Smart metering

What the U.K. can learn from other countries
The global utilities industry is looking towards implementing smart grid solutions to tackle regulatory pressure and rising customer expectations.

The success of the smart grid will depend on its seamless deployment across all areas of operation, as well as energy suppliers, network operators and consumer groups working effectively together.

In the past five years, utilities in U.K. have shown a major shift towards reforms working to keep electricity prices low as possible for customers, decrease reliance on fossil fuels, and ensure a secure supply for the nation.

To facilitate this shift, the U.K. government has mandated a rollout of approximately 53 million gas and electricity smart meters across the country. The government believes smart meters will help customers use energy efficiently and save on energy bills.

As U.K. prepares its future widespread use of smart meters, this report takes a look at countries currently using smart meters including:

- Italy - a pioneer in this field who has already completed deployment
- U.S. & Canada - highest rate of deployment in progress
- Australia - unique deployment completed in only one state, Victoria
- Germany - taking its first steps during the pre-deployment stage

Countries were selected based upon:

- Stage of smart meter deployment progress
- Significant learning opportunities from their deployment process

This report reviews the energy footprint, political environment, future outlook, key drivers and challenges, and customer perception surveys for countries meeting these criteria. The report then summarises each country’s approach and what the U.K. can learn from it.
Italy is relatively poor in energy reserves. Its limited oil resources and gas reserves are further decreasing. The prices of electricity remain higher than average European rates. (16% higher for domestic consumers, 99% higher for industry in 2013). The average price of electricity is similar for both industry and households.

As a member of the EU, Italy is subject to the “20-20-20” targets, or a commitment to increasing electricity generated by renewable energy sources (RES) by up to 20% of total electricity production, a significant reduction in greenhouse gas (GHG) emissions and substantially higher efficiency in energy end-use by 2020.

The Enel’s Telegestore project was a voluntary initiative, resulting in a large-scale smart meter installation programme and paving the way towards smart grids. Recognising the benefits of implementing smart metering, the Italian regulatory authority (AEEG) made the installation of smart meters mandatory in 2006, with minimum functional requirements for all DSOs and low voltage customers starting in 2008 and reaching a 95% penetration rate by 2011. This allowed Italy to meet the EU target of 80% households to have smart meters well before the 2020 target.

Around the year 2000, Enel had four objectives:

- Remote meter reading, both periodical or on request
- Remote control of operations, such
Over the course of the years following the implementation of Telegestore, the Italian electricity sector began moving towards a liberalised market. Distribution and transmission were still subject to regulation, while the rest of the business opened to competition. After the beginning of the liberalisation process, energy retailers offered competitive and differentiated schemes in order to attract customers, a move reportedly facilitated by the DSOs.

- As connection and disconnection of customers or setting the maximum available capacity
- Reduction of thefts
- Show the investment had paid off through an increase in revenue from energy theft detection and prevention

### Italy implementations

- Infrastructure
- Interoperability
- Regulatory environment
- Awareness
- TOU pricing
- Up front cost
- Demand response
- Changing customer preparedness
- IHDs
- Remote disconnection
- Distributed generation integration
- Technology
- Supplier readiness
- Data privacy
- Opt out

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[Smart metering - What the U.K. can learn from other countries]
Italy draws more than €100 million from the European Commission, representing 40% of Italy’s total budget. As the system was designed for DSO requirements, the majority of Italy’s funds were dedicated towards R&D rather than demo & demonstration.

The regulator AEEG is responsible for specifying the key functional requirements of smart meters, with ensuring interoperability as one of its central regulatory concerns. However, in-home displays (IHDs) were not provided along with the smart meters during the installation phase, as the system was designed for DSO requirements.

Since 2008, AEEG has conducted studies and customer surveys to identify small consumers’ need, and willingness to pay for remote in-house displays so as to implement demand response, as well as to study the price elasticity of electricity consumption.

Italian DR Programmes focus on large industrial users, but are poor substitutes for comprehensive approaches such as informed load shedding operated by commercial and household consumers. Interruptible programmes represent 6.5% of peak power, and load shedding programmes initiate automatic load shedding during emergency situations.

At a policy level, the energy regulator Autorità per l’energia elettrica e il gas recently introduced a new mechanism for calculating the price of energy with the aim of shifting consumption to periods of lower and cheaper loads.

Italy is facing a dramatic increase in the penetration of renewable energy sources. Several regulatory developments were introduced that favour the integration of intermittent generation and the transformation of distribution grids in active networks capable of accommodating distributed generation (DG) units.
The mandatory introduction of time-of-use (ToU) electricity in Italy is the largest experiment so far with ToU electricity prices, including more than 25 million household customers and over three million small business customers. The aim of the initiative is for small users to be exposed to cost-reflective prices, providing them with information on the economic value of their electricity use choices.

In its present configuration, the remote control system includes two components. First, each MV/LV transformer station is equipped with a concentrator that collects all data coming from meters via a power-line carrier (PLC), which is also capable of sending instructions to individual meters. Communication thereafter is mainly based on public TLC network (GSM/GPRS). This means that the present configuration does not allow real-time control of the end-point meters.

