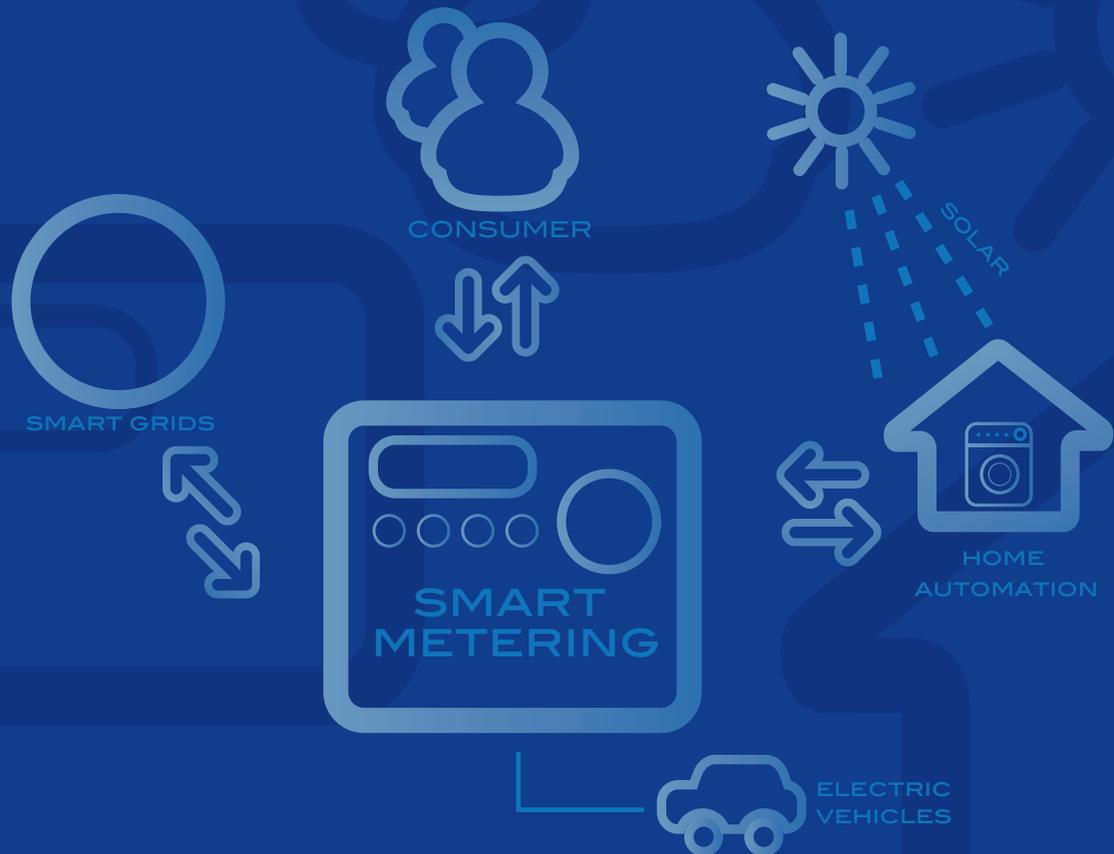




A Guide to Smart Metering

Empowering people for a better environment



ESMIG – WE MAKE METERING SMART

The European Smart Metering Industry Group (ESMIG) is the European industry association that provides knowledge and expertise on Smart Metering and related communications at a European level. ESMIG's members are the leading companies in the European Smart Metering Market: meter manufacturers, IT companies and system integrators. ESMIG covers all aspects of Smart Metering, including electricity, gas, water and heat measurement. Member companies cover the entire value chain from meter manufacturing, software, installation, consulting to communications and system integration. By giving support to European Union Institutions, Member States and Standardisation Organisations, the industry group aims to assist in the development of national and European-wide introduction, roll-out and management of Smart Metering solutions.

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Recently ESMIG has been recognised as an Official Partner of the Sustainable Energy Europe Campaign: www.sustenergy.org.



In the area of European and international standardisation, ESMIG has concluded several cooperation agreements with partners, such as CENELEC, DLMS, ETSI, Open Meter and ZigBee and further agreements are foreseen. The partnership scheme is open to any Standardisation Organisation that shares ESMIG's core belief in open and interoperable standards.



