

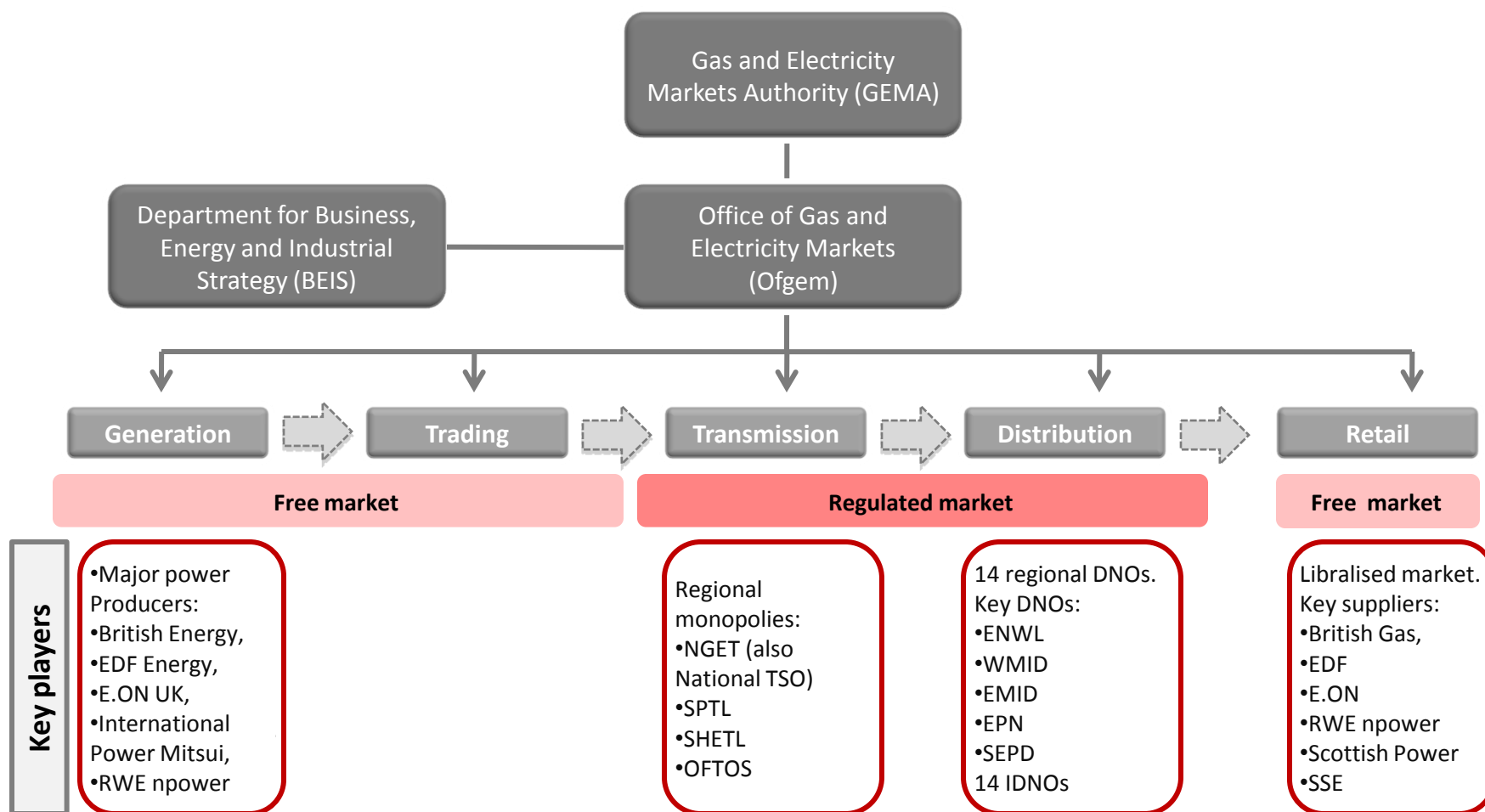
United Kingdom

1. Sector overview
2. Institutional and regulatory structure
 - 2.1 Key institutions and players
 - 2.2 Distribution tariff setting mechanism
 - 2.3 Key recent policy and regulatory developments
3. Sector size and past growth (2008–17)
 - 3.1 Installed capacity
 - 3.2 Electricity production
 - 3.3 Number of consumers
 - 3.4 Electricity consumption or sales
4. Size and growth in distribution network (2008–17)
5. Trends in operational performance (2008–17)
 - 5.1 Distribution losses
 - 5.2 SAIFI/SAIDI
6. Trends in financial performance
 - 6.1 Trends in revenues from electricity distribution
 - 6.2 Trends in capex/investment in distribution network
7. Smart grid and metering efforts
 - 7.1 Metering status
 - 7.2 Smart meter target and rollout
 - 7.3 Smart grid plans
8. Forecast and projections (2018–27)
 - 8.1 Expected growth in consumption
 - 8.2 Expected growth in distribution network and capacity
 - 8.3 Expected investment in distribution network
9. Outlook and opportunities in the sector
10. Inter-DSO comparison
 - 10.1 Ownership and area of operations
 - 10.2. Size and character of operations
 - 10.2.1. Size of distribution network
 - 10.2.2. Number of customers and sales
 - 10.3. Operational performance —Distribution losses, SAIFI and SAIDI
 - 10.4. Financial performance — Revenues, gross profit/loss, net profit/loss, debt-equity ratio, return on equity and capex
 - 10.5. Future plans —Network expansion and planned Capex

1 Sector overview

- Reforms were introduced in 1990 and the market was completely liberalised and privatised by 1999.
- The sector also witnessed significant unbundling, though there are a few energy companies that operate across several verticals.
- Electricity markets of England, Wales and Scotland were integrated in April 2005 under the British Electricity Trading and Transmission Arrangements (BETTA) in the Energy Act, 2004.
- Electricity generation companies in Britain are divided into two categories. 'Major' power producers accounting for about 90% of the net generation capacity, and 'other' power producers comprising small energy producers, accounting for the remaining 10%. Some of the large major power producers are British Energy, EDF Energy, E.ON UK, International Power Mitsui and RWE npower.
- British transmission network is operated and maintained by National Grid Electricity Transmission (NGET), a subsidiary of the UK's largest network company, National Grid plc. However, transmission assets are owned by regional monopoly transmission companies. National Grid owns the transmission assets in England and Wales; Scottish Power Transmission Limited (SPTL) owns them in southern Scotland; and Scottish Hydro Electric Transmission Limited (SHETL) owns them in northern Scotland. The transmission system associated with the offshore wind energy projects is being developed and operated by offshore transmission owners (OFTOs). So far, about 13 OFTO projects are operational.
- The distribution system is operated and owned by regional monopolies. Britain has 14 distribution network operators (DNOs). In addition there are also a number of smaller networks owned and operated by Independent Network Operators (IDNOs). These are located within the areas covered by the DNOs. Currently, there are 14 IDNOs operating in the UK. The retail power market in the country is fully liberalised and consumers are free to choose their supplier.
- The Department for Business, Energy and Industrial Strategy (BEIS), formed in 2016 with the merger of the Department of Energy and Climate Change (DECC) and Department for Business, Innovation and Skills, deals with energy regulation and licensing-related issues in Britain. The Office of Gas and Electricity Markets (Ofgem) regulates the gas and electricity industries in Great Britain and operates under the direction and governance of the Gas and Electricity Markets Authority (GEMA). The wholesale electricity balancing and settlement arrangements are administered by ELEXON.