Fully deployed smart metering systems are considered to have played a pivotal role in accelerating the market liberalisation process. Switching from one retailer to another, as well as changing the tariff structure or other contractual parameters, became a remotely managed operation consisting of new configurations stored in the central system and remotely programmed on the meters.
In addition, smart meters enabled the regulator to introduce a new service for the protection of vulnerable consumers. While bad payers were fully disconnected in the past, they are now allowed a ‘minimum vital service’ (0.5 kW) for two weeks before full disconnection. When the debt is settled, they can be reactivated almost instantaneously.

Big Data is nothing new for Italy, playing a role in central and pilot projects along its entire supply chain and turning information from power plants, networks and customers into a tool for improving the company’s work. Enel’s Global ICT is developing various projects for its different types of activities:

- Partnering with other companies in developing pilot projects to realise predictive systems through analysing data collected by sensors placed at wind farms.
- Analysing non-technical losses in the distribution sector, such as abnormal behaviour in electricity consumption often used to hide fraud attempts.
- Using web analytics and social listening tools to increase its ability for understanding the needs and opinions of customers contacting the company through web, social media or call centres.
The U.K. is a net importer of energy with a dependency level of 28%. The British government expects electricity demand to rise due to the anticipated electrification of transportation, heating and other carbon-intensive sectors, furthering its dependency on energy imports.

The government’s concern regarding energy security is based in part on declining North Sea oil and gas reserves, the anticipated closure of coal-fired capacity in 2015/16 due to tighter environmental regulation, and the anticipated closure of certain nuclear power stations reaching the end of their productive lives. Around 20 Gigawatt (GW) of existing electricity generation facilities will be lost by the end of this decade.

The government-identified principal drivers for reform are:

- Expected increases in electricity demand and electricity prices
- Threatened security of nation’s electricity supply
- Government targets for achieving 15% renewable energy by 2020; 80% carbon reduction on 1990 levels by 2050, and decreased reliance on imported fossil fuels

The British government is focused on green energy and energy sector reform. These long-term strategies are designed to mitigate future price increases, as well...
as securing an energy supply capable of meeting the needs of its industry and general population. Some of the reform measures the government is currently or has considered taking include new feed-in tariffs and performance standards for new fossil fuel stations.

There has been public consultation on the planned smart meter implementation. The government has refrained from making smart meters mandatory while considering how to best address the privacy of electricity usage data. DECC and Ofgem launched the Smart Grid Forum in 2011, bringing together industry experts to look into the key policy, commercial, and technical challenges facing the deployment of a smart grid in Britain.

### U.K. implementations

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SmartGrid GB, launched in 2011 by the Minister of State for Energy and Climate Change, is an organisation for stakeholders involved in smart grid development in the U.K. Under the 'Smart Grid Forum Work Stream Five', nine partners have worked to build and develop this central hub for all things smart grid, both in the U.K. and internationally. SmartGrid GB serves as an important independent forum for information sharing and consultation, aiming to shape government policy towards making smart grids a reality in Britain. DECC, Ofgem, and Consumer Focus are members of SmartGrid GB.

The six major U.K. retailers along with smaller retailers are working closely with Ofgem on a customer engagement strategy for rolling out smart meters.

Consumer engagement is limited to discrete parts of the smart grid, rather than as a whole concept. Industry participants increasingly believe that this approach must change for the smart grid to succeed.

A minority of customers are likely willing to pay for additional functionality, with the most popular function to be the ability for measurement of energy usage of individual appliances.

The economic case for the smart metering programme in U.K. remains positive. It is expected to cost £10.9 billion and bring economic benefits of £17.1 billion.

Certain elements of smart metering are of minimal interest to most customers, such as the way the national rollout is organised. This gives the government a certain degree of freedom. One area of concern among the more technically minded consumers is whether and how smart meters would work.

DECC and Ofgem have put in place regulatory requirements to protect consumers. DECC has also set up an
independent body for smart meters named the Central Delivery Body (CDB), funded by the industry to raise public awareness of smart metering and to help prepare consumers for installation.

In terms of data privacy and security, DECC has designed a framework for looking after how different parties can access energy consumption data and give domestic consumers control over how their energy consumption data is used (except where this is required for billing or for other regulated purposes). For example, suppliers can only use energy consumption data for marketing purposes when the consumer explicitly provides consent.

Distributed generation (DG) is becoming more and more economically attractive where government-led incentives have been set up. The mechanism with the most effective potential incentive is the so-called ‘feed-in tariff’ (FIT), whereby consumers get paid for each excess kilowatt hour they produce and feed into the grid. It is difficult to find forecasts quantifying the expected rise of DG in the U.K. at present. However, if DG does pick up in the U.K., a mix of both medium to small-scale energy storage solutions and Virtual Power Plant (VPP) solutions will need to be adopted and embedded within the electricity grid.

