installation there is a short period of high consumption. After that the data will be relevant for analysis.

2.1.3 Remote reading and laboratory tests and field tests

It seems that it is not possible to replace laboratory or field calibration with remote reading data. There might be some advantages in remote reading. Additional information can be useful in analysis.

There is possibility to use remote reading in new types of field tests. This development will probably need two way data transfer possibilities and perhaps some additional measurements in customer sub station. This kind of development work has not started in district heating sector.

Remote reading makes it possible to find out the consumption profile of a customer. Combining the consumption profile and calibration data might give a possibility to solve the overall error of a customer heat metering. This could be done for example for year period.

3 DISTRICT HEATING SERVICES

One purpose of the project was to find out new services and service products in district heating sector. There can be different kinds of new possibilities with the help of remote reading for example advice in energy efficiency and energy saving, improving the efficiency of operation and maintenance of sub station, and even services of better the indoor temperature etc.

Some new services might need new remote control and remote operation possibilities. Also new organisation models and processes might be needed. There are nowadays much more technical possibilities than before, it is not anymore a limitation. And technology makes it possible to create new business.

4 AUDIT OF THE CONTRACT HEAT CAPACITY OR CONTRACT FLOW RATE

According to the recommendations of Finnish Energy Industries the contract heat capacity (or contract district heat flow rate) is the maximum one hour capacity (flow rate) needed by a customer.



The value should be audited and changed when needed. Flow rate is based on heat load and cooling of district heating water flow in sub station. Remote reading gives possibilities to make the job more accurate and reliable.

There are several methods to audit the contract values.

- Use of billing data does not use the actual measurements of capacity or flow rate. The benefits of remote reading are only more accurate consumption data and reading time information
- Auditing can be done by using special peak value measurement feature of some heat meters. Remote reading can be used to transfer this data from heat meter memory to office.
- It is possible to install special measurement devices to customer heat meters to measure the peak values and to storage the data.
- One possibility is to collect consumption data from each hour of the year by using remote reading. There are different kinds of measures to analyse that kind of data. The same data can also be used for different services and maintenance actions.

In figure 4 is presented an example of analysis of contract heat capacity using hourly measurements.

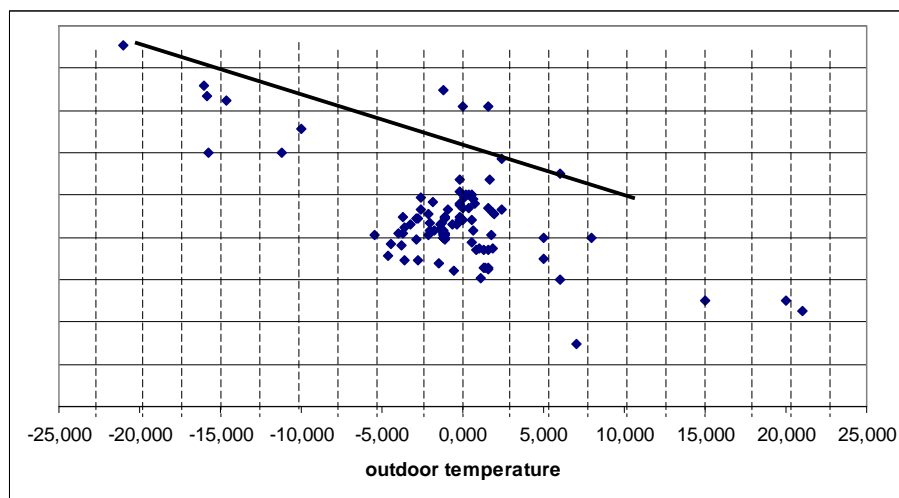


Figure 4 : Contract values using one hour data

5 REMOTE READING IN OPERATIONS OF DISTRICT HEATING COMPANY

Remote reading has advantages also in operation and maintenance of district heating network and production. Sometimes extra data can help to solve problems and failures.

Data from remote reading helps to optimise heat production, to predict the heat load and optimise pumping. Hourly data helps to analyse the heat load during unexpected operation conditions and planned maintenance actions.

In operation and control of district heating network most important is to minimise pumping energy consumption. The measure is to control and optimise of pumping with accurate measurements of



pressure difference in most remote customer connections. Also leakage control can be improved with remote reading data.

Remote reading can be used to measure the temperatures of district heating water in different points of the network. The temperature difference of supply and return district heating water (cooling of district heating water) is important part of efficient network. Remote reading gives a new and efficient measure to control the cooling of each customer.

It is possible to have new tariffs and tariff systems with the help of remote reading. Especially the hourly data gives new efficient tools for new more energy efficient and economical tariff systems.

6 CONCLUSION

Remote reading and especially hourly data information has many possibilities and advantages in district heating business. It is recommended to begin with the hourly bases remote reading because later the collected data may be extremely valuable. This data can be used as basis for new services, new tariffs etc.

At present the data transfer connection is not too expensive to start remote reading. Data storages used to be quite expensive, but the situation has changed rapidly and now they are very affordable.

There are lots of possibilities in organising different kinds of services or in handling alarms etc. There is also a need for further research in many cases, but remote reading seems to be solid basis for many different solutions.

Technology is not anymore a limitation of new services and business.