

WHITE PAPER | Digitalise or Die!

DIGITALISE OR DIE!

REAL-TIME CONTROL OF THE ELECTRICITY
GRID IS VITAL TO DELIVERING 21ST CENTURY
REQUIREMENTS FOR SECURE, EFFICIENT,
CLEAN AND AFFORDABLE POWER

DIGITALISE, OR BECOME OBSOLETE...

- **The energy sector is undergoing a generational transformation** - The limitless availability of affordable energy, and in particular electricity, is not a given as prevailing trends in energy provision and usage are unsustainable over the long term. Global energy demand is projected to increase dramatically to 2050 in all regions, with IEA's 2012 World Energy Outlook predicting >70% increase in electricity demand by 2035.
- **Digitalisation of the electricity distribution grid is essential** if we are to meet and manage demand with affordable energy, whilst simultaneously meeting decarbonisation targets. Smart technology deployment has the ability to reduce projected power demand growth by ca. 20% by 2050. Digitalisation provides the building blocks to enable efficient power management by the individual, the next generation intensive user, commercial consumers and power traders to:
 1. **Increase energy efficiency and power productivity** through active demand and supply management with the implementation of real-time monitoring and control coupled with intelligent distribution - which when combined with better end-user power efficiency results in lower energy consumption per unit of GDP.
 2. **Support enhanced energy security** by enabling delivery of power from distributed and intermittent renewable generation sources to consumers and reducing the dependency on carbon-intensive generation and imported fuels.
 3. **Provide the building blocks for new energy services**, including the necessary intelligent infrastructure for energy services companies (ESCos) to deliver efficiencies and savings.
 4. **Provide a framework to support capital funding** from unregulated markets to deliver advanced infrastructure to support new services.
- **Today's electricity distribution networks are facing both capital investment constraints and operational strain** due to a combination of growing electricity demand, aging infrastructure, intermittent generation sources and increasing costs of capital.
- **Robust, secure and scalable communications & control technology is a vital building block to enable digitalisation** - Utilities operate in a high reliability environment where service down-time is unacceptable. The enabling infrastructure to support digitalisation must provide real-time control, reliable data analytics and scalability.

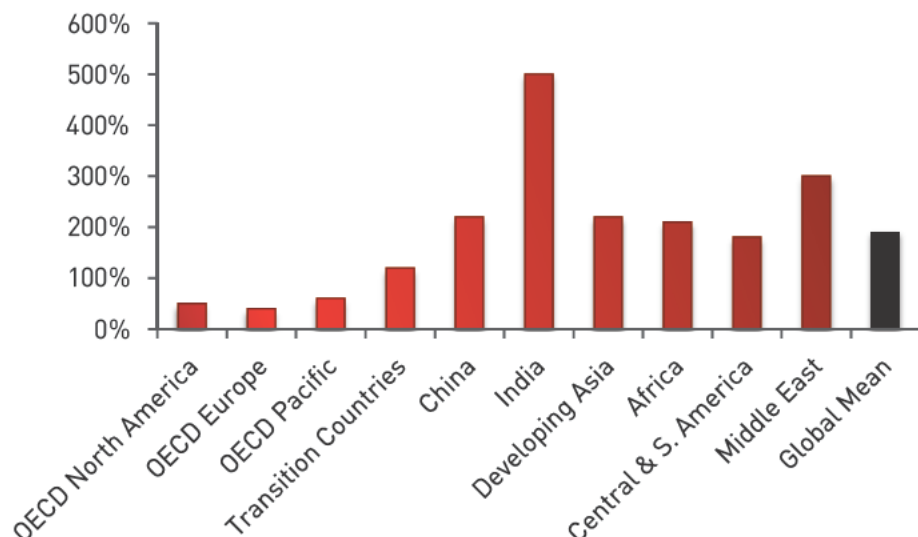
Real-time control of the electricity grid is vital to delivering 21st Century requirements for secure, efficient, clean and affordable power

THE ENERGY MARKET IN TRANSITION

Energy, and in particular electricity, is a central component of our daily lives. It enables virtually every activity we undertake. For many, the availability of energy is taken for granted. It is abundant and affordable. The question is for how long. Globalization, expanding populations and the aspiration for higher living standards increasingly burden the provision of energy and have caused governments to take measures to adapt energy infrastructures to current demands and trends.