The U.K. Demand Response Association has been created to represent all participating providers in the U.K. on the subjects of developing and overseeing policies, strategies, objectives and plans for demand response, peak reduction programs and incentives. Ofgem has estimated that non-domestic buildings (excluding industry) contribute approximately 15 GW (c.30%) to winter peak demands on the U.K.’s national grid, while the retail, education, and commercial offices sectors contribute most to peak demands (over 50%), with a relatively even contribution from the remaining seven sub-sectors.
To fully utilise the potential of smart metering, suppliers are obliged to offer IHDs. IHDs will have dual-fuel functionality, so any second supplier providing gas or electricity in a split-fuel home where two separate suppliers provide gas and electricity can use the IHD provided by the first supplier. However, the second supplier may choose to provide a second display. This will allow continued competition and better customer choice. For modelling purposes, only one IHD per household is assumed.

The U.K. government has set rules and standards to ensure consumers are protected and get the full benefits from upgrading to smart meters. However, smart meters aren’t mandatory. Consumers can choose not to opt-in, meaning smart meter implementation will only work if consumers actively and enthusiastically participate. As of now, there is no fee attached in case customer opts out.

Each large energy supplier reports the number of smart meters it installs and operates in smart mode to DECC. In quarter three of 2015, there were a total of 166,3415 gas and electricity smart meters installed in domestic properties (997,179 electricity smart meters and 666,236 smart gas meters). A total of 644,233 smart meters have been installed in non-domestic properties (616,396 electricity smart meters and 27,837 gas smart meters).

Although Big Data is currently a hot topic in the utilities market, research shows that the actual implementation is limited. In retail electricity, a drive to promote more competition is underway. The foundation is in place, with 92% of researched firms acknowledging that they use complex predictive models based on data analytics. Companies are still far from maximising the potential. Currently, analytics is mainly used for improving operational aspects or gaining knowledge on internal or external behaviour.

Given the number of U.K. electricity customers, the volume of data generated will be huge. The key will be using this data effectively in winning new customers, delivering increases in revenues and growing net profits.
The United States is the world’s second largest consumer of electricity. It receives approximately 84% of its energy from fossil fuels. This energy is used for transport, industry, and domestic use. The remaining portion comes primarily from hydro and nuclear stations. Americans constitute less than 5% of the world’s population, but consume 26% of the world’s total energy output. Regulatory bodies like the Federal Energy Regulatory Commission (FERC) handle specific aspects of the energy and electricity industries, including safety regulations and enforcement. The National Institute of Standards and Technology (NIST) has been entrusted with identifying and evaluating existing standards, measurement methods, technologies, and other supporting services for smart grid adoption. Beginning in 2008 and continuing through 2009, NIST convened workshops and meetings that brought together experts and stakeholders to begin smart grid implementation. The current electric grid found across the United States is quite old. Even though energy demands are much higher now, the electric grid in most communities still functions like it did in the late 1800s.

The U.S. government codified the policy for modernising the nation’s electricity transmission and distribution systems to create a smart grid with The Energy Independence and Security Act of 2007 (EISA). After EISA was signed, smart meter rollouts began in separate U.S. states.
The Department of Energy (DOE) has the broadest responsibilities in regulating power generation and electric transmission, distribution, and retailing. In 2009, DOE announced $3.4 billion in federal stimulus grants for 100 smart grid projects. Aside from this funding, the cost of deployment is being recovered through the retail tariffs paid by consumers. The DOE is also paving the way for Distributed Generation (DG) integration by financing renewables through state incentives.

Public reaction to smart meter deployments has been mixed. For utilities that articulated the benefits of smart metering, consumer reaction has been positive. Customers of Georgia Power, PPL Electric Utilities, Portland General Electric and SMUD have the most positive opinions of their utility after smart meter installation.
The medium customers receive information from their utility also impacts both awareness levels and sentiment. Among customers who receive smart meter information via text message, over 50% say they have a more positive opinion of their utility than those who do not receive text messages. Of customers who receive information via other communication channels such as bill inserts, door hangers and direct mail, more than 60% say the information did not change their opinion of the utility.

The methods of smart meter communications with the most positive impact on customer opinion are mobile and web-based, indicating customers want quick and easy accessibility to the information, as well as the potential for interaction with the utility.

Deployment and use of smart meters tie into the broader picture of the future for the U.S. energy industry. Various key factors need to be looked at, such as infrastructure, inoperability, technology, regulation, along with customer and supplier readiness.

By the end of 2015, there were nearly 60 million smart meters in the U.S.

Demand response is one such key element. FERC has taken a series of proactive steps to promote the use of demand response as a means of creating market efficiency related to capacity reserves. The industry has achieved considerable success in mitigating peak demand and system emergencies through demand response programs.

Over the last few decades, the original utility programs developed for providing load reductions during system emergencies have evolved into more sophisticated programs capable of providing a range of targeted services. Demand response has transitioned from simply a means for shaving peak demand into a valuable tool enabling grid operators to manage the challenges of the modern grid.
In 2009 and 2010, demand response programs in the U.S. experienced relatively little incremental growth. The increase in demand response was much higher between 2010 and 2013, resulting in negative peak load growth. After that, the increase has been smaller. New programs will take time to mature and reach full participation by 2015.

