

# AUTOMATED METER READING BY GARBAGE VAN

## – DISTRICT HEATING FUNEN, DENMARK



*Innovative readout-system of heat meters with RF technology exploits the existing infrastructure.*

### MOBILE READOUT OF MORE THAN 60,000 HEAT METERS BY RADIO

District Heating Funen (Fjernvarme Fyn), situated in Odense (the third largest city in Denmark), has since 2004 been working on an exchange of the entire park of heat meters – in total about 60,000 meters. And at the same time an intelligent solution for the meter readout has been introduced. During the continuous process 5,000 meters are being exchanged on a yearly basis.

In the first installation phase in Odense, a number of different solutions for automated meter reading and data export were on the table for discussion. The commonly applied system solutions didn't quite cover the demands of District Heating Funen, though. A complete radio network would have made up a too comprehensive solution requiring the processing of a considerable amount of data by the energy provider. On the other hand, the automated readout on site (with a handheld terminal for instance) was rejected because of the required manpower. The staff would have been full time occupied with collecting data.

A large scale concept for automated meter readout was requested, but with due regard to the utility's specific need for data. The solution needed to be at the same time simple and economical, but without compromising the data security. These specifications seemed to call for a customized solution.

The outcome of the discussions is a mobile radio network – a semi-automated solution that reduces the costly and security sensitive human factor to a minimum.

### THE GARBAGE VAN-SOLUTION

At a relatively early stage of the process, the idea occurred to take advantage of an already existing infrastructure. The garbage vans were in the beginning mentioned merely as a humorous remark, but soon all parties realized the perspectives of this scenario: the garbage vans do not only drive regularly, they also come near every single household.

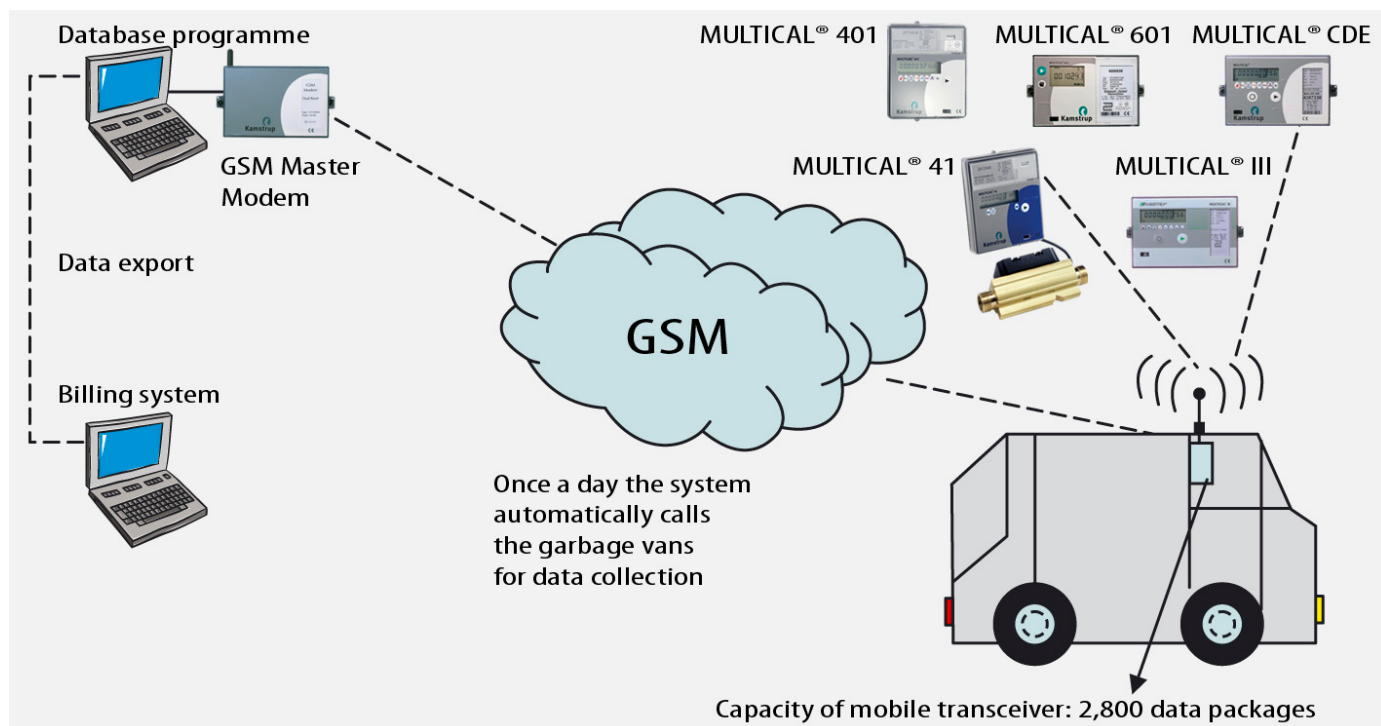
The idea was to use the 'automation' of this routine by equipping the garbage van with a transceiver that could receive signals from the meter and manage the data export to the utility.