The limitless availability of affordable energy is not a given. Energy demand is projected to increase dramatically between 2010 and 2050 in all regions. At the same time, electricity is the fastest-growing component of total global energy demand. Global electricity consumption is forecasted to increase by over 150% between 2007 and 2050, according to the International Energy Agency (IEA). The challenges are thus clear. Failure to develop our energy and power systems will severely impact our daily lives.

ELECTRICITY CONSUMPTION GROWTH 2007-2050E



Source: IEA

The development of smart grids and technologies is paramount to the common goal of global populations for energy security, economic prosperity and climate change mitigation. Smart technology deployment has the ability to reduce projected power demand growth by ca. 20% by 2050.

THE SMART GRID DEFINED

The smart grid is an intelligent electricity network that employs advanced digital communications technologies to monitor and provide real-time management and control of electricity flows from generation through to consumer. The smart grid of the future will be able to co-ordinate today's large, centralised power plants as well as the rapidly expanding number of distributed energy resources. The ability to accommodate and integrate these distributed resources is critical to the evolution of the energy infrastructure which must accommodate distributed demand and supply management. For example, Germany has added some 85GW of new power capacity over the past decade, of which over 80% is distributed renewable generation.

DIGITALIZATION OF THE GRID

Digitalisation requires real-time control and pricing of supply and demand in order to balance resources. At the core of digitalising the grid is the 'digitally enabled' or 'smart' meter connected to the Internet, which interfaces between end-users and electricity providers acting as a conduit for the two-way flow of information as well as providing both customers and utilities with data on electricity pricing and consumption, including the time and amount of electricity consumed.

Smart meters enable consumers to monitor and securely manage energy consumption on a real time basis and reduce energy costs and energy consumption. For the utility, smart meters not only enable better load management but also increase the range and quality of services that can be offered to the customer.

MECHANICAL VS SMART METER



Source: Maingate

Smart meters harness the power of the Internet. A secure wireless communication network transmits data. The vision is for smart meters to provide consumers and utilities with the following core functionality:

- Remotely delivered alerts via email, text-messaging, smartphones, with time-of-use pricing information;
- The ability to mine, store and report end-user consumption data for any defined time intervals;
- Accurate billing displacing estimated invoices;
- Enhanced energy diagnostics;
- The ability to remotely pinpoint the location and magnitude of power outages through a function that alerts when the meter is subject to power failure;
- Remote activation/de-activation; and
- Management of revenue streams and debts for energy service providers.

Deployment of smart meters among end-users has been gated by high investment and installation costs. Utilities have been slow to invest in these devices given high unit costs in the range of €200-400, and consequent long payback periods.

Current smart meters are often overloaded with excessive processing power and memory. There is potential for increased adoption in deployments of a device with lower functionality and reduced pricing, of the order of €30-50 per unit. A “stripped back” meter is still more than capable of communicating with a gateway to gather and transmit data, while providing an array of tailored services to consumers. At the same time, a scalable platform provides electricity suppliers with a standard toolbox of services, which can be further customized to service specific customer groups. An economically driven model, the hurdles currently blunting utilities become more surmountable, while the consumer is well incentivized to become an active energy user.

REGIONAL REGULATION IS CREATING A MULTI-SPEED MARKET

Smart grid adoption is evolving at different speeds around the world, with more rapid deployment in regions with higher energy costs, and slower adoption where the imperatives for demand management and efficiency that shape policy are less acute.