There has been pushback to smart meter rollouts due to health and privacy concerns, and a negative response to the increased electricity costs that have accompanied smart meters. In response to these developments, there have been a series of government and industry initiatives to address these concerns. Various state governments have enacted legislation protecting the privacy of consumer energy consumption data, and states like Maine, California, and Nevada have ruled that customers must be allowed to opt out of smart meter installations for a fee.

As utilities awake to the full scope of value they can deliver through social media, they are partnering with companies such as Opower and Simple Energy to deliver more efficient energy usage, faster outage repairs, and empowering customers to manage and benefit from their relationship.

In 2011, there were more than 37.3 million smart meters installed by 492 U.S. electric utilities.
By the end of 2015, there were nearly 60 million smart meters in the U.S. The International Energy Agency projects that cumulative global installations of smart meters will increase to almost one billion before the end of 2018.

New evidence is emerging that utilities are not ready for the challenges of Big Data. Oracle has released a report that utilities using smart meters are seeing 180 times more data than similar organisations that haven’t adopted smart meters. The results show 94% of the executives surveyed indicated that their organisations were collecting and managing more data today than they were two years ago, but were uncertain about the way to deal with that data.

In fact, 93% “believe their organisation is losing revenue as a result of not being able to fully leverage the information they collect.” The greatest challenge they faced was a lack of talent able to visualize, comprehend, and translate data into actionable intelligence.

However, some utility companies are in the process of preparing for challenges they may face from Big Data in the future. Baltimore Gas & Electric is setting up a hub-and-spoke model data analytics organization to support existing analytics and end users within the specific business areas while also seeking to further develop additional analytics across the organization.

The U.S. is on track to meet its 90% smart meter penetration target by 2020. This is a big boost for the U.S. energy industry. Smart meters will play a critical role in shaping the future of the electric grid through integrating new technologies and allowing innovations across the grid.
Australia is a net exporter of energy, with coal as its primary export in this area. Domestic energy consumption represents a third of total energy production. However, the country has suffered severe energy problems caused by energy shortages since 2006 and 2007. Peak demand continues to grow at a considerable rate of around 3% per year, driven mainly by the increased use of air conditioning. The main goals behind the decision to roll out smart meters are peak clipping and giving customers tools to manage and diminish their electricity consumption.

Inspired by Victoria, a consortium led by the national utility Energy Australia, the state of New South Wales, and the cities of Newcastle and Sydney successfully won a A$100 million contract from the Australian government to install 50,000 smart meters across five sites in June 2010. Newcastle, Scone, the Sydney Central Business District (CBD), Ku-ring-gai, and Newington were all selected to receive the smart meter rollout. The project is called “Smart Grid, Smart Cities.”

Among the Australian states, Victoria has played the lead jurisdiction role in energy sector reform. After concluding the competitive electricity markets were the natural domain of the private sector in the mid-1990s, the Victorian government disaggregated and repackaged the disparate pieces of the state’s electricity businesses into discrete generation, distribution, and retail businesses to be

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**Victoria (Australia)**

**Energy Status**
- Exporter

**Market Structure**
- Deregulated

**Roll out date**
- 2009

**Manning Body**
- Distribution system operator

**Deployment strategy**
- Mandatory

**Penetration achieved**
- ~100%

**Penetration Target 2020**
- NA

**Types of meters**
- Internal, AMI

**Age demography 40+**
- 48.06%
sold by open tender process. Since then, other states, including South Australia in 2001, Queensland in 2006-2007 and most recently New South Wales in 2010-2011 have followed similar models, divesting all or part of their respective electricity and gas businesses to the private sector.

In April 2007, COAG committed to a national rollout of electricity smart meters to areas where benefits could be demonstrated to outweigh costs. On the basis of the national AMI cost-benefit report, a distributor-led rollout of AMI in Victoria was estimated to offer net benefits in the range from -$101 million to $690 million (NPV at 2007).

The Victorian state government mandated that 2.5 million residential and small

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### Victoria (Australia) implementations

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business customers have a smart electricity meter installed by the end of 2013. One of the crucial features of their rollout is the ability for customers to receive data about their energy usage by half hourly intervals, enabling them to potentially reduce their consumption during peak times. The rollout began in 2010, and identified that smart meters should be part and complementary to a wider smart grids approach, rather than implemented in isolation.

However, initial stage of deployment saw a huge uproar against smart meters. Poor communication and lack of awareness among the population forced consumers to rely on often inaccurate online sources and stories. An early criticism of the programme was that IHDs were not mandated with the rollout of the meters.

Consumers must be informed about current prices and consumption levels in order to adjust to price signals. Smart meters alone do not bring about consumption reductions. Consumers must be informed about current prices and consumption levels in order to adjust to price signals. IHDs provide immediate continuous feedback and act as constant reminders.

