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ON THE UK SMART METERING SYSTEM AND VALUE OF DATA FOR DISTRIBUTION SYSTEM OPERATORS

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Abstract

The Smart Metering Implementation Programme (SMIP) is an ongoing energy infrastructure upgrade that is delivering 53 million smart electricity and gas meters for homes and small businesses in the UK. The programme is expected to deliver economic benefits for customers, energy suppliers and the national grid. The programme is also enabling the transition to a more efficient, and flexible smart grid as well as the decarbonisation of the energy sector to achieve the Net Zero carbon emissions goal by 2050. However, with the immense data generated by smart meters connected to the low voltage distribution networks, further technical benefits can be unlocked. This paper provides an overview of the smart meter system in the UK with its originally intended benefits. Then the physical, functional, interface and data specifications of the smart meters are detailed to give an idea of the possible uses of these data. Finally, the paper discusses the technical benefits that are possible from combining the smart meters' data with industry 4.0 technologies such as decision support systems for network reinforcement and investment, active monitoring and management of the network and its assets, and data-driven digital twins of the distribution networks.

1 Introduction

Motivated by the need for tackling climate change through cleaner and more efficient energy sources, Great Britain passed the Energy Act of 2008 [1]. This act was then followed by a number of programmes that enabled renewables integration with more flexible energy systems. The Smart Metering Implementation Programme (SMIP) was one of the most successful programmes that entailed national, customer and energy supplier's benefits; starting from enabling the end-customer to closely monitor and control their energy use, to enabling a highly flexible and resilient energy system in the UK.

The SMIP success is dependent on the coordinated effort between the Office of Gas and Electricity Markets (Ofgem) as a regulator, and the energy suppliers which funded and carried out the actual smart meters roll-out. The Department for Business, Energy, and Industrial Strategy (BEIS) was responsible for providing the strategical framework and governing policy that ensured the delivery of customer benefits.

UK energy suppliers started rolling different types of smart meters, each with different standards and their interoperability was not initially considered. This led to the intervention of the former Department of Energy and Climate Change with the Smart Metering Equipment Technical Specifications (SMETS) [2] to provide a framework for interoperability that would set the minimum physical, functional, interface, certification , testing levels and requirements for the smart meters rolled-out. SMETS also introduced the need for an In-Home Display (IHD) that would be a near real time monitoring device for customer's electricity and gas consumption. IHDs have an update interval of 10 seconds for electricity usage and 30 minutes for gas.

Another key enabler for the SMIP was the establishment of the Data and Communications Company (DCC) which operates the national metering communication infrastructure connecting all smart meters. The development of the Smart Energy Code (SEC) represented a multi-party agreement between energy suppliers, network operators and other parties, governing their contractual agreement with the DCC.

This paper initially gives an overview of the UK's smart metering system and highlights the initial planned SMIP benefits to all stakeholders, followed by detailing the physical, functional, interface and data specifications of SMETS2 smart meters. The paper finally discusses the immense potential value of the smart meter data available at the DCC and how such data can enable significant insight and functions for distribution system operators (DSOs) using industry 4.0 technologies. To the best of author's knowledge, there is no academic publication to date gathering such information on UK smart metering system and laying the ground for future prospects to UK DSOs from smart meter data processed by the DCC.

2 The UK Smart Metering System

The current system architecture of the UK smart meters infrastructure can be split, as shown in Fig. 1, into three main sections. Customer premises represent all the residential houses and commercial buildings having a SMETS smart meter. The central communication infrastructure is currently a licensed monopoly to the Data & Communication Company (DCC) routing all the smart meter data between the customers and different parties interested in the data. The service users are the energy market parties using the smart meter data, such