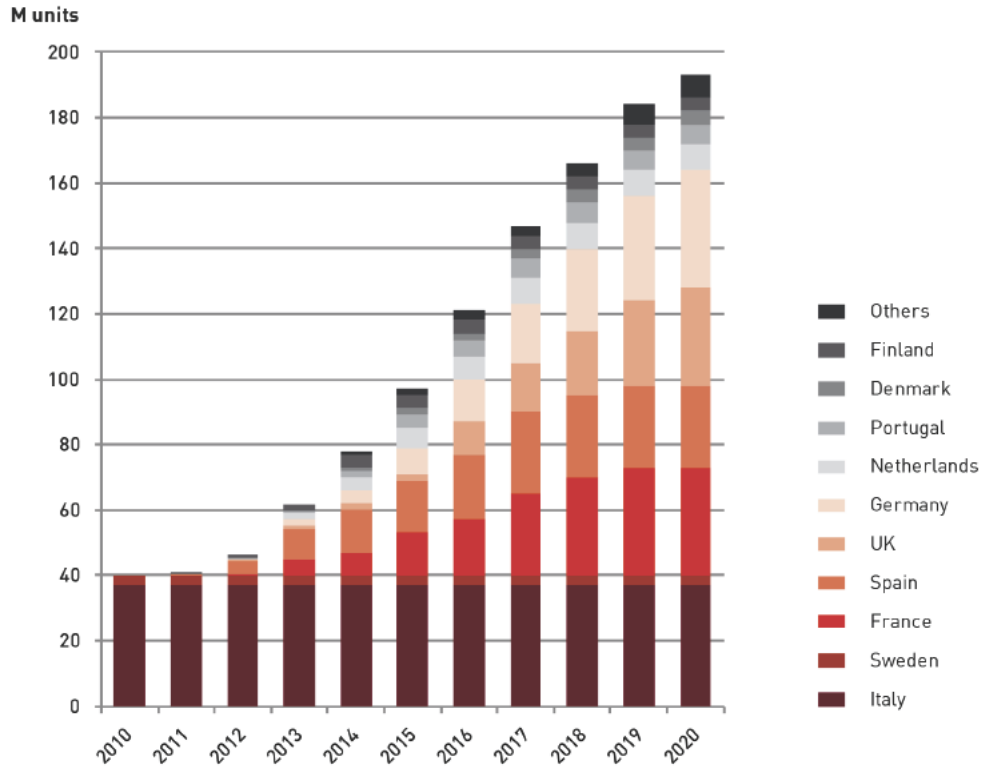
Governments are reacting in different ways to today's energy challenges. Some countries rich with oil and gas resources are finding little reason to change, while others who have become overly dependent on energy imports are pioneering radical shifts in the way energy is produced, distributed and consumed. The United States, for example, has visibly turned to natural gas to secure its future energy, developing world-leading technology to extract gas from previously unreachable sources, with the knock-on effect of dramatically reducing its gas prices. Elsewhere in Japan, the Fukushima disaster has forced the country to turn away from nuclear as its key energy source, investing instead in renewables and energy storage. Meanwhile in Europe Germany has served as a shining example of how renewables can be combined with smart infrastructure to reduce energy demand through efficiency gains, while also providing sustainable generation solutions. Developing nations have different priorities – and different problems. India for instance has huge issues to tackle in energy theft and grid losses, with approximately a quarter of its energy being illegally tapped from its network. The key takeaway from all this is that, whilst global energy demand and efficiency is a global problem, solutions are very much driven by local and regional factors.

Collaboration on policy among EU member states is critical to participants in the electricity sector. The absence of effective policy has reduced the pace of smart grid deployment. However, policy is slowly taking shape.

EUROPE AS AN EARLY ADOPTER MARKET

Europe's more acute energy security issues have driven more progressive regulation in support of smart meter infrastructure. For example, on 25 October 2012 the European Council adopted the new Energy Efficiency Directive which now serves as a roadmap for the EU's energy efficiency strategy. The directive retires the Energy Savings and the Cogeneration Directives and includes new mechanisms to drive efficiency improvements, while improving the effectiveness of existing measures.