Smart meters became a controversial political issue. When the new government came to power after the general election, they ordered a review and introduced government-led, consumer-focused communication campaign: “SwitchOn: Take charge of your power bill”. The government also launched a web portal educating customers on smart meters, flexible pricing, usage data, and price comparison.
Canada is one of the few developed nations that are net exporters of energy. Almost all of Canada’s energy exports go to the United States, making it the largest foreign source of U.S. energy imports. Canada is the top source for U.S. imports of oil, gas, and electricity. Provinces like Ontario, British Columbia, Saskatchewan, and Quebec have implemented or intend to implement a smart meter rollout. Ontario has completed the province-wide rollout of 4.6 million smart meters. Canadian electric utility Hydro-Québec has installed nearly 1.4 million of 1.7 million meters by April 2014.

In terms of market structure, Canada has both a regulated and deregulated market. Of Canada’s ten provinces, Alberta and Ontario are deregulated.

In Canada, jurisdiction over energy is divided between the federal and provincial governments. Provincial government utility boards have jurisdiction over the exploration, development, conservation, and management of non-renewable resources, as well as generation and production of electricity.

Federal energy jurisdiction is primarily concerned with regulation of inter-provincial and international trade and commerce, as well as the management of non-renewable resources on federal lands. The National Energy Board (NEB) is an independent federal regulatory agency for the Canadian energy industry.
In 2008, the first smart meters were installed in Ontario through a supplier-led rollout. Provinces have followed a voluntary as well as a mandatory approach since then, with deregulated states like Alberta and Ontario mandating smart meter installation.

Remote disconnection and opt-outs have been two challenges directly affecting customers.

Energy companies like Hydro Quebec (which has the highest customer base of three million) has remotely disconnected more than 50,000 customers last year due to non-payment of bills. However, as per law, the utility must reconnect electricity to clients cut off by the first of December, and cannot cut off power for anyone between

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**Canada implementations**

- **Infrastructure**
- **Up front cost**
- **Distributed generation integration**
- **Interoperability**
- **Demand response**
- **Technology**
- **Regulatory environment**
- **Changing customer preparedness**
- **Supplier readiness**
- **Awareness**
- **IHDs**
- **Data privacy**
- **TOU pricing**
- **Remote disconnection**
- **Opt out**

- Fully implemented
- Partially implemented/in-progress
- Poor/non-existent implementation
December and the third of March. This ensures no one in the province spends the winter without electricity.

Opting out of having a smart meter is not possible in some Canadian provinces, though others have a provision for a monthly opt-out fee.

Canada is challenged by an ageing infrastructure.

Investment for Canadian smart meters has come through private and public funding. The government has allocated $22 million towards smart meter installation programs. However, there is still a lack of an external source for funds.

Demand response implementation and participation is varied across Canada. Even though it is available in all the provinces, it is only offered by a handful of utilities.

Canadian utility companies are media savvy, with majority of them having Facebook and Twitter accounts for reaching out to customers. However, there has been limited success in educating customers about smart meters.

Acceptance of smart meters is very high in provinces where government has taken a proactive approach in leading a consumer education campaign. In provinces where there have been no awareness campaigns, acceptance has been low. Various polls suggest that there is still a lack of trust towards smart meters. Canada has been able to achieve 49% penetration in terms of smart meter rollout, but does not have a smart meter implementation target for 2020 as some provinces have missed internal smart meter rollout deadlines.

Canadian utilities have been open in their approach towards adapting smart metering technologies, but only 48% of Canadian businesses have invested in the technologies needed to process Big Data.

The Canadian energy industry has successfully capitalized on the wealth of energy resources at its disposal, but is in danger of losing this advantage if it does not embrace the changing trends related to demand response and Big Data.
Germany is the largest consumer of energy in the world and has the largest market of electricity in Europe. It imports two-thirds of its total energy requirement. The main source of energy is coal. Germany is going through an energy transformation, “Energiewende”, and intends to eliminate its current use of nuclear power by 2022. Therefore, it is restructuring its energy mix, and plans to triple its share of renewables to 80% consumption by 2050. Smart meters will play an important part in this phased-out approach to energy transformation. There are 47.5 million metering points, of which 11.9 million will be equipped with smart meters by 2022 (23%) and 15.8 million by 2032 (31%).

Germany is wedded to a municipal approach. Almost half of all electricity supply companies in the country are owned by local governments, communities or small businesses, with many increasingly out-competing privately owned utilities and pushing them out of the market. There are 900 energy companies that operate in the German electricity market, but 80% of electricity generation is controlled by four large companies: RWE AG, E.ON Energy AG, Vattenfall Europe AG, and Energie Baden-Württemberg Aktiengesellschaft (EnBW,) which hold a 43.8 per cent share of the energy retail market, as well as a major share of generation (mostly thermal).

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**Germany**

**Energy Status**
Importer

**Market Structure**
Deregulated

**Roll out date**
2012

**Manning Body**
Distribution system operator

**Deployment strategy**
Mandatory

**Penetration achieved**
~4%

**Penetration Target 2020**
23%

**Types of meters**
AMR, AMI

**Age demography 40+**
58%
Germany is a federal parliamentary republic. It usually has a coalition government (one liberal and one conservative party, currently) as none of the parties are able to achieve a majority in elections.