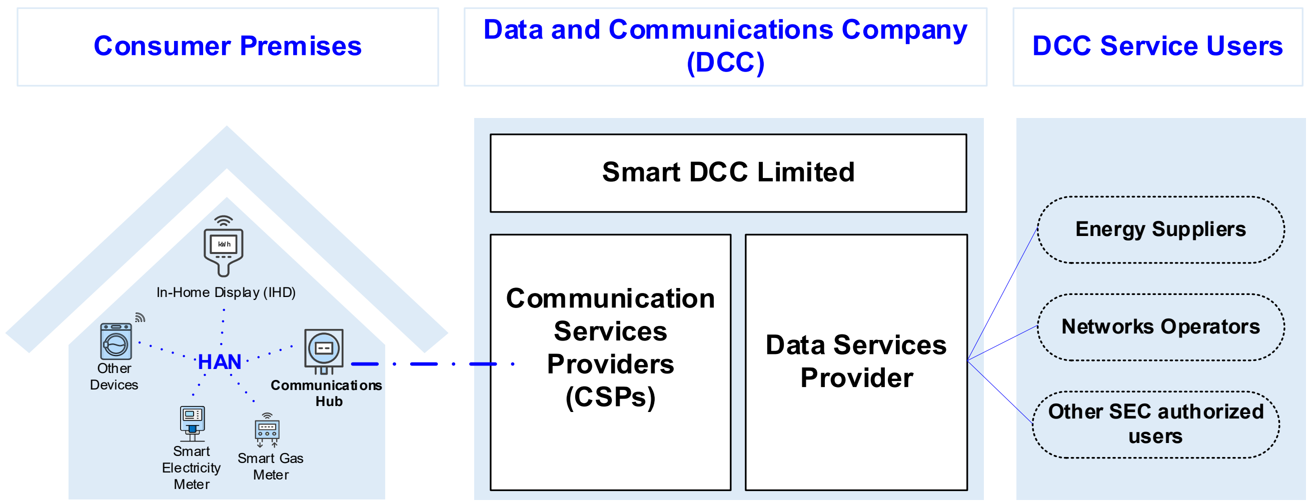

Fig. 1 The UK's Smart Metering System [3]

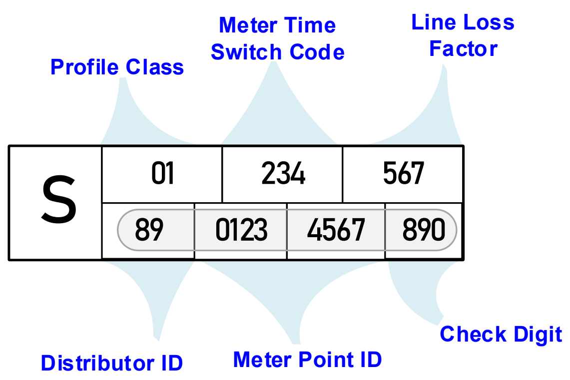

Fig. 2 Breakdown of the Meter Point Administration Number (MPAN)

as the energy suppliers, network operators and third parties; each using the data in a sense that fits with their respective business models and only accessing data from customers providing them with a consent. In this paper, the focus will be on the domestic electricity smart meter installation which significantly out numbers non-domestic smart meter installations.

2.1. Customer Premises

Customer premises refers to domestic customers with a smart meter installed. The in-premises meter installation represents the largest portion of the smart meters system cost taking up 56% of the total costs. This cost is divided between the different components installed at the customer such as the meter itself, the Communications Hub (CH), the in-home display (IHD) and installers costs.

2.1.1. The Smart meter

A typical smart meter compromises a measuring element as in traditional meters, as well as a digital display that provides consumption information as in digital meters. However, smart meters excel over both traditional and digital meters in having higher recording capabilities, since its internal data storage can store consumption data for a year, in addition to having a Communications Hub (CH), provided by the DCC, to enable communication with the national smart meters network. Locally, smart meters are provided with a ZigBee interface to communicate with the Home Area Network (HAN), most importantly the In-Home Display (IHD). The CH gateways the smart meter readings to the DCC through a communication services provider (CSP).

Each electricity smart meter has its own Meter Point Administration Number (MPAN) identifier, as shown in Fig. 2, which is a number indicating the following:

- **Profile Class** - the first two digits after the 'S' letter, represents an indication of 24-hour consumption for a property.
- **Meter Time Switch Code** - the following three digits are indication of the number of registers that the electricity meter has.
- **Line Loss Factor** - the last three digits on the top row are related to the costs that distribution companies charge suppliers for cables usage in the meter's area.
- **The Distributer ID** - the second row starts with two digits that are a representation of the distribution company responsible for energy supply in the region.
- **Meter Point ID** - the following 8 digits are unique identifier for the metering point.
- **Check Digit** - a three digit-based check number to verify the Distributer ID and Meter Point ID.

