KNX and OMS position paper
Cross-functional systems for home and building automation as well as smart metering

Preliminary comments

Europe currently imports more than 50% of its primary energy. This percentage is expected to rise to approx. 60% by 2040. The debate on energy saving was therefore initiated in the European Parliament with the slogan “20-20-20 by 2020”:
In 2006, the European Energy Efficiency Directive was passed which became the basis of national laws. It requires the consumption-based billing of energy. Since a conscious approach to energy usage is an essential part of saving energy, the end users should be provided with information about their consumption at frequent intervals so that they can control it.
A prerequisite for the economically viable implementation of this requirement is the standardisation of the consumption meter infrastructure. This was recognised by both manufacturers and users of consumption meters and the Open Metering System Group (OMS Group) was founded with the aim of establishing an interoperable communication standard without dependence on manufacturers or media. This has been achieved successfully in recent years with the amendment of the European norm EN 13757.
In 2009, with the mandate M/441 on smart metering, the European Commission tasked the European standards bodies

- CEN – European Committee for Standardisation,
- CENELEC – Comité Européen de Normalisation Electrotechnique and
- ETSI – European Telecommunications Standards Institute

with standardising an interoperable communication system for smart metering in Europe. The European norm EN 13757 was introduced by the CEN. The Smart Metering Co-Ordination Group (SMCG) has ensured a mutual recognition of the relevant norms with the involvement of the technical committees of the CEN and CENELEC. This means that electricity meters with communication according to EN 13757 are classed as compliant with the standards according to CENELEC.
The EN 13757 series of standards, which has achieved interoperability through the OMS specification, is thus the only communication standard for meters and related devices, which enables the users to record meters of all media economically with one communication system (Figure 2).

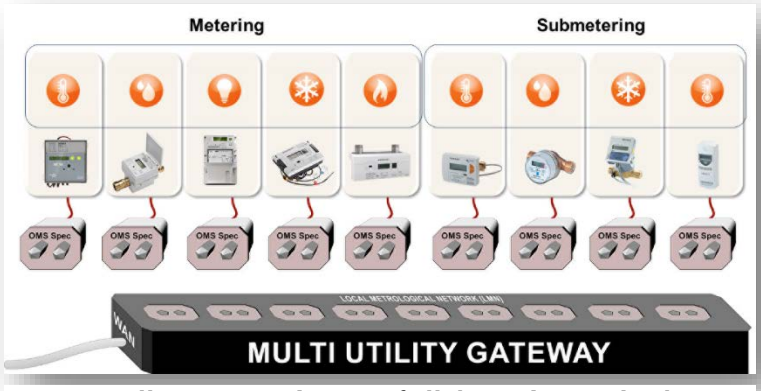


Figure 1: All measuring devices of all the media speak “the same language”

As it was conceivable that in addition to measuring devices and consumption-based billing, further components such as control systems in buildings are necessary to achieve the energy-saving goals of the EU, the KNX Association, which represents the world-wide standard for home and building automation, became a founder member of the OMS Group.

Cross-functional systems

Figure 2: Interplay between metering and sub-metering, home and building automation and energy supply with volatile energy sources.

When developing the OMS specification, future-oriented solutions were taken into account in connection with other applications around the building. The common use of the radio standard EN 13757-4 by OMS and KNX is thus a direct bridge from metering to home and building automation according to the world-wide KNX standard (ISO / IEC 14543). It is therefore possible in one system to inform the end users frequently about their energy and water consumption and to control the energy demand management. This concept is the basis for the implementation of smart cities.

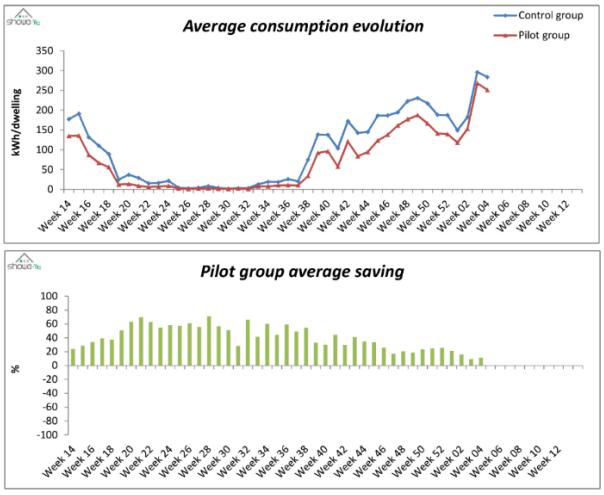
Conscious approach to energy usage

With the European project SHOWE-IT ("Real-life trial in Social Housing, of Water and Energy efficiency ICT services")[1], the result of the energy saving due to this conscious approach could clearly be proven. A consortium of 12 partners installed the SHOWE-IT system in three locations in Tuna (Stockholm, Sweden), Ecully (Lyon, France) and Rochdale (Manchester, England).