PROJECTED SMART METER ROLLOUT 2010-2020E



Source: Maingate

Previous energy efficiency policies have been relatively weak. As it stands, the EU will fall short of meeting its 20-20-20 energy savings target of reducing energy consumption 20% below the 1990 level. According to the latest calculations, efficiency gains are currently tracking 10% by 2020. The role of the smart meter has been highlighted as a key efficiency driver in the new Directive. Within the scope of realistic technical and financial considerations, lawmakers aim to ensure that end-users receive a competitively priced smart meter to accurately record how much energy they consume and precisely when they use it.

SUPPORTING TRANSFORMATION OF THE ELECTRIC UTILITIES

Traditionally, utilities have dominated the provision of the electricity we consume on a daily basis in our homes and the work place. Their services span from the generation of power from resources such as gas, coal, nuclear and renewable resources, to the transmission over proprietary high voltage lines and ultimately the distribution via low and medium voltage lines for end-consumption. Regulators seek to unbundle this value chain by de-coupling power generation services from transmission and distribution. Accordingly, there are significant opportunities for utilities who adapt their business models to changing regulation (e.g. in line with the EU Directive 2009/72/EC). Opportunities are pervasive across energy trading, demand and supply management and other new energy services.

SMART INFRASTRUCTURE PROVIDES A PATH TO MARKET LIBERALISATION

Regulators are increasingly moving towards a de-regulated market and rewarding innovation in the distribution of energy. Market liberalisation encourages competition and innovation to improve energy productivity without impairing the performance of the system. The smart grid is central to this innovation and provides the platform for fully un-regulated markets to develop.

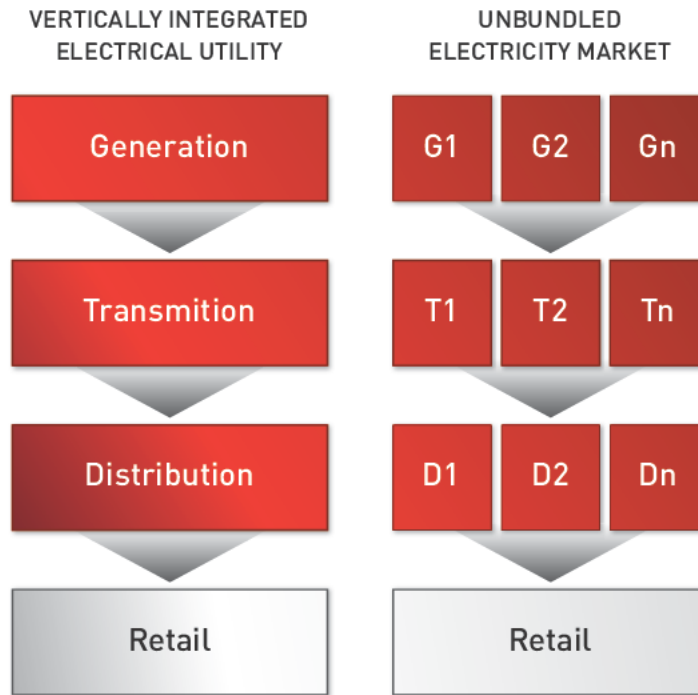
The real-time monitoring and control of energy demand and supply through the smart grid enables more efficient and reliable distribution of energy. New forms of value-add energy services have evolved because energy consumption and supply can be controlled and energy efficiency measured. New energy services companies with energy efficiency value propositions are entering this increasingly un-regulated growth market. These services range from providing flexible Cloud-based energy management services to individual consumers through turn-key energy services contracts for larger consumers (covering demand reduction measures and affordable secure decentralised supply) as well as other energy procurement and trading services.

Deployment of the smart grid contributes to the objectives of energy policy makers worldwide. Regulators are set to continue to support its deployment with the market expected to be substantial and fast growing. There are significant opportunities for existing and new energy services companies that recognise the changes occurring in the market to participate. Competitive benefits will accrue to early-movers that shape the market.