2.1 Key institutions and players – electricity market structure



Note: NGET: National Grid Electricity Transmission; SPTL: Scottish Power Transmission Limited; SHETL: Scottish Hydro Electric Transmission Limited; OFTO: offshore transmission owners; ENWL: Electricity North West Limited; WMID: Western Power Distribution (West Midlands) plc; EMID: Western Power Distribution (East Midlands) plc; EPN: Eastern Power Networks plc; SPED: Southern Electric Power Distribution plc

Source: Ofgem; Global Transmission Research

2.3 Recent policy and regulatory developments (1/2)

Impact of Brexit

- UK has been an important proponent of liberalised European Union (EU) energy markets and the EU's Third Energy Package. Given that the UK government has been at the forefront of efforts to liberalise and develop cross-border energy markets, it is likely that the UK would continue to implement and be supportive of many aspects of the Third Energy Package.
- On the other hand, post Brexit EU energy policy may get a stronger regulatory focus. In the longer-term, regulatory practices may, therefore, diverge between the EU and the UK.
- Amongst all, Hinkley point remains the most discussed casualty of the UK's decision to leave the EU. The re-assessment of the Hinkley point plan remains a political decision by the government in the UK, and while the new government came into power after the Brexit vote, it is unclear what role the nuclear power project will play in the UK's broader energy agenda post Brexit.

New regulatory framework for network companies

- In March 2018, Ofgem proposed a new regulatory framework to be implemented from 2023. In addition to a lower cost of equity (between 3% and 5%) and changes to how the cost of debt is set, Ofgem's consultation on options for a new regulatory framework include:
 - A default five-year price control instead of the current eight-year period.
 - Tougher requirements to put network companies' business plans for the next price controls under the microscope. Meanwhile, wider scope for opening up high value network upgrades to competition across the sector.
 - A targeted innovation programme to support strategic challenges across the sector and to involve third party inventors and entrepreneurs in trying new business models.
 - Measures to ensure that consumers don't pay for capacity which is not used. Failsafe measures to protect consumers including companies having to share more of the savings they make due to greater efficiency or use of innovation with consumers.
- At present, Ofgem is awaiting stakeholders response to the proposal which is scheduled to close by May 2, 2018. The regulator is expected to finalise the framework for setting the next price controls in summer 2018 while the new companies will submit business plans by autumn 2019. Ofgem's final view on price control allowances will be published by the end of 2020.

3.1 Installed capacity

- At the end of 2017, UK had an estimated installed generation capacity of 83,503 MW, of which almost 62% was conventional steam and combined cycle and the remaining was based on nuclear, hydro, renewable and conventional steam and combined cycle. Since 2008, installed capacity has grown at a CAGR of XX%.

Table 1: Installed generation capacity, 2008–17 (MW)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017E
Hydro	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	4,351
Nuclear	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	9,497
Conventional steam and combined cycle	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	48,491
Gas turbines and oil engine-based	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	1,417
Wind	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	11,244
Solar and other renewables	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	8,503
Total	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	83,503
Annual growth rate (%)	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX

Figure 1: Installed electricity capacity by technology, 2017 (%)

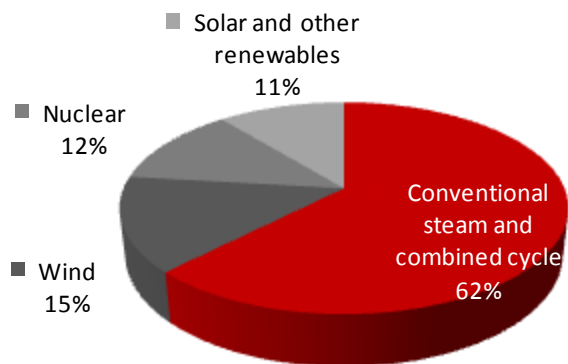
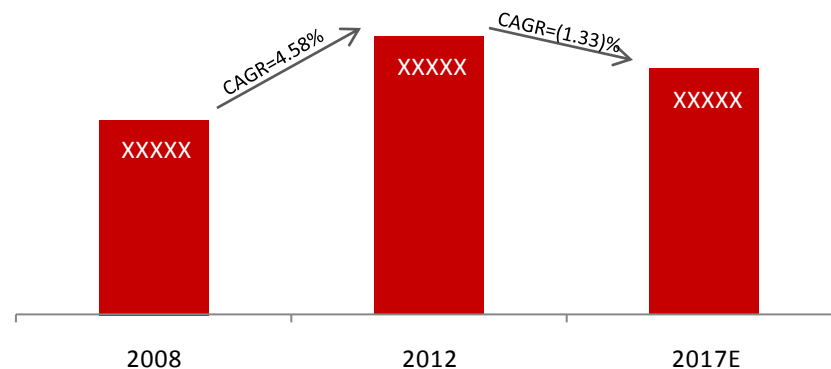


Figure 2: Growth in installed capacity, 2008–17 (MW)



Note: The table does not include data for Northern Ireland.

Data for 2017 is based on actual onshore, offshore wind and solar capacity addition of 2,590 MW, 1,680 MW and 954 MW respectively (without derating capacity done by Digest of United Kingdom Energy Statistics (DUKES) while reporting installed capacity figures). It is assumed that capacity based on all other sources remained unchanged during the year.