EMPOWERING PEOPLE FOR A BETTER ENVIRONMENT

The EU's 20-20-20 goals (20% increase in energy efficiency, 20% reduction of CO₂ emissions, and 20% renewables by 2020) all depend on the re-configuration of the European electricity grid into a "smart grid". The key to transforming the grid is the roll-out of Smart Metering technologies. Yet the importance of Smart Metering is often not fully understood.

The current European transmission grid will have to meet several challenges, such as the integration of large amounts of off-shore wind power; the massive trading flows a liberalised energy market entails as well as active demand-side management measures. The ability to cope with these challenges is exactly what is required in order to meet the EU's energy and environmental policy goals. If the grid is to be transformed to perform these functions then the associated metering infrastructure must be likewise transformed because this is what will change consumers' behaviour, and will provide the data needed to make the network function.

These ambitious European targets mean that we must change; not only our energy infrastructure must change, but also consumer behaviour. Smart Metering is an essential building block for the education and empowerment of customers, an essential development if we are to make real energy savings.

According to the recently passed Internal Market for Electricity and Gas Directives, EU Member States must "ensure the implementation of intelligent metering systems." The Electricity Directive foresees full deployment by 2022 at the latest, with 80% of consumers equipped with Smart Metering systems by 2020.

Smart Metering is a technology that is available here and now. The 20-20-20 goals and the deployment targets in the Electricity and Gas Directives have timeframes stretching for more than a decade, but the citizens of Europe can start enjoying the benefits of Smart Metering much sooner. Now is the time to make the transformation to a modern infrastructure of the future. We cannot meet the environmental and energy challenges of the 21st century with metering technology from the 19th century. A first step in this transition of the grid must be the introduction of Smart Metering. The technology is already at our disposal.

This Guide has been written to inform the debate about Smart Metering and to show how its full potential can be realised for the benefit of consumers, society as a whole and the environment.

"Smart Metering, combined with direct customer
feed-back has been shown to increase energy
efficiency by 5-15%, and in some cases even up to 20%"

SMART METERING TECHNOLOGIES

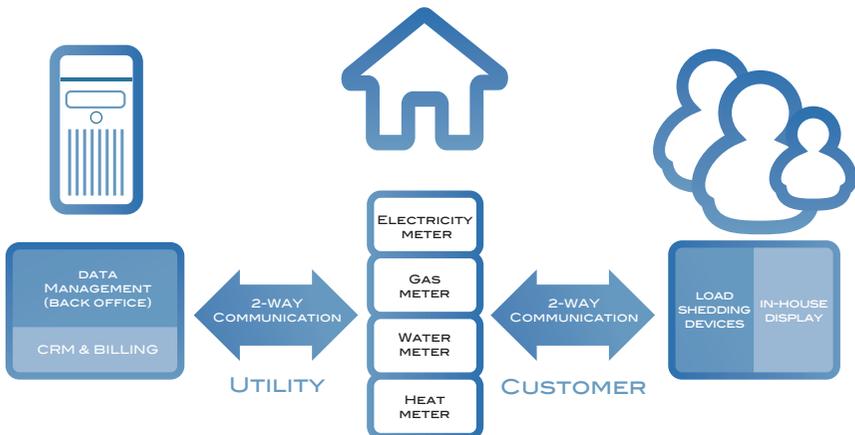
Smart Metering¹ offers consumers, suppliers, network operators, generators and regulators a wide range of useful tools and services enabling ultimately a smarter energy world. Generally, Smart Metering technologies consist of several different technical components which may vary according to the specific market conditions in different Member States, but the majority include the following features:

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1. Accurate measurement and transmission of electricity, gas, water or heat consumption data
2. Provision of a two-way information gateway and communication infrastructure between the meters and relevant parties and their systems, for:
 - raising awareness and empowering the consumer through delivery of actual consumption data
 - improving Customer Relationship Management (CRM) and services, including automated billing/invoicing based on detailed metering data
 - managing energy networks/grids better by shifting or reducing energy consumption, e.g. through Demand Side Management (DSM)
 - enabling new energy services for improving energy efficiency
 - encouraging decentralised, micro-generation of energy, thus transforming the consumer into an energy producer ("Prosumer").

Smart Metering systems feature a number of innovations: digital technology, communications, control and better operation of networks. Smart Metering technologies will change the way that metering works completely. They provide customers with much more information on how they use energy and enable those customers to reduce their usage.

This Guide examines the new functionalities made possible by Smart Metering and the wealth of new services and applications that can now be offered.