A vital step towards liberalising the markets is the “unbundling” of the electricity system, which forces vertically integrated entities operating across the entire system to divide the components into market-driven and regulated units. To achieve this segregation, companies are legally divested (de-coupled) at the transmission and distribution levels or new ones are created to separate these operations.

Varying degrees of unbundling exist around the world today. The UK is one of the most advanced with the market broken up throughout the system and full competition at the retail end of the market. Continued EU unbundling will further support the digitalisation of the energy system and the adoption of the smart grid.

UNBUNDLED, DEREGULATED ELECTRICITY MARKET



Source: Enexis, Maingate

FINANCING THE SMART GRID DEVELOPMENT

The current structure of the regulated markets does not provide the investment conditions necessary for large-scale deployment of the smart grid. Existing technologies and systems are also not feasible. Market liberalisation will increase competition and provide a substantial market opportunity for new-entrants with viable innovative value-add solutions.

Innovators have developed economically viable business models by combining “stripped back” smart meters with Cloud-based services. These models will enable the flow of capital from the private sector and drive large-scale adoption of the smart grid.

In addition, the un-regulated market supports innovation and creates the framework for substantial investment. This and increasingly favourable regulatory conditions will generate major opportunities for participants with low cost solutions in a rapidly expanding market.

MARKET-DRIVEN ACTIVITIES COMPRESS COSTS

Regulated infrastructure does not have to be expensive. New smart IT solutions can reduce required investments for smart meter deployment by over 50% by combining the regulated infrastructure with the un-regulated (market-driven) business model, thus sharing the cost of the build-out.

Cloud-based services delivered over the Internet are the backbone of smart grid applications and make it possible to marginalise the importance of costly technology. With lower investments required, infrastructure rollout can be accelerated.

DEREGULATED INVESTMENT OPENS THE PATH TO NEW CLOUD BASED SERVICES BASED ON SMART METER TECHNOLOGY

There is a transformation underway in the energy markets, part of which is moving beyond smart meters and communications, by introducing consumer interaction into the equation. The model is to bundle services with affordable Cloud-based technology, the key component of which is cheap and secure communication between the consumer and the Cloud.

THE OPPORTUNITY TO DELIVER VALUE-ADDED (UNREGULATED) SERVICES

DYNAMICS

Internet is creating new markets for delivering Cloud Services

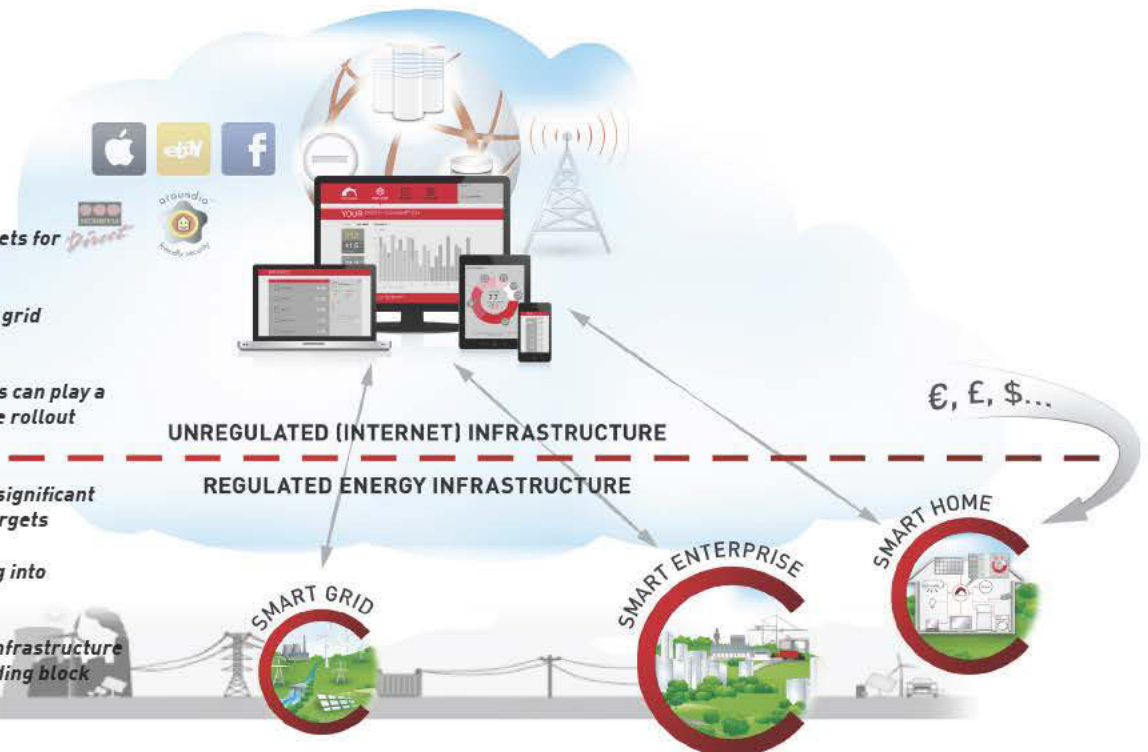
More capital available to fund grid infrastructure