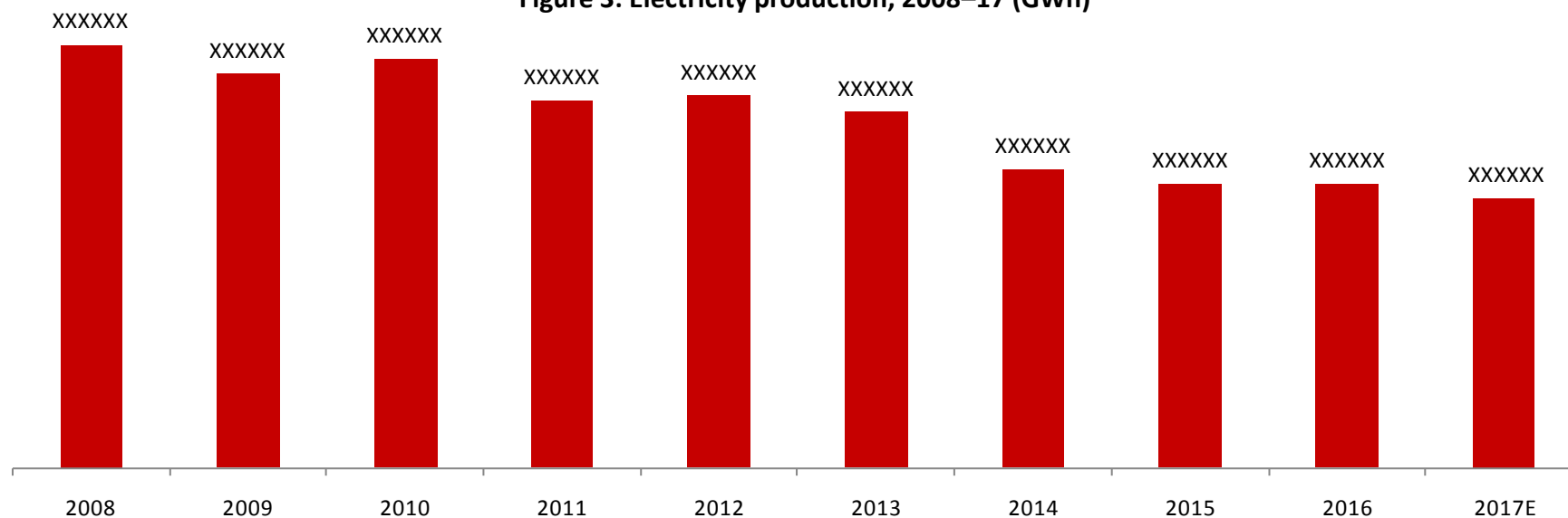
Data is for April-March fiscal year

Source: Department of Energy and Climate Change, UK; Global Transmission Research

3.2 Electricity production

- Around XXXXX GWh of electricity was produced in the UK during 2017. Electricity generation has declined at a CAGR of XX% since 2008.

Figure 3: Electricity production, 2008–17 (GWh)



Note: Data is for April-March fiscal year

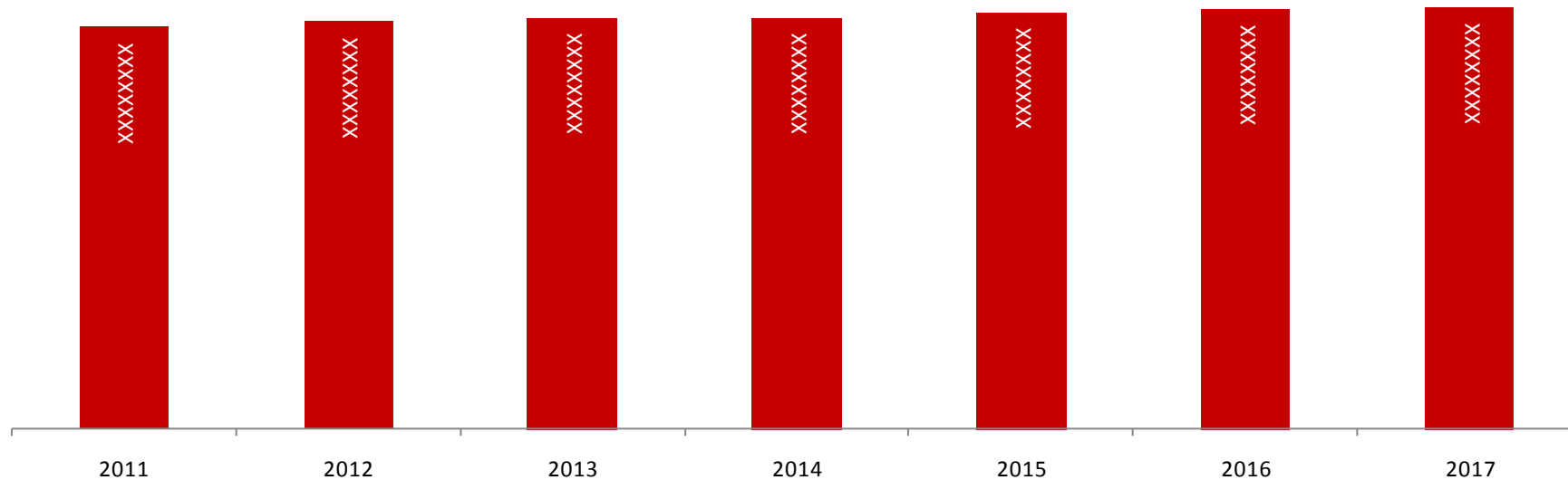
The table does not include data for Northern Ireland. Some of the historical data has been revised by the Department of Energy and Climate Change (DECC). Data for 2017 is based on the CAGR for 2006 and 2016.

Source: Department of Energy and Climate Change, UK; Global Transmission Research

3.3 Number of consumers

- In 2017, the number of electricity consumers stood at XXXXXX. Since 2011, the consumer base has increased at a CAGR of XX%.

Figure 4: Growth in number of consumers, 2011–17



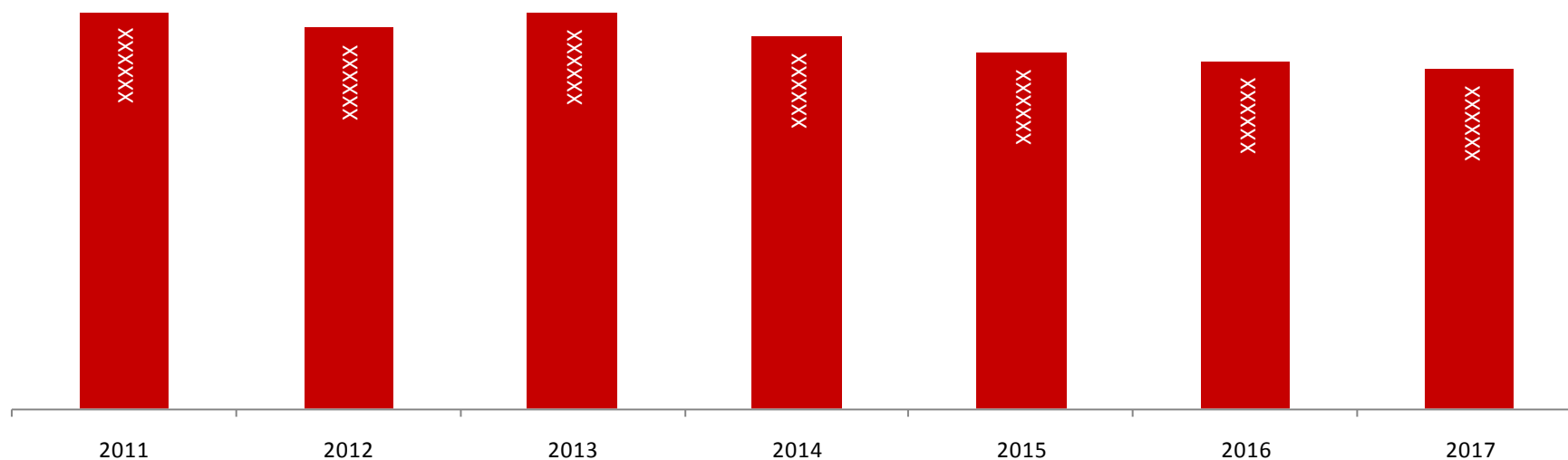
Note: Data is for April-March fiscal year