The German government has been promoting renewable energy resources for several years, which have already contributed 17% to electrical generation in 2010. With the decision to step out of nuclear energy generation, these energy resources become even more important with an increase to 35% planned in 2020 and 80% in 2050. The Renewable Energy Act (EEG) is designed to encourage cost reductions based on improved energy efficiency from economies of scale over time. An intelligent power grid in Germany
is crucial for the success of the transition to a new energy mix.

The enacted turnaround in energy policy has accelerated the restructuring of grid-based energy supply. Clear progress is being made in shifting from a centralized to a decentralized energy supply system. Significant changes are taking place on the customer side. Inactive customers are becoming prosumers, who are actively helping shape the energy system. These changes are increasing the necessity of using measurement and communication technologies, as well as data processing.

One of the biggest challenges facing the future decentralised energy supply system is managing power flows so that the energy supply is secure. The electricity supply would become more flexible through active feed-in management and increasing usage of demand-side management measures. Smart metering systems will play an important role here.

80% of customers will be equipped with smart meters

In the end of 2011, the German regulator Bundesnetzeagentur issued a positioning paper on smart grids and smart markets. The smart grid is concerned with grid capacity management, while the smart market focuses on energy management.

The legal basis for the introduction of smart meters is the overhaul of German Energy Industry Act in 2011. It led to the implementation of the EU Directive included in the Third Internal Market Package, which provides for the introduction of smart meters to assist the active participation of consumers in the electricity supply market. It stipulates that 80% of the customers will be equipped with smart meters. However, member states are allowed to make the introduction dependent on the economic assessment.

The smart grid’s transmission and distribution network is strongly regulated, while the smart market is open for competition.
of the long-term cost and benefits to the market and individual consumers.

The Federal Ministry of Economics and Technology engaged Ernst & Young to evaluate the nationwide introduction of smart meters on an economic basis. Cost-to-benefit analysis (CBA) for a large-scale rollout by 2020 was negative or inconclusive for particular consumer groups in Germany, Latvia, and Slovakia. Since it was found economically justified, it suggested that a tailored approach could see Germany’s smart meter implementation become the best in Europe.

The economic assessment of long-term costs and benefits associated with the German smart meter rollout considered the “Rollout Scenario Plus”, which includes the installation of intelligent meters and the mandatory installation of smart meter systems for the following consumers:

- Consumers with annual electricity consumption over 6000 kWh
- Major generation facilities
- Final consumers in new and renovated buildings

In the rest of the cases, it is recommended to use intelligent meters with an upgradeable measuring system and no external communication link in accordance with the National Energy Act (EnWG). Combined with a certified smart meter gateway, these can be extended to a Federal Office for Information Security compliant smart metering system and securely integrated into any communication system.

This mixed rollout will help all consumers save power and money, increase economies of scale, and allow market participants such as device manufacturers and meter operators to plan with decreased risk and increase certainty.

The cost of this mixed rollout of smart meter systems and intelligent meters would be significantly less than implementing the EU target and deliver greater energy benefits from the outset.
The modelling shows this scenario would see Germany lead Europe in meter rollouts by 2029. Therefore, its penetration target so far is only 4% until 2014, and aims to achieve only 23% penetration until 2020.

Germany has the highest number of organisations involved in smart grid projects. Energy companies, utility companies, energy retailers and electricity service providers manage the largest budget in Germany.

There are three, ten-step phases to a German smart grid.

1. Separation and interaction of market and network
2. Legal and regulatory framework
3. Research and development, pilot and demonstration projects
4. Standards, norms, data protection and security
5. Measurement: sensor systems in the grid, roll-out of smart metering systems
6. Management and control: automation of the networks
7. Local and global optimisation within the energy system
8. Storage facilities and electric mobility, hybrid networks
9. Variable generation - supply side management
10. Variable consumption - demand side mgmt.
Germany’s smart meter rollout brings utilities both opportunities and challenges. Opportunities abound in developing new business models to allow for the integrated, streamlined implementation of meters by the country’s more than 1,000 distribution network companies (DNOs), although competition will be fierce from both traditional players and new market participants.

Germany’s energy markets continue to be plagued by substantial structural problems. Energiewende (the transformation of Germany’s energy system) is a massive project. It can only succeed if the reliability of the power supply is not put at risk.

Challenges will arise in reviewing and updating business models and ensuring that proposed rollout plans are in line with the recommended strategy. Smart meters offer opportunities in data management and value-added services. However, utilities must be vigilant in managing the associated privacy and data security risks.

In the absence of a comprehensive national policy, smart meters in Germany has been left to market forces, restricted to pilot projects and a few commercial offerings. The smart metering market’s development is dependent on the results of the current rollouts. One of the most developed countries is taking too measured a step towards smart meter installation.
Observations

<table>
<thead>
<tr>
<th>Have you heard about smart meters?</th>
<th>How did you come to know about them?</th>
<th>Would you be interested in having a smart meter installed in your home?</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="https://via.placeholder.com/15" alt="Icon" /> <strong>YES</strong> 55% <img src="https://via.placeholder.com/15" alt="Icon" /> <strong>NO</strong> 45%</td>
<td><strong>FRIENDS</strong> 43% <strong>MEDIA</strong> 26% <strong>SUPPLIERS</strong> 20% <strong>GOV</strong> 11%</td>
<td><strong>YES</strong> 55% <img src="https://via.placeholder.com/15" alt="Icon" /> <strong>NO</strong> 45%</td>
</tr>
</tbody>
</table>

European countries like Germany and U.K. are more aware.