¹ Often also referred to as "Advanced Meter Management" (AMM) or "Advanced Metering Infrastructure" (AMI).

SMART METERING FEATURES

Like conventional meters, Smart Meters measure amounts of energy or water flowing through them. But whereas conventional meters must be read manually, and the consumption calculated since the last reading, Smart Meters provide specific information on how much energy or water was consumed, when it was consumed and at what tariff – a continuous calculation that conventional meters are incapable of. Provided with detailed operational data the network operator is also able to decrease the cost to serve, by targeting investment in the network more accurately and thus maximising the benefits of system reinforcement.

But Smart Metering offers much more:

Digital technology

Smart Metering takes advantage of all the advances in modern digital technology; it enables data communication and can measure and deliver more information. More quantities and larger amounts of data can be stored until collected and meters can also be re-programmed or re-configured remotely,

Communications

Smart Metering enables long range communication with the energy company and short range links into the home. Consumption data can be read remotely and tariffs can be updated remotely. Smart Metering provides a communication gateway that functions as an interface between devices in the home and provides customers with real time data.

Control

Smart Metering allows for remote configuration and adjustment. This can be used in a number of ways, for instance, for supplier switching, remote reconfiguration of the meter as a credit or pay as you go meter; as the customer chooses to switch their supply contract. Finally, the meter can be used as the interface of a home automation network.

Better operation of networks

Smart Metering can greatly assist the network operator by providing detailed operating data from the ends of the network. Power quality can be measured by the meters and the network adjusted to improve its overall operation. Outages or leakages can be detected faster and system recovery monitored, minimising inconvenience to customers.

Using these functionalities Smart Metering can support a whole range of new services. Many of these features are already available and in use for large commercial or industrial consumers. The revolution in Smart Metering is seeing these features transferred to the residential and small commercial sectors with significant benefits to consumers, utilities, environment and society.