Unregulated service providers can play a valuable role in infrastructure rollout

Regulated utilities are under significant pressure for CO2 reduction targets

Often restricted from entering into new services

Struggling to "afford" smart infrastructure - which is a fundamental building block in pricing energy demand



Source: Maingate

Storing energy information in the Cloud allows consumers to access the data they want with a from anywhere at any time and are also able to identify which services they need and select customised functions. The data can also be accessed by third-parties with the approval of the consumer. This accessibility is essential to cater for innovation and the establishment of a smart home eco-system, with its foundation in energy management.

Accessibility will also enable third-party contribution to facilitate 'big data' storage and analysis. This will enable a collaborative approach to capturing, searching, analysing, storing and visualizing energy data, as well as bringing other relevant data into the equation.

Cloud-based energy services such as demand management can be offered in real-time at a lower cost to the consumer. The consumer merely requires an affordable communication device (gateway), an Internet connection and a service package suited to his or her needs.

The model is sound. But further demonstration and deployment are vital to show consumers the way. We validated this service concept in early 2011. The 100koll joint project with E.ON in Sweden demonstrated to customers how to access their energy consumption data in real time, either via in-home displays, the web or from smartphones. As a result, E.ON now boasts a massively improved dialogue with these customers and has given consumers the ability to assume responsibility for their energy usage.