Source: Ofgem annual report; Global Transmission Research

3.4 Electricity sales

- Around XXXXXX GWh of electricity was delivered or carried/sold/distributed in the UK during 2017. Since 2011, electricity sales has decreased at a CAGR of XX%.

Figure 5: Growth in electricity sales (GWh), 2011–17



Note: Data is for April-March fiscal year

Source: Ofgem annual report; Global Transmission Research

4.1 Growth in distribution network

- In 2017, UK's distribution network comprised about XXXXXX km of line length. Since 2011, line length increased at a CAGR of XX%.
- EPN has the largest network with at 12% share in the total line length and SWALES has the least share in the total network.

Figure 6: Growth in distribution line network, 2011–17 (km)

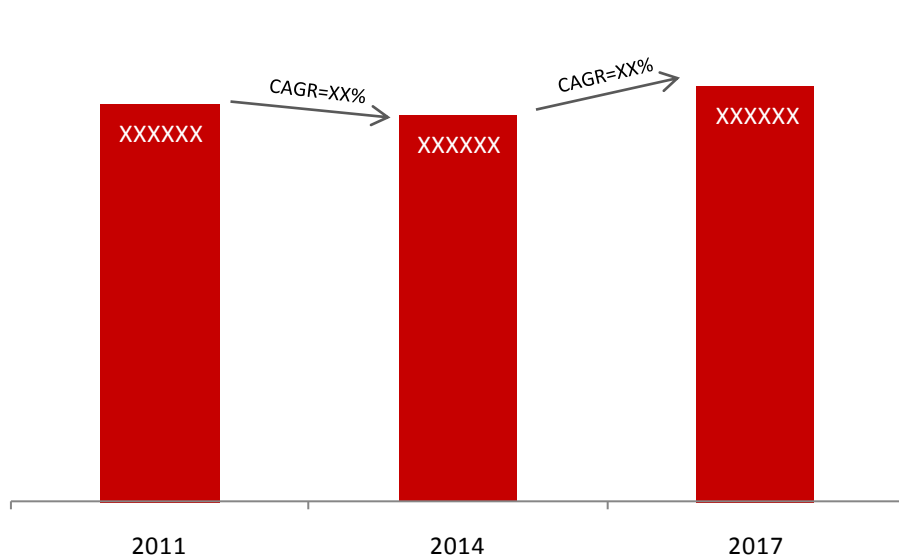
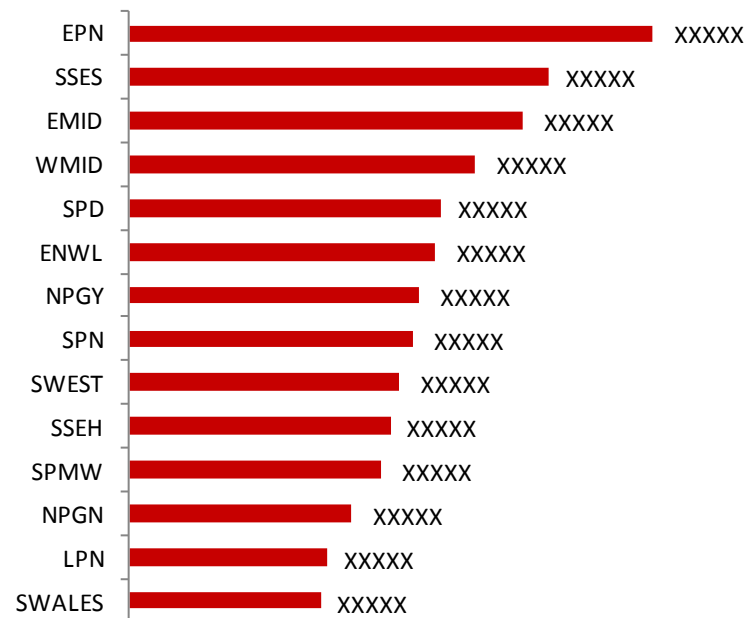


Figure 7: Share of key players in line length, 2017 (km)



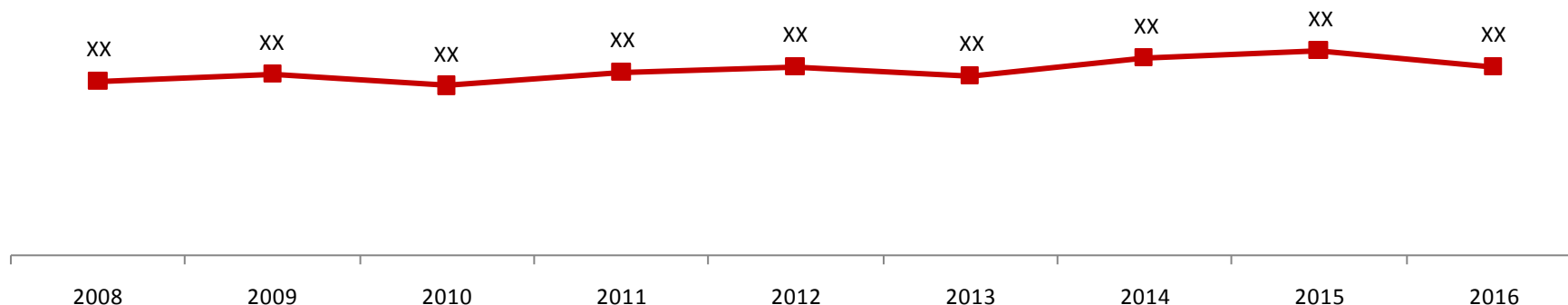
Note: Data is for April-March fiscal year. The decline in line length in 2014 is on account of an audit that was undertaken during 2012/13 of the inventory of network assets for SP Distribution plc (SPD) and SP Manweb plc (SPMW) wherein it was identified that there was a change in length of overhead lines and underground cables.