<table>
<thead>
<tr>
<th>Do you have a smart meter installed in your home?</th>
<th>Do you think smart meters will help you?</th>
<th>Has the bill amount reduced post-smart meter installation?</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="https://via.placeholder.com/15" alt="Icon" /> <strong>YES</strong> 53% <img src="https://via.placeholder.com/15" alt="Icon" /> <strong>NO</strong> 47%</td>
<td><img src="https://via.placeholder.com/15" alt="Icon" /> <strong>YES</strong> 88% <img src="https://via.placeholder.com/15" alt="Icon" /> <strong>NO</strong> 12%</td>
<td><img src="https://via.placeholder.com/15" alt="Icon" /> <strong>YES</strong> 78% <img src="https://via.placeholder.com/15" alt="Icon" /> <strong>NO</strong> 22%</td>
</tr>
</tbody>
</table>

Those who support smart meter installation are able to think of at least one advantage. The most common is controlling energy usage.

<table>
<thead>
<tr>
<th>What are customers’ apprehensions about smart meters?</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="https://via.placeholder.com/15" alt="Icon" /> Bills may not be accurate</td>
</tr>
<tr>
<td><img src="https://via.placeholder.com/15" alt="Icon" /> Invasion of privacy</td>
</tr>
<tr>
<td><img src="https://via.placeholder.com/15" alt="Icon" /> Data security</td>
</tr>
<tr>
<td><img src="https://via.placeholder.com/15" alt="Icon" /> Radiation from the meter</td>
</tr>
</tbody>
</table>

Although smart meters are supposed to increase accurate billing, customers are still skeptical of its success.

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Although the government is responsible for communicating any major change in the industry however customers rely on personal contacts.

European countries like Germany and U.K. are more aware.

Those who support smart meter installation are able to think of at least one advantage. The most common is controlling energy usage.

The outcome is positive with majority of the population reporting reduction in bills.
Conclusions

Italy is one of the best examples of successful implementation of the mass rollout strategy. It mainly focused on cost-reduction of metering services, remote connection/disconnection capability and energy theft reduction. Italy strongly adhered to its goals and the execution of its timelines, steps which will also need to be taken in the U.K.

The United States and Canada provide key lessons for achieving a strong customer buy-in and high penetration despite diverse demographics. Customers in some U.S. states and Canadian provinces had concerns about health and privacy due to smart meters. However, utilities proactively reached out to customers and communicated the benefits of smart meters, which led to a good post-installation response. The success of smart meters largely depends on how well customers utilise the visibility of consumption data and control their energy usage. To replicate this success, creating the right level of awareness and customer buy-in will play an instrumental role in U.K. smart meter rollout.

Germany is still in the nascent stage of smart meter deployment, and has spent a reasonable amount on CBA. It is targeting customer segments which will benefit most from smart meter deployment. Smart meters have been initially mandated for only specific groups, such as those whose electricity consumption is more than 6000 kWh/a, new buildings, renovation-sites and properties with renewable generation. Simultaneously, it is installing easily upgradeable intelligent meters, which can be securely integrated with the smart meter systems for remaining sites. This installation and integration process is easier to deploy, smoother to accept, and economically effective as compared to a mass rollout. The U.K. could adopt a similar approach to win more support and a seamless rollout.
Australia deployed smart meters in just one state. Victoria opted for a massive and aggressive smart meter rollout strategy where customers had no option to opt-out. Penetration was prioritised over customer buy-in, resulting in a customer backlash due to misleading stories and opinions in the media. Not providing IHDs with smart meters further aggravated the situation, as customers did not get the desired visibility of their usage. At almost a year after the Victoria government claimed near completion of the smart meter deployment, their communication network is still unstable. Recently, energy company AusNet Services has put together an AUD 28.75 million (U.S.$21 million) compensation package for customers whose smart meters are not transmitting usage data due to communication network failure. Keeping in mind this mass rollout of smart meters, network readiness will be vital for the U.K.

Understanding the challenges
The study of selective geographies helps form an understanding of challenges related to smart metering. Today, smart meter and smart grid initiatives are forcing a major transformation in the utility industry. Many utilities are rethinking their business models and business processes as a result of this shift in the way, energy is generated, delivered and consumed.

From an industry perspective, the focus has shifted from the challenges of planning for smart meters to executing and delivering on the expectation that smart metering will revolutionise energy management and grid reliability across the globe.

Two major challenges underpin the delay in the mandate for mass roll out of smart meters in U.K.:

> Adherence: Considering the fact that timelines have been postponed multiple times, the U.K. requires robust planning and strict adherence to its assigned timelines.