A pilot group and a control group were established in each of the locations. The consumption of electricity, water and heat is measured and registered in both groups. The pilot group also received an “In Home Display” which displays the actual consumption as well as KNX room temperature control devices.

The goal of SHOWE-IT was to evaluate the influence of the conscious approach to energy usage of the end consumers on their energy and water consumption.

The installation in Sweden is particularly remarkable. The costs for the heating supply are included in the rent. The residents therefore did not have any financial benefit in saving heat energy.



Heating			
Average saving per dwelling on the period			
kwh	kg CO2eq	Kr	%
1215,6	99,7	607,8	27,5

Figure 3: Evaluation of the heat consumption in Tuna (Stockholm) in comparison with the pilot and control group[2]

1 http://showe-it.eu/

2 Sweden analysis_Heating_20140207 (SHOWE-IT internal evaluation)

The role of OMS and KNX in smart metering protection profiles

In Germany, the Energy Industry Act was revised in 2011 based on the European Energy Efficiency Directive and the law regarding the digitalisation of energy consumption was passed in 2016. In this regard, the Federal Office for Information Security (BSI) was instructed to develop a smart metering protection profile[3] to enable the consumption data to be read out securely via a measuring system (one or more intelligent meters are read out remotely by a smart meter gateway). The technical guideline BSI TR-03109[4] describes the requirements for the implementation in technical systems. This guideline contains the OMS specification for the communication system in the local metrological network (LMN).

To implement the requirement that the end user should be informed promptly about their current consumption, the interface for the home area network (HAN) is available on the smart metering gateway (SMGW). A KNX system can e.g. take over the distribution of information to the individual end users. Figure 5 shows the example of a KNX server receiving the consumption data from the smart meter gateway via the HAN interface and transferring it to the individual display units in the flats in the apartment building. This information can then be used for the optimisation of the energy consumption or monitoring functions in the building control.

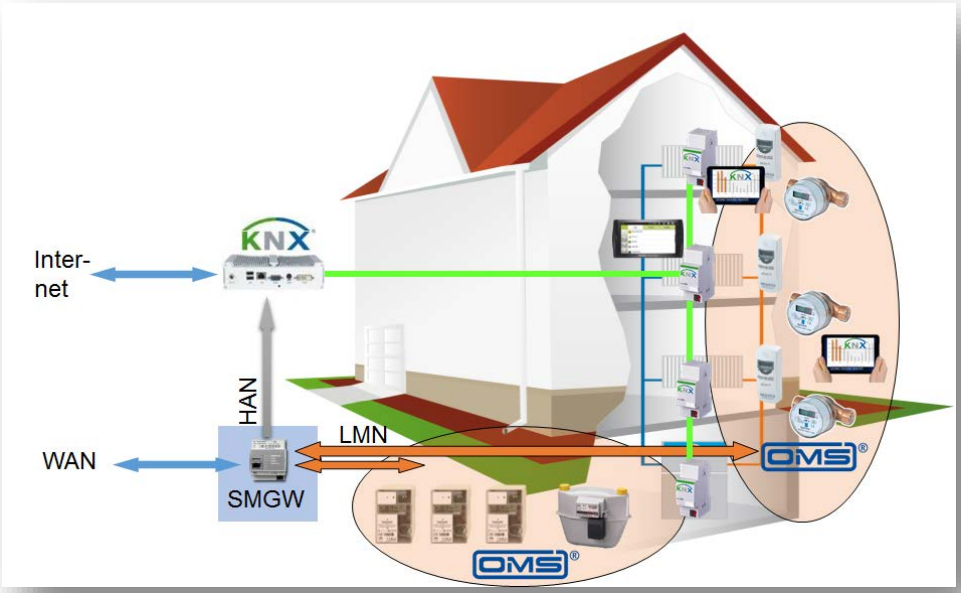


Figure 4: KNX as an information system in an apartment building with measuring system

Interplay of OMS and KNX in energy optimisation and information

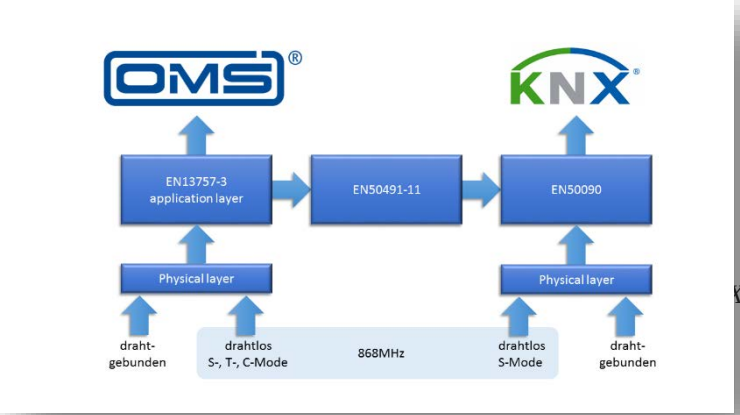
Measuring systems for electricity meters are stipulated in Germany for loads with more than 6,000 kWh electrical energy per year. This affects approx. 10 to 15% of households.