EPN: Eastern Power Networks plc ; SSES: Scottish Hydro Electric Power Distribution plc ; EMID: Western Power Distribution (East Midlands) plc ; WMID: Western Power Distribution (West Midlands) plc ; ENWL: Electricity North West Limited; NPGY: Northern Powergrid (Yorkshire) plc ; SPN: South Eastern Power Networks; SWEST: Western Power Distribution (South West); SSEH: Southern Electric Power Distribution plc; NPGN: Northern Powergrid (Northeast) Limited ; LPN: London Power Networks plc ; SWALES: Western Power Distribution (South Wales) plc

Source: Ofgem annual report; Global Transmission Research

5.1 Distribution losses

Figure 8: Trend in electricity losses (%)



Note: Data represents both transmission and distribution (T&D) losses.

Data is for April-March fiscal year .

Source: Department for Business, Energy & Industrial Strategy, UK; Ofgem; Parliament.uk; Global Transmission Research

- The transmission and distribution (T&D) losses, as a percentage of the total energy sold stood at around XX% during 2016 and witnessed an improvement over the XX% recorded during 2015. Over the past nine years, the losses have witnessed an increasing trend, growing at a CAGR of around XX%.
- According to the data published by Ofgem, the distribution losses stood in the range of around X-X% for the years 2018–10.
- However, a similar range has reportedly been observed during the recent years, according to which, the distribution losses fall in the range of around X-X%, while the transmission losses vary between 1% and 2%.

5.2 SAIFI/SAIDI

Figure 9: Trend in customer interruptions (CIs)

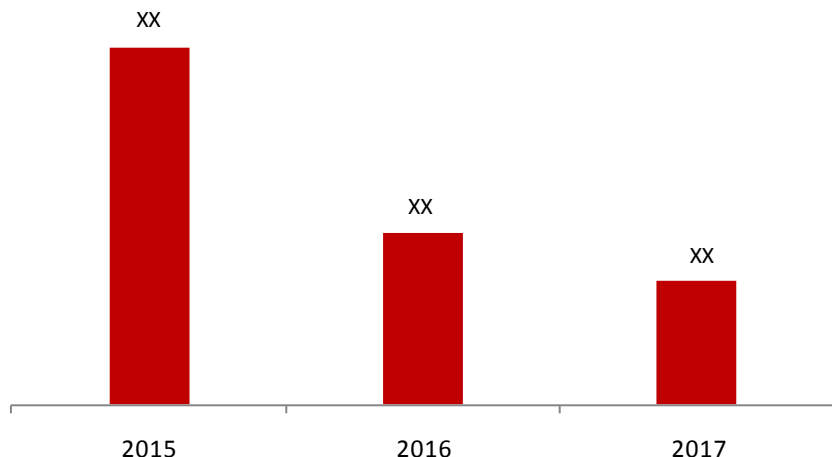
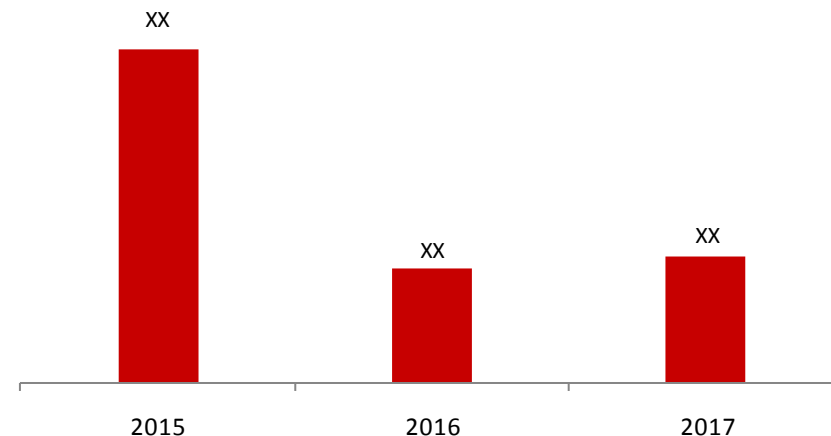


Figure 10: Trend in customer minutes lost (CMLs)



Note: CI: number of customer interruptions per 100 customers on the network; CML: average length of time customers are without power per interruption

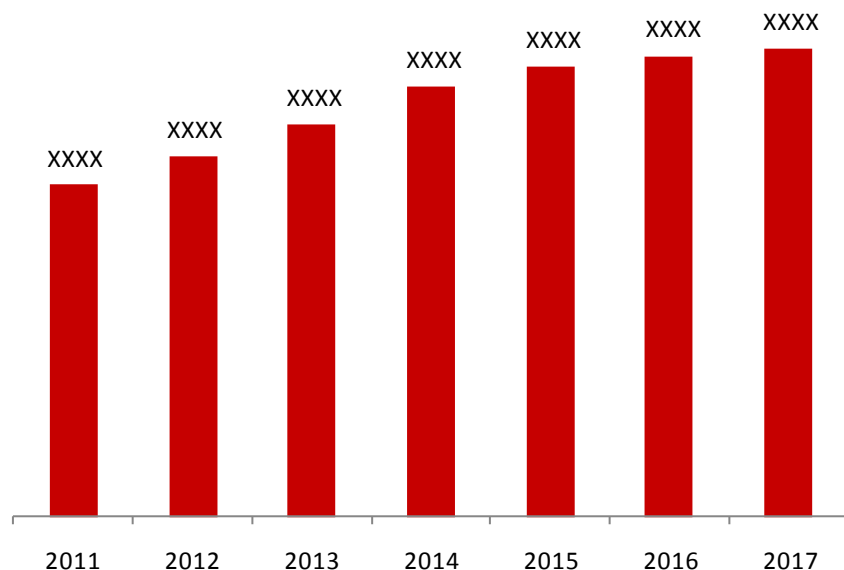
Data is for April-March fiscal year

Source: Ofgem annual report; Global Transmission Research

- Customer interruptions (CIs) ranged from XX to XX for 2016. For 2017, it ranged from XX to XX, which depicts a slight improvement as the index reached a new low of XX in 2017. However, the highest value of XX, recorded in 2017 was greater than the 2016 highest value of XX.
- Customer minutes lost (CMLs) for the utilities ranged from a low of XX minutes to a high of XX minutes during 2016. Meanwhile, for 2017, it ranged from a low of XX minutes to a high of XX minutes. The change from 2016 to 2017 does not depict an overall improvement in the indicators, since the CMLs reached the highest in 2017.
- The reliability of power supply by discoms varies considerably across the country. In 2017, London Power Networks (LPN) registered the lowest CI of XX while CI for Southern Electric Power Distribution (SEPD) was as high as XX.
- Western Power Distribution (South Wales) witnessed a significant improvement in the number of CIs with a decline of XX from XX in 2015 to XX in 2017. However, Scottish Hydro Electric Power Distribution (SEPD) recorded the most improvement in the CMLs with a decline from XX minutes in 2015 to XX minutes in 2017.
- In comparison to 2015, CIs and CMLs have witnessed a significant decline. A key contributor could be the RIIO-ED 1 price control which incentivises DNOs to improve network performance.