> Upgradable technology: The minimum technical requirements for smart meters have been laid down in SMETS Ver. 1 & 2. There have been multiple instances where smart meters were found to be
non-compliant with SMETS specifications. Suppliers have been asked to remove such meters from the customer sites as well. These instances raise questions on the conviction and the determination of participants in this ambitious project.

With rising customer expectations, cost pressures and environmental regulations, the following questions need to be answered:

 › How to ensure affordable energy for all customers?
 › How to increase revenue through loyalty, adoption and advocacy?
 › How to gain a better understanding of customers to personalise the experience?

EXL's Smart Journey E2E Framework has been designed to allow the provider to effectively address these challenges and remain an indispensable part of smart meter rollout across all geographies. It covers all major aspects of the Smart Journey – from prospect identification to generation of SMART value for the business.

EXL’s Smart Journey E2E Framework
Prospect identification is done keeping various factors in mind such as revenue generation, cost to serve and flexibility to change. It helps:

- Identify right customers for lower costs and provide better customer experience using prioritisation rules
- Optimise selection algorithms to target high the most valuable customers
- Prioritise efforts based on customer readiness for smart meter

Challenges addressed

**Targeted approach:** An approach targeting the right customer segments for maximum output can become instrumental. The U.K. can identify parameters like consumption levels, age of the customer, willingness to adapt to technology, and the percentage of money spent on energy. Such customers offer two-fold benefits to the suppliers as they can be active participants contributing towards achieving the desired results and play a pivotal role in creating awareness amongst the population.
Customer awareness: Irrespective of the region, customer awareness remains the foremost challenge when trying to convince customers to subscribe to a new product or service. Consumers will always be reluctant to experiment with something new unless they are aware of exactly what they are getting. EXL’s Customer Education Framework comes into play. Customer segmentation involving focused campaigns, omni-channel communication comprising informative emails and sample energy reports, social media sentiment analysis and tracking replies to emails and posts will not only spread awareness, but also ensure that customer reluctance becomes customer acceptance.
Installation

Ensure a smooth transition by managing end-to-end operations for smart meter installation. EXL offers following tools:

- **Forecasting engine** — Forecast meter requirements aligning with installation phases
- **Data quality assessment** — Cleanse and validate accounts for installation
- **Stranded asset valuation and reverse logistics** — The process includes meter valuation, checking for meter reusability, optimum warehousing and reinstallation
- **Installation support dashboard and final reconciliation** — Monitor the progress of SMART installation by collecting and preparing data, then using it to identify KPI’s for desired deliverables

Challenges addressed

**Deployment strategy and seamless installation**: Devising the best rollout strategy and having a seamless installation are other major hurdles faced by suppliers. The rollout of smart meters should be achieved in a cost effective way to optimise maximum benefits by keeping various factors in mind including revenue generation, cost to serve and flexibility to change. EXL helps counter these challenges by mapping an end-to-end journey from installation to customer experience.
Servicing — Provider perspective

Re-design processes, billing systems, and change mindsets to deliver SMART outcomes

- Build real-time load forecasting models and estimate price elasticity
- Fraud detection through real-time anomaly capture
- Visual analytics to minimise shutdowns and unlock value from efficient customer service

Challenges addressed:
- **Demand response** — EXL helps deliver compelling campaigns customised to consumption patterns of individual households – drilled down to appliance-level detail
- **Fraud detection** — Application of different fraud detection models such as cluster, historical and behavioral
- **Service disruption** — Detect full or partial outage and categorise, prioritise and inform your customer
Servicing from the customer perspective and SMART value

EXLs analytics based Customers Outcome and Retention Model helps in mapping, providing an end-to-end journey, and converting data into insights for delivering SMART value.

- Devise CSAT strategies based on actionable insights
- Analyse consumption data and proactively alert customers on high usage
- Advise customers in setting target limits and gaining insight
- Customer segmentation for basis consumption pattern and recommend time of usage prices
Design compelling loyalty schemes based on consumption switching models

Delivering a seamless omni-channel experience

Create a smart call centre strategy to focus on what is best for customer

Challenges addressed:

Choice — While offering choice to the customer for smart meters with an opt-in/out approach can build the customer’s trust in suppliers, it can also hamper the ambitious goal of covering the population by 2022. However, due to the conservative customer view, it is suggested that the U.K. continue with the same option. EXL’s ‘Prospect’ strategy plays a major part in gaining the customer buy-in through seamless customer experience CSAT strategies and loyalty schemes. EXL can assist with positive customer feedback to aid customers in making a choice to opt-in for a smart meter.

Maintaining transparency — Customers will only be willing to opt-in if they see smart meters providing unheard-of transparency levels. For example, a significant amount of customer queries or complaints revolve around billing. The majority of customers either do not understand their bills or believe that they have been charged incorrectly. EXL provides real-time visibility of customer energy consumption, helping them understand their bill and encouraging them to reduce their energy spend. This helps suppliers create winning demand response campaigns.
[ Smart metering - What the U.K. can learn from other countries ]

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