Consequently, District Heating Funen contacted the local authorities in order to present the concept that was soon known as "The Garbage Van-Solution"; and the project was immediately sanctioned. A decisive factor for the permission was that Kamstrup, the system provider, could guarantee that the driver would in no way be influenced by the radiation from the transceiver, and that he could go undisturbed about his work.

The system requires no manual operation and no obligatory procedure. The data readout takes place automatically when the garbage vans drive their usual route.

The heat meters are delivered from the manufacturer with the radio modules integrated. Directly behind the driver's seat in the van is the transceiver placed which contains two objects: a data receiver in the form of a radio concentrator and a GSM modem. The GSM modem transmits the collected data to the utility where the central software processes the data.

# AUTOMATED METER READING BY RADIO



As the garbage vans drive around the residential area, the transceiver automatically calls the meters by radio. The meters then instantaneously respond by sending their ID-number and the logged data.

## DATA EXPORT IN A SECOND

As the vans move around in the residential area, the transceiver automatically calls the meters via radio. The meters respond by sending their ID-number together with the stored data. This communication takes place within a second. Optimizing the time of the radio communication is crucial because the information must be collected while driving by. The van doesn't have to stop still in order to let the exchange of information take place.

It was clear from the beginning that the utility and the system provider had to adapt themselves to the infrastructure and not the other way round. The garbage van personnel must in no way be bothered by the meter reading. A precondition for an optimal system that doesn't involve any human action is that the meters are supplied by the power line which secures an immediate response. Battery supplied meters lie dormant when they do not communicate, which is why they require a short while to be "woken up".

The integrated module of the individual meter sends in the short period of data export with an effect of 10 milliwatt. The radiation coming from the meter thus corresponds to the radiation from a baby alarm or a remote control. For the sake of comparison, an ordinary cell phone has an effect of 2,000 milliwatt.

The concentrator in the van operates with a dynamic list of 200 meters that are continuously called up. Meters that are not integrated in the system, but still get caught up, will be sorted out by the central software when the ID-number fails recognition in the database. An already contacted meter is within the next 30 minutes no longer reachable. This protects against unnecessary double storing of data in those cases where the van returns the same way.

The transceiver in the van has a storage capacity of 2,800 readings typically corresponding to four days readouts. This capacity is entirely adequate since the transceiver is emptied daily: once a day at 8 p.m. the transceiver gets a call from the utility in order to execute the data transmission. This call is automatically generated by the central software via a GSM master modem.

One and the same data package that is delivered by each meter, contains a combination of present data as well as data from a cut-off date, all of which are enclosed in a customer file which is being sent to the utility. The cut-off date in the data logger is permanently predetermined as the last day of the month at 11:59:59 p.m. Data that are stored at this time are used for billing, internal analysis, and production forecast. Independently of the next drive by of the garbage van, these logged values secure that the

<sup>1)</sup> The radio modules applied by Kamstrup are in concordance with the demands of the REC ERC 70-03 and are tested according to EN300 220 and EN301 489. The frequency is the same as for the ISM-band (433,050 – 434,790MHz).

utility gets its billing data from the whole supply area from exactly the same time. The present data, derived, for instance, from the real time clock and the leak surveillance, are used for optimizing the operation of the district heating grid. Since the implementation of the system, the mobile concentrator has once been updated with new software via GSM for a redefinition of the data package.

## UPGRADING TO A FULL SCALE RADIO NETWORK

The communication module in each individual meter is a radio route-module which is actually capable of passing on the radio signal of another meter in the network. The garbage van solution implies a direct data transmission from meter to transceiver, but because of the already integrated radio route-module, the system is prepared for a later upgrading to a full scale radio network. With all the necessary hardware being beforehand installed, it only takes an update of the software to equip the system with unlimited options for automated data transmission.

Each meter has, because of the radio route module, the capability of routing the signal to 70 other meters and form part of a network where 300 integrated meters communicate among themselves. This high communicative flexibility secures an always open path to the permanently mounted concentrator even if the radio signal should occasionally weaken.



The data transceiver is placed behind the driver's seat.

The full scale radio network gives access to an indefinite amount of data and a system security of 100%; and it eliminates the time factor at the call-up as the meters at any time can be contacted by the utility. Furthermore, an unlimited number of readout-jobs can be performed completely independent of the type of data.