6.2 Trend in capex in distribution sector

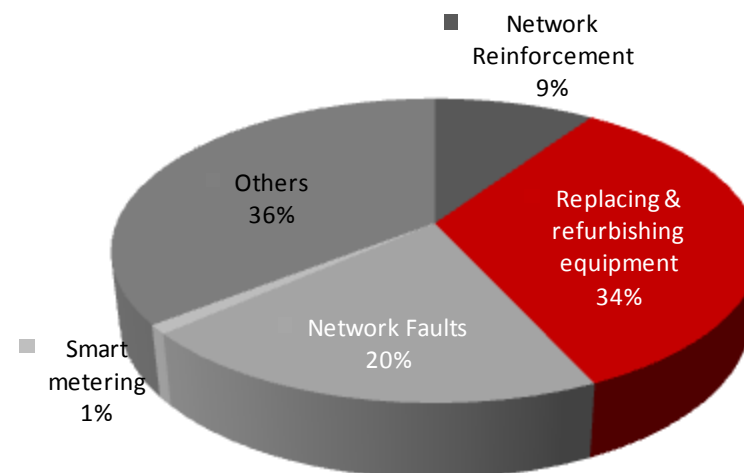
Figure 12: Trend in growth of distribution capex (GBP million)



Note: Data is for April-March fiscal year

Source: Ofgem annual report; Global Transmission Research

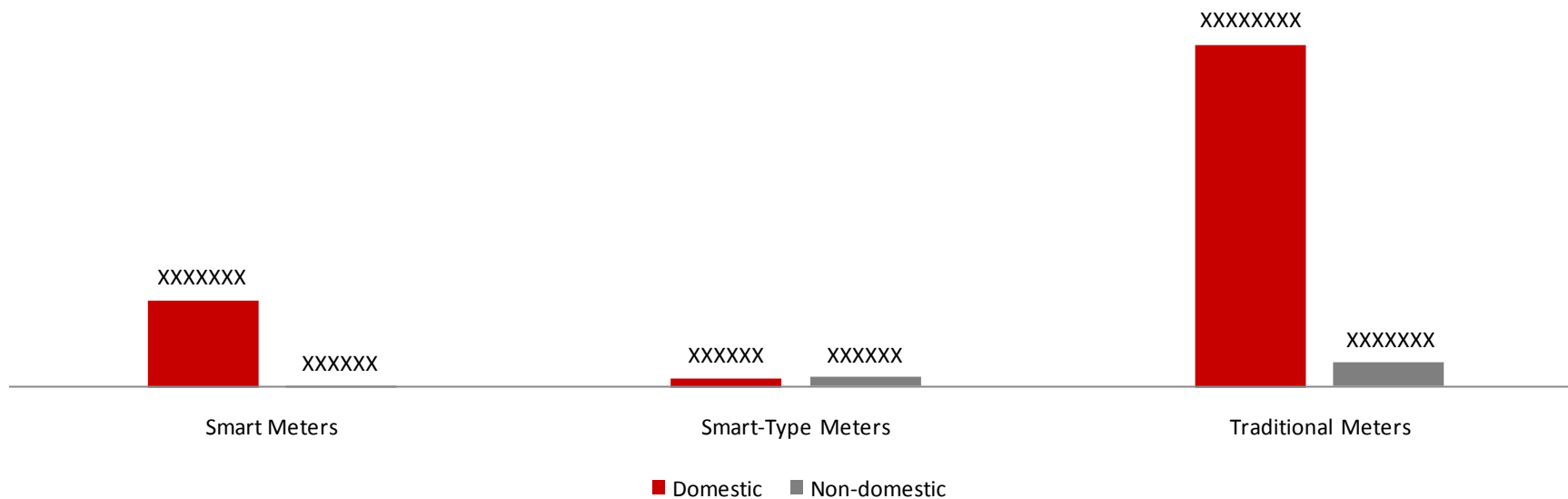
Figure 13: Component-wise share of distribution capex, 2017 (GBP million)



- The total capex of the distribution utilities is estimated at about GBPXXXX million in 2017. The total capital expenditure has grown at a CAGR of around XX % between 2011 and 2017.
- Majority of the expenditure has been directed towards network reinforcement, replacing and refurbishing of equipment and correcting network.

7.1 Metering status (1/3)

Figure 14: Number of domestic and non-domestic meters operated by large energy suppliers, by meter type (2017)

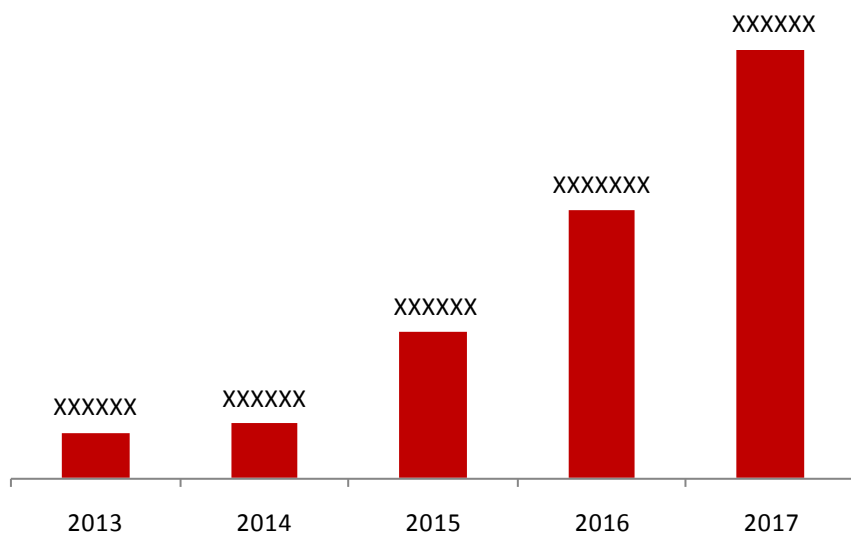


Source: Department for Business, Energy & Industry Strategy

- As of 31 December 2017, there were a total of over XX million meters operated by large energy suppliers across Great Britain.
- Of these, over XX were traditional meters, XX% were smart meters and remaining XX% were smart-type or advanced meters.