This MPAN is used by the DCC to register each meter to the energy supplier and the DSO to whom the data of the meter are routed to for billing and consumption aggregation.

2.1.2. The Communications Hub (CH)

The information in the smart meter is gatewayed to the WAN and HAN through the Communications Hub (CH). It uses the radio waves of the Communications Service Provider (CSP) in the meter's region, this is the network provider that carries the data to the DCC. Also, the CH relays this information to the HAN via a local ZigBee network.

2.1.3. Home Area Network (HAN)

The home area network (HAN) is similar to the home's WiFi network, but instead of using the WiFi's IEEE 802.11n protocol, HAN uses ZigBee technology that usually uses the same 2.4 GHz band. Also, for wider coverage and in order to avoid the conflict with Home's WiFi network, some CHs incorporate an 868MHz ZigBee network for what is called dual-band CH [4]. Alt-HAN, is a UK-based company [5] responsible for providing special connectivity solutions for longer ranges of HAN in large or complex premises.

A typical HAN will accommodate the CH for electricity and gas meters and the IHD as the default HAN interface (discussed in the next sub-section). The HAN is also capable of interfacing other Type 1 devices that can receive information and alerts from the CH and send responses and alerts back, in addition to Type 2 interface devices that can only display information and alerts received from the CH.

HAN connectivity enables a large number of possible applications such as customized Customer Access Devices (CAD), that can display more details than a typical IHD. It has the ability to connect to the WiFi network and to make the energy consumption information available via web or smartphone apps. Other than the supplier's provided IHD, third-party CAD devices can be obtained individually from companies such as Hildebrand Technology Limited, Chameleon Technology, and Octopus limited; all of which enable the customer to explore more insights about their instantaneous and historical consumption, in addition to dynamic pricing at which they are importing/exporting electricity. This becomes very helpful for customers with local generation, who would like to export energy or reduce their energy bill. Another prospect application of the HAN network is connecting smart appliances to take part in an opt-in demand side management, which saves money for customers by shifting load to off peak periods, as well as, enabling utilities to flexibly shift the demand to maintain supply power quality.

2.1.4. In-Home Display (IHD)

The In-Home Display is now the way that millions of customers around the UK monitor their electricity and gas consumption as it changes in real time. A small screen constantly shows the electricity consumption readings updated every 10 seconds in addition to cumulative consumption on a daily, weekly and monthly basis together with its cost. The IHD also displays the Active Tariff Price per kWh which, in addition to historic consumption, helps in adjusting customer's energy saving plans as well as payment modes whether prepayment or credit.

2.2. Data and Communications Company (DCC)

The DCC is a subsidiary of Capita plc, licensed by the government [6] and regulated by Ofgem to operate the wide area network (WAN) of the SMIP. It is also supporting the roll-out of SMETS2 smart meters and the migration of the SMETS1 meters to the DCC network. At scale, DCC is planned to support 53 million smart meters [7]. Each smart meter is connected to the DCC through the CH, through two CSPs, Arqiva limited operating in the northern parts of the UK, while Telefonica PLC operating in the central and southern parts. The communication technologies used vary by area: 2G, 3G, 4G, radio, and meshed CH networks.

The DCC is merely providing the central technical infrastructure and the cyber-security requirement for the WAN [8], while it does not hold any databases of the metering information which are passed on from connected homes to their suppliers. The DCC does not store smart meter readings but only a register of meters' metering point information, transactions, and energy suppliers. This makes switching between suppliers a matter of updating a record in that register enabling next-day energy supplier switching.