<sup>2)</sup> Kamstrup offers various solutions for data reading and data management. Apart from the manual solutions with readout by handheld terminal or pc and the various radio solutions for remote readout, there is also the PLC-solution (Power Line Communication), where the data are transmitted via the power grid. Normally, however, Kamstrup does not recommend the PLC-solution as it entails some security issues. In case of overload or power outage, data will be lost. High load in the grid narrows the bandwidth for data transmission. Cf. Ulrich Stein, Jan Carlsson, Jan Welinder, SP Technical Research Institute of Sweden: Signal transmission via the low-voltage power grid, April 2006.

The required monthly readout by District Heating Funen is effortlessly obtained because the garbage in Odense is being collected twice a month. In case the call for some reason misses a meter, another contact is attempted 14 days later. This highly strengthens the readout performance.

The system is scalable, which means that the number of metering points can be infinitely expanded without impairing the performance. All experience says that radio communication is by far the most secure solution.



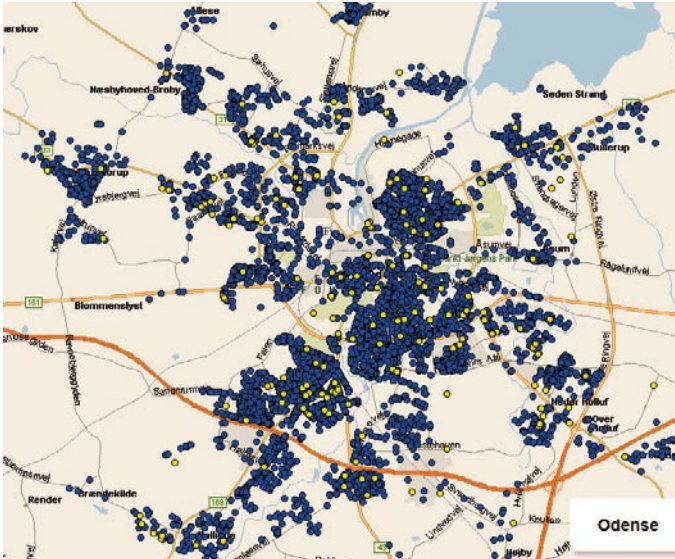
The inside of the data transceiver with GSM modem and radio concentrator.

## TROUBLE SHOOTING

From the beginning of the project, Kamstrup pointed out a target area of 2,035 meters that were closely monitored in order to optimize the performance. Out of this area 19 meters showed problematic readings because of remote placing in relation to the transceiver of the garbage van. By means of the Microsoft MapPoint-programme and a GIS-map, the difficult meters could be exactly located. It turned out in many cases to be larger buildings like schools or public baths where the meters are not located near the garbage pick-up. In a close cooperation, the utility and the system provider could then initiate a trouble shooting plan.

A number of solutions can be decided on. The meter can be equipped with a GSM-module of its own; an antenna can be mounted in order to prolong the range; or a further permanent concentrator can be placed between the meter and the garbage pick-up.

# MULTI UTILITY READOUT-SYSTEM



City of Odense with hinterland: Blue dots mark already read meters, yellow dots mark meters awaiting readout.

## FROM DATA COLLECTION TO DATA ANALYSIS

The garbage van-solution has quickly spread. Currently, ca. 40,000 heat and water meters are being installed in a multi utility-system in Esbjerg. Multi billing is an obvious opportunity with automated reading.

Electricity meters, though, are excluded from the mobile radio solution. Electricity utilities demand larger amounts of data and shorter intervals between the readings. A combined system with automated readout of meters for three energy supplies (electricity, heat, and water) requires a full scale radio network as in the Roskilde-Hillerød project (near Copenhagen).

The mobile radio solution sets the operation costs at a minimum. The investment will probably be recovered within eight years. The main reason for the cost reduction is the small amount of work force needed for the data collection. But apart from the financial benefit, District Heating Funen also takes advantage of a much more detailed overview of individual household consumptions to the effect that customer service and energy advising have improved considerably. Problems with supply and particularly irregular consumption patterns are now registered far earlier than before; and, in addition, a much more accurate statistic opens up to a more controlled load management based on exact knowledge of the energy demand.

## BEST PERFORMANCE

When everything is considered, the automated remote reading system unfolds perspectives in terms of a more viable reallocation of resources. Time and work force can be moved from the bothersome collection of data to analyzing data and more customer oriented tasks. Today's supply company faces still more complicated challenges from customers and lawmakers. Formerly, only supply security was central for the business, now also reductions of CO<sup>2</sup>-emissions must be regarded.

Energy companies are therefore compelled to take recourse to a number of energy saving initiatives in order to stay competitive and prepare themselves for future political measures. One such initiative is to motivate the customers to a more energy aware behaviour. To this end, accurate consumption statistics are an efficient tool.