7.1 Metering status (3/3)

Figure 15: Annual smart meter installations across domestic and non-domestic sites



Source: Department for Business, Energy & Industry Strategy

Table 4: Annual smart meter installations in domestic and non-domestic sites

Year	Domestic installations ¹	Non-domestic installations ²	Total
2013	XXXXXX	XXXXXX	XXXXXX
2014	XXXXXX	XXXXXX	XXXXXX
2015	XXXXXX	XXXXXX	XXXXXX
2016	XXXXXX	XXXXXX	XXXXXX
2017	XXXXXX	XXXXXX	XXXXXX
Total	XXXXXX	XXXXXX	XXXXXX

Note 1—Domestic installations depict number of smart meter installations by both small and large energy suppliers

Note 2—Non domestic installations depict number of smart and advanced meter installations only by large energy suppliers

Source: Department for Business, Energy & Industry Strategy

- In 2017, over XX million smart meters were installed across Great Britain. Smart meter installations during 2017, registering a XX% increase on the number of meters installed in 2016.
- Domestic installations accounted for XX per cent of the total smart meter installations.

7.2 Smart meter target and rollout

2020 target

- Energy suppliers are required to take all reasonable steps to roll out smart meters to all their domestic and small business customers by the end of 2020.
- Significant ramp-ups for achieving this target are planned for 2019 and 2020.

Overall progress in 2017

- According to Ofgem, for most large suppliers, the number of smart meters in their customer portfolio at the end of the year was in line with the annual milestones they had set themselves for 2017.
- As of February 2018, the majority of installed meters are first generation smart meters, compliant with the first version of the Smart Metering Equipment Technical Specifications (SMETS1).

Key challenge

- A key challenge cited by suppliers for 2017 was securing installation appointments with customers.
- However, according to Ofgem suppliers have been testing and trialling new customer engagement approaches, expanding their use of channels and gathering insight to address concerns.
- Some of the small suppliers are yet to comply with Data Communication Company (DCC) obligation, which is a breach of their licence. Ofgem is currently addressing this issue directly with those suppliers.

Way forward

- Suppliers' plans for 2018 indicate a modest increase in installations compared to previous years, followed by more significant ramp-ups in 2019 and 2020.
- In the first half of 2018 suppliers plan to continue to install SMETS1 meters and advanced meters at non-domestic premises, while carrying out testing and piloting SMETS2 meters.
- In the second half of the year, suppliers plan to gradually transition to SMETS2 installations, ahead of the SMETS1 and the advanced meter exception end dates.

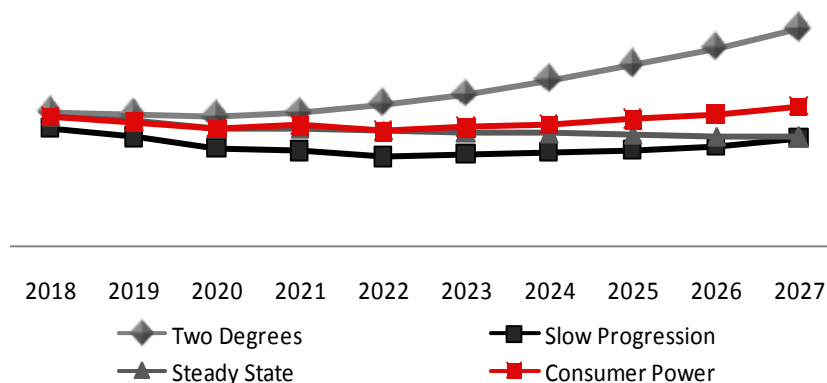
8.1 Expected growth in consumption

Table 5: Expected growth in electricity demand (TWh)

Year	Two Degrees	Slow Progression	Steady State	Consumer Power
2018	329	325	328	328
2019	328	323	327	327
2020	328	321	326	325
2021	329	321	325	326
2022	331	319	325	325
2023	333	320	325	326
2024	336	320	324	326
2025	339	321	324	327
2026	343	322	324	329
2027	347	323	324	330

Source: NGET's Future Energy Scenario (FES) 2017; Global Transmission Research

Figure 16: Expected growth in electricity demand (TWh)

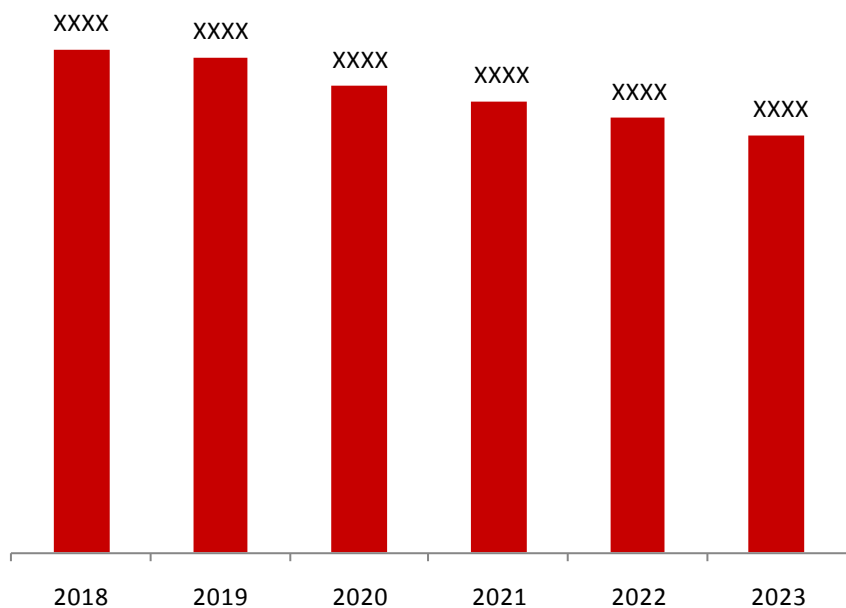


- According to the NGET's Future Energy Scenarios (FES) 2017, electricity consumption in the Great Britain is expected to increase at a CAGR of about 0.6% and 0.1% between 2018 and 2027 under the Two Degrees and Consumer Power scenarios, respectively. The demand is expected to decrease at a CAGR of about 0.1% each in the Slow Progression and Steady State scenarios respectively.