2.3. DCC Service Users

The DCC provides a consent-based gateway for its service users to access customer's data, this access is governed by the Smart Energy Code (SEC). Licenses are issued to energy suppliers and DSOs which are directly concerned with the data from their respective service areas. In addition, there is also other authorised users that can use the data. These can be organisations that can provide technical or technological services to energy companies such as smart metering systems PLC, or to provide product recommendations and comparison between electricity suppliers for the customers. Also, they can be companies that develop CADs for customers such as Hildebrand Technology Limited and Chameleon Technology Limited. Licenses have been also given to companies that provide data interface and core network data application programming interfaces (APIs) such as Octopus Energy limited and N3rgy limited.

3 Smart Meter's Specifications

In order to maintain the inter-operability of smart meters in the network, the SMETS1 followed by the SMETS2 specifications [3] were published to specify the physical, functional, interface and data requirements of the smart meters. These specs have been implemented into the millions of connected smart meters to the network. In this section each of these specifications are detailed in order to provide an understanding of what data is available from the smart meters infrastructure and the potential applications that can be based on acquiring and analysing it.

3.1. Physical Components

The physical requirements specify the smart meter's hardware components such as internal clock, data storage, measuring element, user/HAN interface requirement, and a switch to connect and disconnect electrical supply [3].

3.2. Functional Specifications

Functional specifications of smart meters are the most relevant to DSOs and energy suppliers and are discussed in the following sub-sections..

3.2.1. Display and storage of information

The meter is capable of storing and displaying the unique Customer Identification Number and MPAN, payment mode, balance, credit and debit information, time-of-use (ToU) tariff details. These values can be displayed on the meter's user interface or on the IHD through a HAN.

3.2.2. Payment Mode

Customers have two payment modes from which they can choose or switch remotely. These are the Credit Mode and Prepayment Mode. In the Credit Mode a standing charge is to be paid by the customer which is calculated according to the consumption and ToU profiles. As for the Prepayment Mode, credit is added to the meter's balance, and consumption is subtracted from that credit. The prepayment mode performs the same cost calculation according to the ToU profile and it also provides an emergency balance in case the meter balance gets exhausted.

3.2.3. Pricing

The pricing depends on consumption measured and multiplied by the 48 ToU tariff registers, relating to half-hourly bands per day. In addition to that, a ToU with block pricing is available which would switch between four ToU blocks within each band of eight according to switching rules that depend on the consumption amount and pre-set consumption thresholds. This is achieved by comparing the accumulated consumption to such thresholds and rules, and the accumulated consumption amount is reset daily.

3.2.4. Communication Specifications

The smart meter's clock is precise within 10 seconds of Coordinated Universal Time (UTC). This clock accuracy and synchronization with UTC is essential for communication with HAN or DCC's WAN. The smart meter is able to connect to devices through the HAN to a minimum of seven Type 1 Devices and four Type 2 Devices. This connection enables sending or receiving information or alerts to these devices within the house. As for the communication with DCC a separate Communications Hub is installed above the smart meter.

3.2.5. Load Limiting

In the case of power import exceeding a certain load limit power threshold set in the smart meter, an alarm is sent via the HAN and user interface and the electricity supply is cut. In case of the prepaid payment mode, where the meter main & emergency balances were below a certain disablement threshold, the supply can only be enabled by raising the balance above that threshold.

3.2.6. Recording

A very important function of the smart meter is to record and retain data about consumption even in the case of power outage. The following records are kept in the smart meter's memory:

- Cumulative active and reactive energy imported and exported.
- Billing data by accessing the ToU registers with other billing logs.
- Consumption data and consumption cost.
- The instantaneous cost consumption.
- Daily tariff read and consumption data.
- Half-hour profile data of active and reactive energy import and export.
- Maximum demand import and export data.
- A status of power threshold that can be low, medium or high.

3.2.7. Security

The smart meter is a critical part that can compromise the entire cyber-physical system of smart meters network. This can happen with motives such as consumption records manipulation, electricity theft or illegally obtaining customers' consumption or personal data. There are various security measures that vary from PIN code for the user interface to cryptographic algorithms and security credentials via private and public keys for communication..

3.2.8. Ability of Switching Auxiliary Loads

The smart meters are also able to control the switching of up to five HAN-connected auxiliary load switches based on a calendar command that can support up to 200 switching rules within any date range down to half-hour resolution. The switching is performed, and the status of individual switches is recorded after each switching.