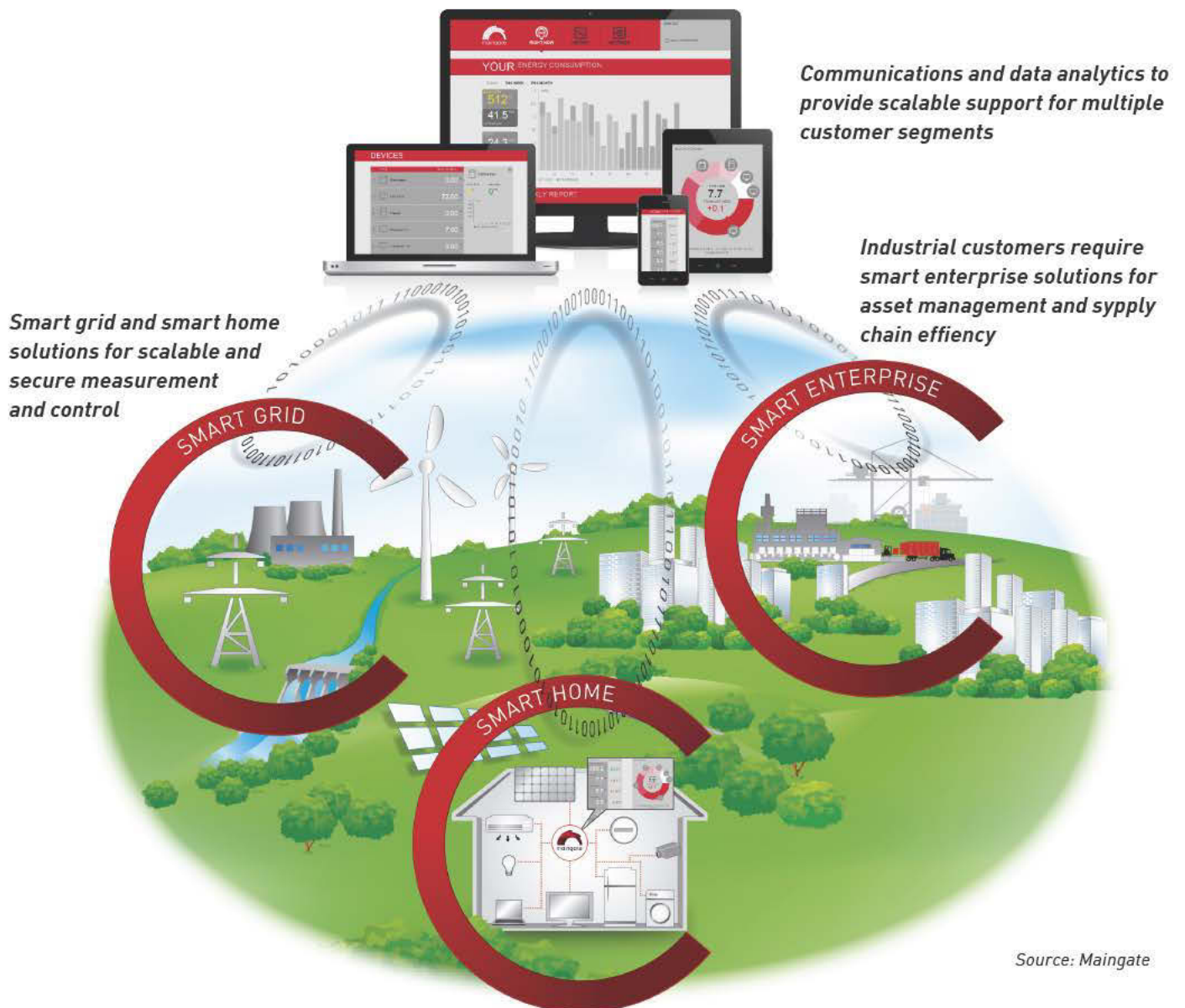
“By enabling consumers, in real-time, to act on their consumption we have created an opportunity to move energy consumers to become energy citizens,” says Maingate CEO, Baard Eilertsen. “An energy citizen will understand how consumption has an effect on the environment and the cost of living, leading to a responsible use of energy and awareness of his or her own consumption patterns. This awareness is highly important when we know that we cannot continue to consume the amount of energy we are currently doing.”

THE FUTURE INTELLIGENT GRID

Digitalisation of the electricity distribution grid is essential if we are to meet and manage demand with affordable energy, whilst simultaneously meeting decarbonisation targets. Robust, secure and scalable communications & control technology is a vital building block to enable digitalisation.

Maingate is focused on delivering robust, secure and scalable communications & control technology for energy distribution customers. With a #1 market position in the Nordic region, Maingate leverages a decade of experience to provide reliable solutions as the technology partner of choice to over 1,000 customers including over 300 leading European energy utilities such as E.ON and Vattenfall.

MAINGATE'S MVIO SOLUTION DELIVERS END-TO-END CONTROL



Source: Maingate

ABOUT MAINGATE

Founded in 1998, Maingate is the proven end-to-end energy solutions provider for clients in the European market. We design, create and deliver energy solutions within the context of smart homes, smart enterprise and smart grids. Our focus is to develop customized energy solutions, based on our clients' specific requirements.

Based on our capabilities and systems for information management, consumer interaction and device communication, our energy solutions will benefit both our clients' end customers and their operations. With significant experience over many years in international energy markets, we offer energy solutions based on deep experience in both the energy business and the local markets.

This means our clients can trust us to deliver what we say, and our solutions will be innovative and adapted specifically to their needs.

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