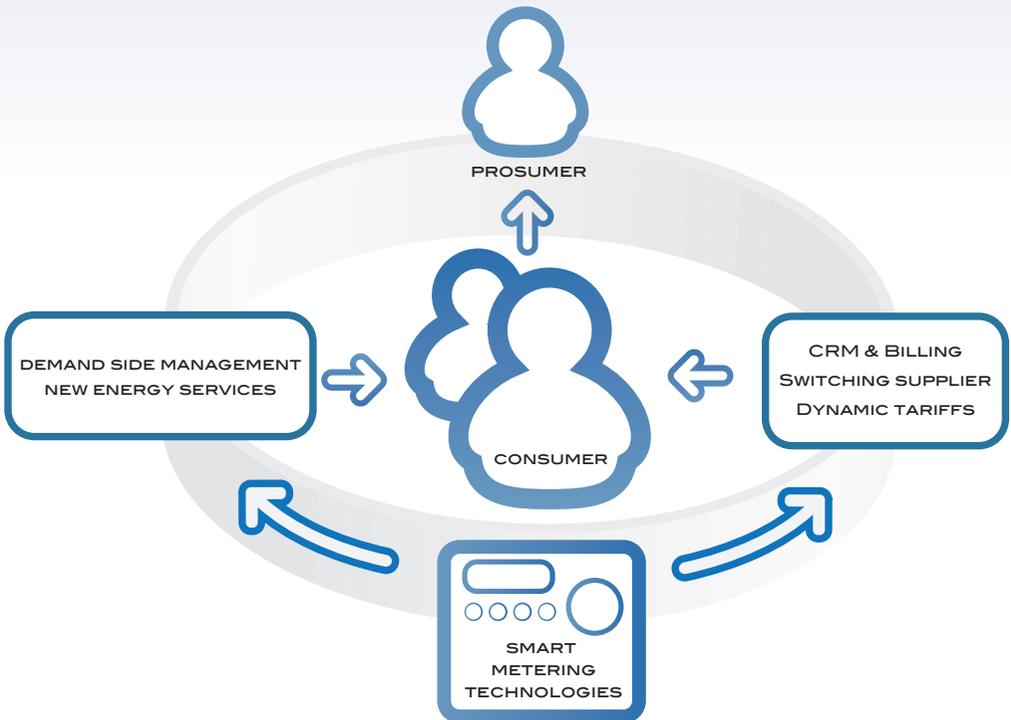
NEW SERVICES PROVIDED BY SMART METERING

Give consumers much more information on their energy consumption

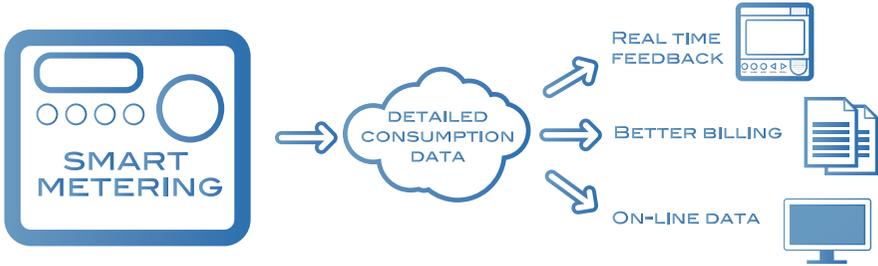
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Traditionally, the primary role of utility metering has been to accurately measure usage of electricity, gas, water and heat. Until now this usage data has been - with some exceptions - manually collected by the utilities. Consequently utilities lack quality data on the consumption of their customers. This limits the frequency and accuracy of consumers' bills, and the ability of utilities to engage with customers.

Smart Metering will revolutionise the availability and usefulness of consumption data. It will empower consumers, raise customers' awareness of their energy and water use and allow them to make informed decisions on heating, lighting and appliance upgrades. Ultimately this will lead to a significant change in consumer behaviour towards sustainable consumption patterns.



Smart Metering produces accurate, detailed consumption data that can be provided to customers in a number of ways.



- **Better billing** – Smart Metering will allow utilities to send their customers more accurate bills based on actual consumption data. Using these bills utilities can provide targeted advice on energy consumption and allow customers to see long-term trends in their consumption. Detailed consumption data helps customers understand how they use energy and empowers them to reduce their consumption. Finally, customers should appreciate having a detailed knowledge of their actual energy cost.
- **On-line data** – many utilities now provide their customers with website portals where they can view their bills. With data provided by Smart Metering technologies these can be made much richer environments where customers can benchmark their consumption and carry out analysis on energy-saving investments.
- **Real-time feedback** – Smart Metering will provide new energy consumption feedback routes. The local communications interface allows data to be streamed directly to displays in the house or local software applications. This data can be provided in real time at very short intervals so that customers can immediately see the effect of turning individual appliances on and off. This will enable customers to understand in much greater detail the way they use energy and the relative impact of different appliances. The data can also be converted to currency or carbon basis to increase its relevance to the customer. Customers can also use real time feedback to set alarms that alert them to unusually high consumption.²

Giving customers direct feedback on their energy usage will enable them to reduce their consumption without affecting their quality of life. Armed with this information, consumers can understand and modify their relationship to energy use and take control of it.

In Europe, North America and Australia a variety of studies, pilot projects and mass roll-outs of Smart Metering systems combined with direct feedback have shown energy savings of 5%- 15% and sometimes even as high as 20%.

² Assessment of Achievable Potential from Energy Efficiency and Demand Response Programs in the U.S.: (2010–2030). EPRI, Palo Alto, CA: 2009. 1016987.

NEW CUSTOMER SUPPLY CONTRACTS

At the moment conventional meters only allow utilities to offer simple supply contracts to their residential customers with a maximum of one or two rates and profiled consumption patterns. Smart Meters will make it possible for utilities to offer more varied contracts.

- **Demand response** – Smart Meters can support a larger number of Time of Use (ToU) rates so that utilities can charge different tariffs at different times of the day, reflecting the true cost of generating the electricity. Utilities can also offer contracts that have a premium rate for occasional peaks in demand (critical peak pricing, CPP). The meter communications can be used to warn customers in advance before peak rates apply.
- **Dynamic tariffs** – Smart Metering allows for greater flexibility in supply offers. Consumers can actively react to price signals.
- **Load management** – Suppliers will be able to offer their customers a contract allowing the energy company to remotely adjust the customer's load. For example, the energy company can remotely raise the set point for an air conditioning thermostat in the customer's property. Although the customer will not notice much difference, the net reduction in the load can be enough to keep reserve capacity at safe levels or even prevent a collapse of the system and reduce costs. The energy company can, in turn, pass these savings to the customer. Trials have shown that much of this reduction is sustainable.³
- **Energy services** – Looking further forward, Smart Metering and two-way communications will give utilities the ability to use more detailed consumption data and information to deliver new and innovative energy and water services – selling energy and water-efficiency products, etc rather than “simply” energy.
- **Interval data billing** – Smart Metering systems can measure and collect 'interval data' where the consumption is recorded every half hour or so. This data is currently used for large customers but is too expensive to collect with conventional residential metering. It allows the customer to be charged for the actual cost of the electricity they use instead of receiving estimated bills.
- **Pre-payment** – Electricity Smart Meters fitted with a switch can be remotely reconfigured as either a pre-payment or a credit meter allowing customers to easily switch contracts. This would support the growth of pay as you go, an increasingly popular option for electricity customers.
- **Prosumers** – Small scale, decentralised generation of energy, such as solar and wind-power technology will become more important in future. The traditional customer role will change as he becomes at times either an energy producer (selling surplus energy generated locally) or a consumer (“Prosumer”). Smart meters can support this process by measuring not just the energy consumed but also the energy generated, and can communicate this data instantly.