3.2.9. Voltage quality measurement

Smart meters are equipped with different metrics to measure the voltage quality. The measurements that a typical smart meter keep for voltage quality are:

- Average RMS voltage measurement
- RMS over voltage detection and extreme overvoltage detection
- RMS under voltage detection
- RMS voltage sag detection
- RMS voltage swell detection

As indicated these measurements can help in providing further insight which can be of a benefit for DSOs.

3.3. Interface Specifications

On the front panel of the smart meter is a user interface which provides personal data, metering point information, enabling or cutting supply as well as managing credit. It also provides versatile displays and options through its HAN interface, which enables most of the credit, tariff and consumption monitoring and management options such as adding credit, activating emergency credit or managing debt. The HAN interface is also used for controlling payment mode and setting the tariffs. It is also used to read, clear or configure operational data and parameters relating to the different operational functions discussed in section 3.2.

3.4. Data Specifications

The smart meter's memory maintains four types of data:

Constant data- such as the identifier, manufacturer identifier, model type and variant.

Internal data- relating to security credentials used to authenticate connection during installation.

Configurational data- these are values that are configured when installing the meter such as the different operational thresholds, load limits, measurement periods, payment mode, PIN hash, clock and calendar synchronization, tariff registers, and tariff type.

Operational data- these are the data collected or calculated during the smart meter operations, such as accumulated power import or export, as well as, the price, debt, billing data, local time, and different operational and billing logs.

4 Smart Metering Implementation Programme Benefits

Despite the environmental and financial motivations that drove the regulatory framework of SMIP, such a nation-wide programme had to show benefit across all its stakeholders. In other words, Ofgem needed to assure that the programme provided benefits to the end customers first, then to energy suppliers to justify their required investments in addition to show national benefits such as improving grids' efficiency and flexibility.

4.1. Customer Benefits

Examples of the benefits that the programme can provide to the **customer** are:

- The smart meter puts an end to bill estimation and makes sure that customers are charged only for the energy they use.
- The IHD provides real time information about consumption, which can help customers budget, plan energy savings, and easily detect inefficient appliances that consume more power than expected.
- Customers on a prepaid plan can top up their smart meters remotely while customers on credit plan can view historical records of consumption costs and tariffs.
- Smart meter data enable remote support from energy suppliers for matters such as balance, changing tariff, or payment mode.
- The SMETS2 smart meters enable customers to easily switch between suppliers in the next working day while keeping the same device.
- Smart meters save the suppliers some operational costs by not sending personnel to manually record readings and less customer calls service. Hence, it is supposed that customers with smart meters will benefit from cheaper tariffs.
- The prospected programme benefits to the DSO will bring down the electricity delivery costs to customer premises, which will, supposedly, reduce final costs to the customer.
- Smart meters can help in reducing the average electricity outage duration, which mean customers will regain supply much quicker than before with selectivity in getting only meters connected to the faulty line disconnected.

Despite these direct benefits, in addition to other indirect benefits that could be attained through bringing the whole system costs down, customers are not obligated to change to smart meters, while suppliers are required to meet roll-out targets. This makes the social acceptance of smart meters a critical aspect of the programme success and attaining its benefits [9].

4.2. Electricity Suppliers' Benefits

The electricity suppliers are taking up the costs of the smart meters' roll-out and were obligated with roll-out targets by connecting all homes and small non-domestic buildings to avoid fines [10, 11]. Other than fines, the smart meters roll-out was driven by forthcoming financial benefits to suppliers, such as:

- Not sending personnel to collect meter readings from the customer's premises. Also, automated readings are more accurate, instead of relying on customers submitting their own readings, which can be inaccurate. The total benefit of the automated reading is £2.3bn [12].
- The DCC is a centralised smart meter registration point which means **supplier switching** can be a matter of changing record, hence saving £1.2bn [12] which would have been accrued by suppliers for managing customers switching.
- The monitoring specifications and information provided by the IHD will cut **customer calls** handling costs by £1.2bn [12].
- Previously, many suppliers used quarterly payment to save money on reading and estimation of bills, but with the availability of billing data from smart meters, more **frequent billing** will in turn reduce debt build-up saving around £1.1bn [12] of what might have been bad debt charges.
- Suppliers' remote tariff changing is another benefit of smart meters that will save suppliers approximately £170m [12] that would have been spent on visits to change tariff method.
- The higher consumption data resolution will allow suppliers to distinguish between power lost due to technical losses or due to energy theft, in addition to the ability to target these attempts.
- Over the air (OTA) firmware upgrades will increase the technology's lifetime using the same smart meter device as well as enabling the adoption of new tariffs, dynamic pricing, and demand side management.