If you take into account that on average only approx. 23% of the energy costs are spent on electricity in a four person household, you “give away” the most essential contribution to energy saving if you neglect the heat consumption. The goal must therefore consist in combining the

3 https://www.bsi.bund.de/DE/Themen/SmartMeter/Schutzprofil_Gateway/schutzprofil_smart_meter_gateway_node.html

4 https://www.bsi.bund.de/DE/Publikationen/TechnischeRichtlinien/tr03109/index_htm.html

meters of all the energy types in one communication system so that subsequent information, monitoring and optimisation systems can process the information meaningfully.
The OMS specification describes the interoperable communication process for all the meters of all manufacturers in metering and submetering. The operator of the measuring equipment can therefore be certain that he can record all the consumption values of a building with one single communication system.



With the regulations described in EN 50491-11, the information from the measuring devices can be transferred from OMS into the KNX communication system in a standardised format (Figure 6).
For residential and commercial buildings, there are many possibilities for using consumption and status information in the building automation system:

a) Informing the residents and tenants
b) Monitoring the building supply system for inadmissible values (excessive temperatures, burst water pipes etc.)
c) Optimising the building parameters e.g. for the increasing of energy efficiency and reduction of the CO_2 emissions.

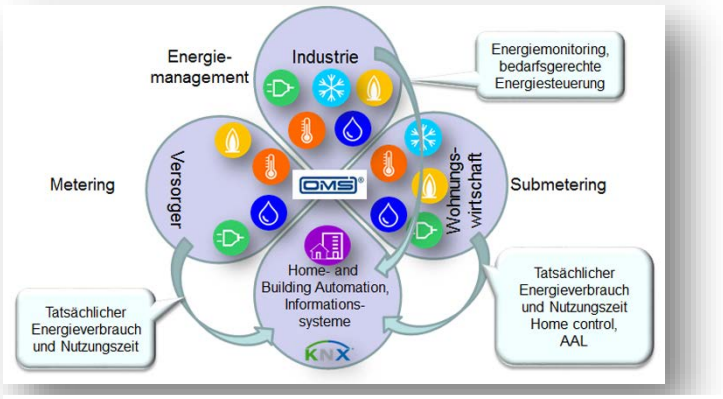


Figure 6: Interplay of different application areas from the consumption meters with the KNX systems

It is not only a good idea to transfer consumption data to a KNX system in residential and office buildings. Energy management systems are of particular significance for industry in accordance with EN 50001. A KNX system can play out its strengths in the demand-based control and regulation of the building system.
In future, energy suppliers will try to optimise the energy consumption according to energy demand e.g. through time-based tariffs. A load can only make optimum use of this range of tariffs with the help of an automation system (KNX).

Further development

KNX web services are KNX's response to the need to free KNX installations from KNX-specific features and to make the access to KNX networks more IT friendly. An image of the KNX network is stored in the KNX web service interfaces: it is possible to browse this image as if it was a web page. It is not only possible to visualise the status of devices but also to control them via RESTful web services: the gateway then translates these commands into KNX-specific commands without the developer of the web client having to master KNX.
In this way, the KNX of Things (KNXoT) which has been in existence for some time can be seamlessly integrated into the Internet of Things (IoT). KNX web services also allow an IT friendly coupling between KNX and OMS.

Summary

The energy savings in private households can only be achieved if it is possible to record regularly i.e. monthly, weekly or even daily which loads use which type of energy i.e. electricity, gas and heat. Only with this comprehensive level of information is it possible to achieve a change in user behaviour which in turn leads to considerable reductions in CO_2 emissions.
Energy management systems are required in industry to optimise the energy consumption.
In future, energy suppliers will regulate the supply and demand of energy through time-based tariffs.
In all these cases, it is necessary to link an interoperable communication system for consumption meters which is not dependent on any manufacturer, media or branch (the Open Metering System) with the home and building automation system (KNX system).
The transfer of consumption data from the OMS system to the KNX system was standardised with the European norm EN 50491-11. A common advancement to the web services is advisable and therefore worth aspiring to.
It is therefore possible in one system to inform the end users frequently about their energy and water consumption and to control the energy demand management.
The goals of the European Union can only be achieved with these interconnected, standardised systems (Figure 1). The reduction of the energy consumption in residential and commercial buildings and industry is accompanied by the reduction of the CO_2 emissions without the need for additional investment.
A study by the ITG Dresden[5] has shown that when these ideas are implemented in residential buildings in Germany, approx. 6.5 million t CO_2 per year could be saved without additional costs.

[5] Short assessment of the contribution of intelligent measuring systems for electricity, gas and heat in the reduction of CO_2, ITG Dresden 2015