³ Demand Response: a decisive breakthrough for Europe. How Europe could save Gigawatts, Billions of Euros and Millions of tons of CO₂. CapGemini, VaasaETT and Enerdata: 2008.

RUNNING ENERGY BUSINESSES BETTER

Smart Metering will transform the way that utilities run their businesses and reduce their costs to serve, with major benefits for them and their customers.

Improved billing process – The ability to remotely read meters will lead to fewer complaints about bills and allow customer service agents to check meter readings live whilst dealing with an enquiry. In return for investing in Smart Metering, the energy company will incur lower costs for reading meters, especially those in hard-to-access properties.

Supplier switching – In competitive markets Smart Metering will support customers in switching more easily between suppliers. The meters can be read easily when the contract changes so that the process can be carried out in 24 hours.

Meter management – Smart Meters can be remotely disconnected and the firmware can be updated without entering the site, offering greater convenience to the energy company and customer.

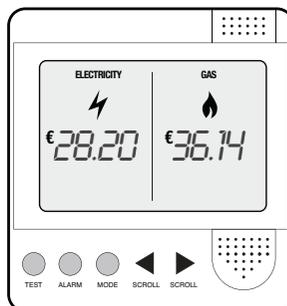
Fraud/Revenue protection – Smart Meters can offer more sophisticated fraud detection techniques, protecting income for the energy company and keeping prices down for the customer.

Network management – Through real-time consumption data and aggregation of consumer profiles Smart Metering allows for a more precise forecast of energy consumption which improves the network management and planning processes.

MULTI-UTILITIES

Smart Metering applies to other utilities just as much as electricity. Smart Meters can be provided for gas, heat and cooling as well as water. Smart Metering for other utilities can be provided as separate systems run in parallel or they can share infrastructure thus allowing for synergies which will lead to reduction in the costs to serve. For instance the electricity meter can collect data from the gas meter and provide a communications channel to the gas utilities back office.