4.3. National Benefits

The smart meter programme is a large step towards UK government goals of net zero emissions and achieving a reliable and flexible UK energy system. It will also open the opportunity for demand side management programmes that use dynamic pricing to control flexible appliances to create savings for the customer while operating off peak and solving issues such as curtailment. The Ofgem-regulated DCC, providing centralized registration of smart meters, stimulates the competition and innovation between energy suppliers for providing further added values to the customer by means of bill saving, better monitoring, control, or dynamic tariffs. These innovations are critical for suppliers since switching became much easier, meaning that customers can always seek a better supplier that matches their preferences. This enhances the innovation in the energy market. Finally, as will be discussed in section 5; the smart meter data can certainly be of immense technical advantage for the entire grid operations and especially for DSOs.

5 DSOs' Technical Benefits

The existing smart meter network can provide vast amounts of data across the country, with a resolution down to half-hourly readings. In addition to the electricity smart meter's ability to send measurement every 10 seconds through the HAN interface, the smart meters also provide voltage quality reports, outage alerts, and manipulation alerts. Such data can all be combined for numerous technical benefits for energy suppliers, DSOs and the whole grid. Unlocking these benefits will provide direct financial benefits across the board, in addition to environmental benefits such as higher control over emissions and enhancing the stable integration of renewables. In order to achieve these network technical benefits, a data-driven approach needs to be applied to the smart meter data.

5.1. Network Planning and Asset Management

A direct benefit of smart meters would be producing data-supported decisions regarding network reinforcement. For example, the aggregate data received from smart meters on a specific feeder can provide higher resolution and accuracy of the demand distribution along the feeder which is a more precise measure than the maximum demand indicator (MDI) from the substation. This information is then utilized to accurately model new load connection calculations using a load flow tool taking into consideration the assets parameters such as transformers and cables rating.

5.2. Fault Mitigation and Quick Supply Restoration

This represents a significant operational advantage of smart meters data for DSOs on all fault management phases:

- **Fault mitigation**: The analysis of power and voltage data received from smart meters and their change over time can be used for protective activities e.g., cable's insulation degradation, which in turn will reduce the frequency of fault occurrences.
- **Fault notification**: With traditional meters, the fault notification came from customer calls that classifies as a fault only if two calls were received. This typically spans multiple minutes after the fault occurrence which is critical for the DSO's Customer Minutes Lost (CML) performance indicator. The smart meter's 'last-gasp' outage alerts can be an instant notification to the DSO of the fault event. This can also create savings for the DSO through reducing their call centre costs, since customers will rely on the automated outage notification instead of calling.
- **Reduction of operational costs to locate and fix faults:** The number and locations of smart meters that have sent 'last-gasp' alert can be used to narrow down the search area of the fault, resulting in targeted deployment of the dispatch teams. This is reported to create a minimum saving of £50 on CML cost [12] for each fault in addition to ensuring quick supply restoration.

5.3. Deployment and Detection of Low Carbon Technologies

The addition of emerging low-carbon technologies (LCTs) to the network such as electric vehicles, heat pumps, batteries and small-scale PV generation is challenging for DSOs with traditional operation. Hence, DSOs role is expanding more than being a network operator to become DSOs, in order to manage the deployment of LCTs at different points of the network and the challenges they bring.

The voltage recording capability of smart meters can provide useful insights regarding the connection of low-carbon technologies (LCTs), particularly the voltage at the end of a feeder, since a high voltage at the end of a feeder can indicate the existence of a small-scale generation (e.g. rooftop solar generation). On the other hand, a low voltage at the end of a feeder, in addition to the temporal loading information from smart meters, can be an indication of an Electric Vehicle (EV) connection point. This reduces the need for physical monitoring of the network, which in turn can support phase balancing operations and improve the efficiency of network reinforcement investments by directing them to these locations.