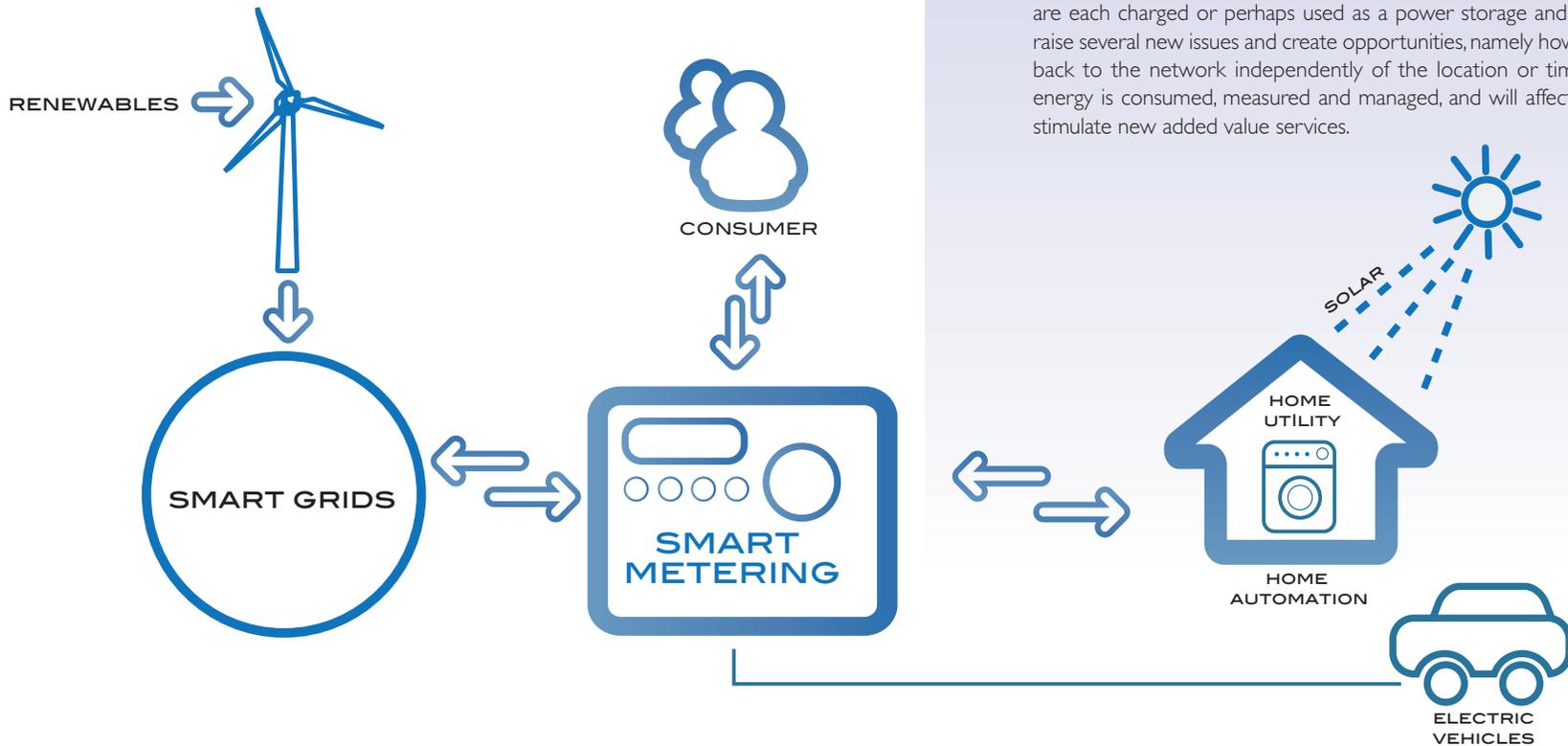
The benefits for other utilities are also similar; customers benefit from seeing their consumption and can learn where to make economies. Utilities gain most of the same benefits as for electricity metering. Seeing their electricity, gas, heat and water consumption on a single display can help customers compare their relative carbon impacts, provided that they are given information on the carbon emissions related to each energy company. This would also allow 'green' suppliers to differentiate themselves.



RENEWABLES AND DISTRIBUTED GENERATION

Smart Metering can be used to integrate the growing number of embedded renewable generators, such as wind and photovoltaic. Smart Metering systems can readily be set up to measure exported power, when the customers use less power than they generate. They can also measure the output of the generator and supply this data to the energy company to provide a complete picture of the generator's performance. The Smart Metering communications links can also be used to manage fleets of embedded generators as though they were a single large plant – so-called virtual generators.

Smart Metering can also support flexible tariffs, where the energy company can offer a contract where the price of electricity is variable from period to period. This is especially useful when renewable generators, such as wind turbines, are producing more or less power than expected. This can help reduce peak loads or increase load when output is high.



ENABLING A SMARTER ENERGY WORLD

Smart homes – Smart Metering technologies can function as an interface for smart homes devices. This would allow comprehensive home energy management, linking the heating and appliance controls and giving customers the tools to monitor their operation. This could enable the provision of buildings communications systems – with knock on effects for controlling heating, lighting, ventilation and appliance use.

Smart grids – Energy supply networks face huge challenges in the future with an urgent need to improve their operation and efficiency and fit them for our future energy needs. They will need to accept much higher levels of distributed and renewable generation. Smart Metering will be a key element of this transformation. Smart Metering will also allow the transmission and distribution of more energy within existing network capacity due to optimisation and better energy management. Demand management facilities will also give the network operators valuable tools to manage load on their networks.

Electric vehicles – Smart Metering will be an important element of any future use of smart electric vehicles. They will present a major load for the grid that must be managed when they are each charged or perhaps used as a power storage and source. Finally, electric vehicles also raise several new issues and create opportunities, namely how and when to charge or give energy back to the network independently of the location or time. This is likely to change the way energy is consumed, measured and managed, and will affect energy supply contracts as well as stimulate new added value services.



WE MAKE METERING SMART

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