5.4. Active Network and Assets Management

The low voltage distribution network management is becoming more challenging than ever, since it features [13]:

- Large number of domestic, radial or mesh topologies, with minimal to no measurement's devices other than electricity meters, which makes voltage anomalies and electricity theft go undetected.
- High R/X ratio especially with underground cables making line's resistance an important factor in correlation with voltage.
- Unbalanced and uncertain loading patterns, which becomes more significant with connected LCTs, leading to continuous need for network reinforcement to mitigate their effect.
- Bi-directional power flow due to small-scale generation at some sites, increasing the voltage level.

Hence, DSOs are motivated to utilize existing system parameters and network topology alongside the smart meters' data stream to create an advanced Active Network Management (ANM) software that is able to:

- Analyse such data, providing higher visibility of the network, and reducing network reinforcement needs and making them more targeted.
- Pinpoint voltage excursions and restoring normal condition (e.g., switching an on-load tap changer (OLTC) transformer) accordingly.
- Detect and act on potential electricity theft attempts.
- Analyse the historic voltage profile of the network to be used alongside the load profiles to give an indication of any new connection and their type (e.g., an EV charging point) and taking action accordingly.
- Analyse aggregated historical demand data, to investigate peak demand and factors in order to better dispatch generation.
- Filter fault notifications by automatically polling meter's supply status around the faulted meter area to confirm the existence of a permanent outage, as well as determining outage area. This could filter false fault notifications as in the case of an in-premise related issue rather than network outage.

5.5. Development of a Distribution Network Digital Twin

The concept of creating a digital twin (DT) in a power system context in literature is mostly limited to physics-based DTs of long or medium transmission line models [14-17]. This is not the case with distribution networks since they have much larger number of nodes and complex topologies that makes creating a physics-based DT challenging. However, as for the case of ANM system, a data-driven digital twin (DT) can utilize existing data about the network (e.g., topology diagrams) in addition to real time data from smart meters across the network to combine the functionalities of ANM with statistical and machine learning models to create further insight about the distribution network. Examples of the applications that a data-driven distribution network DT can provide are:

- Perform multiple 'what-if scenario' simulations to evaluate optimal location for network reinforcement or new connection points (e.g., choosing where to add a new EV charging point).
- Use historical data and trained machine learning models, to translate different meter readings into their operational indications (e.g., a spike in voltage measured by smart meters around a specific node, might indicate excess generation at that point).
- Placing the DT in the middle of automated control loops as in dispatching generation or connecting loads as part of demand side management. In addition, DT can be used to automatically adjust OLTC transformer to regulate voltage around the nominal values.
- DTs can support the management and condition monitoring of the network lead assets such as transformers and cables, through advanced prognostics and predictive maintenance methods.
- DTs can also aid in providing further insights in the case of network faults by pinpointing fault locations using smart meter outage reports, supply status, voltage levels and historical data.

6 Conclusions

The UK smart meter implementation programme (SMIP) has already started delivering some of its planned economic, social and environmental benefits. Nevertheless, the biggest programme asset is actually in the data streams from millions of connected smart meters to the centralized DCC network. This can unlock a large number of benefits to multiple stakeholders, starting from enabling the customer to have further control over their energy consumption and a facilitated supplier switching process, to providing energy suppliers with insights supporting new competitive plans, tariffs and demand side management products. This paper also suggested potential benefits that could be unlocked by using industry 4.0 technologies such as, big data, machine learning models and digital twins in analysing smart meter data to deliver a multitude of technical advantages for DSOs. Examples include decision support in network reinforcement and asset management, detection of LCTs, active condition monitoring, and digital twin of distribution networks. More innovative applications are also attainable through data access to researchers and other service providers in the energy sector. However, this stresses on the need for making this data available to such parties with the right access standards and guidelines, as laid in the Energy Data Taskforce [18], in order to seize the full potential of the national smart meters network.

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