8.3 Expected investment in distribution network

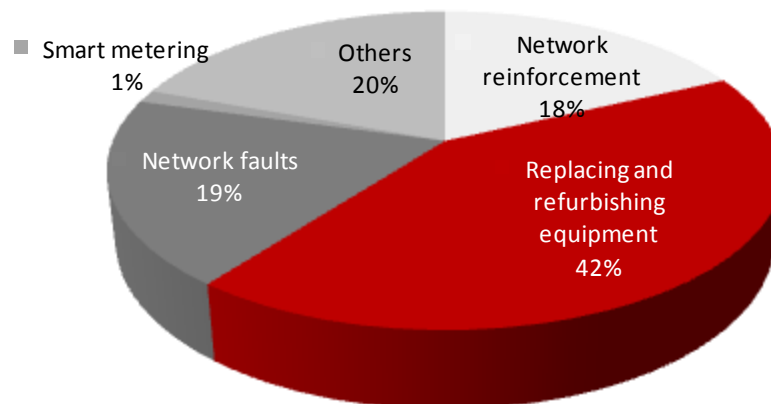
- According to Ofgem, GBPXXXXXX million is expected to be invested in Great Britain’s distribution network between 2018 and 2023.
- The investments will be directed towards replacing and refurbishing equipment (42%), network faults (19%), network reinforcement (18%), smart metering (1%) and others (20%).

Figure 18: Planned investment in distribution network during 2018–23 (GBP million)



Source: Ofgem

Figure 19: Key Segment wise share of investment in distribution network during 2018–23 (%)



10.1 Ownership and area of operations

As of 2017		
Name	Ownership	Area of Operation
Electricity North West Limited (ENWL)	Privately-owned	North West Great Britain
Western Power Distribution (West Midlands) plc (WMID)	Subsidiary company of Western Power Distribution plc (owned by publicly quoted US-based PPL Corporation)	West Midlands
Western Power Distribution (East Midlands) plc (EMID)	Subsidiary company of Western Power Distribution plc (owned by publicly quoted US-based PPL Corporation)	East Midlands
Eastern Power Networks plc (EPN)	Licensed network of UK Power Networks owned by CK Group (CKG)	North London and East Anglia
Southern Electric Power Distribution plc (SEPD)	Subsidiary company of Scottish and Southern Energy Power Distribution Limited (SSEPD) owned by SSE plc	Southern Great Britain

Source: Respective Discoms; Global Transmission Research

10.2.1 Size of distribution network

Table 6 : Growth in line length and transformer capacity of top 5 DSOs

Name	2011		2017		CAGR (%)	
	Line length (km)	Transformer capacity (MVA)	Line length (km)	Transformer capacity (MVA)	Line length	Transformer capacity
ENWL	XXXXX	XXXXX	XXXXX	XXXXX	XX	XX
WMID	XXXXX	XXXXX	XXXXX	XXXXX	XX	XX
EMID	XXXXX	XXXXX	XXXXX	XXXXX	XX	XX
EPN	XXXXX	XXXXX	XXXXX	XXXXX	XX	XX
SEPD	XXXXX	XXXXX	XXXXX	XXXXX	XX	XX

Source: Ofgem; Global Transmission Research

10.2.2 Number of customers and sales

Table 7 : Growth in number of customers and electricity sales of top 5 DSOs

Name	2011		2017		CAGR (%)	
	Sales (GWh)	Number of consumers	Sales (GWh)	Number of consumers	Sales (GWh)	Number of consumers
ENWL	XXXXX	XXXXX	XXXXX	XXXXX	XX	XX
WMID	XXXXX	XXXXX	XXXXX	XXXXX	XX	XX
EMID	XXXXX	XXXXX	XXXXX	XXXXX	XX	XX
EPN	XXXXX	XXXXX	XXXXX	XXXXX	XX	XX
SEPD	XXXXX	XXXXX	XXXXX	XXXXX	XX	XX

Source: Ofgem; Global Transmission Research

10.3 Operational performance

Table 8 : Key operational parameters of top 5 DSOs

Name	2008			2017		
	Distribution losses (%)	Customer interruptions (number)	Customer minutes lost (minutes)	Distribution losses (%)	Customer interruptions (number)	Customer minutes lost (minutes)
ENWL	XX	XX	XX	XX	XX	XX
WMID	XX	XX	XX	XX	XX	XX
EMID	XX	XX	XX	XX	XX	XX
EPN	XX	XX	XX	XX	XX	XX
SEPD	XX	XX	XX	XX	XX	XX

Note: Data is for April-March fiscal year.

Customer interruptions are the number of customer interruptions per 100 customers on the network.

Customer minutes lost are the average length of time customers are without power per interruption.

Source: ENWL, WMID, EMID, EPN and SEPD; Global Transmission Research

10.4 Financial performance

Table 9: Key financial parameters of top 5 DSOs (GBP million)

		ENWL	WMID ¹	EMID ¹	EPN	SEPD
2008	Revenues	XXX	XXX	XXX	XXX	XXX
	Profit before tax	XXX	XXX	XXX	XXX	XXX
	Operating profit	XXX	XXX	XXX	XXX	XXX
	Debt-equity ratio	XXX	XXX	XXX	XXX	XXX
	Return of equity	XXX	XXX	XXX	XXX	XXX
	Capex	XXX	XXX	XXX	XXX	XXX
2017	Revenues	XXX	XXX	XXX	XXX	XXX
	Profit before tax	XXX	XXX	XXX	XXX	XXX
	Operating profit	XXX	XXX	XXX	XXX	XXX
	Debt-equity ratio	XXX	XXX	XXX	XXX	XXX
	Return of equity	XXX	XXX	XXX	XXX	XXX
	Capex	XXX	XXX	XXX	XXX	XXX
CAGR (%)	Revenues	XXX	XXX	XXX	XXX	XXX
	Profit before tax	XXX	XXX	XXX	XXX	XXX
	Operating profit	XXX	XXX	XXX	XXX	XXX
	Capex	XXX	XXX	XXX	XXX	XXX

Note: 1- WMID and EMID become operational in 2010, hence financial data for years prior to 2010 is not available. Data is for April-March fiscal year.

.Source: ENWL, WMID, EMID,EPN, SSEC; Global Transmission Research

10.5 Future plans – Smart grid and metering

Table 12: Planned network capex of top 5 DSOs (GBN million)

Cost saving forecast with installation of smart grid, metering and innovations (GBP million)		Smart grid and metering plans
ENWL	132	-No robust or coherent strategy for incorporating smart grids -Benefits of smart meters installations are estimated at GBP3.4 million
WMID ¹		
EMID ¹	128	-Future plan aims to deliver a moderate level of benefits through the use of smart meter - The total IT and data and communications company (DCC) costs associated with the installation of smart metering are GBP24.3 million
EPN ²	135	-The rate at which smart meters will be rolled out remains unclear. The completion date of 2020 is now one year later than originally planned, primarily to allow the electricity and gas retailers to agree data and system designs and complete their testing programmes. -Smart meters will be installed by meter operators on behalf of electricity suppliers. -The total costs of IT and DCC associated with the installation of smart metering are GBP67.2 million
SEPD	NA	NA

Note: 1- Data represents the total plan of Western Power Distribution plc which owns both WMID and EMID

2- Data represents the total plans of UK Power Networks which manages three licensed distribution networks EPN, South Eastern Power Networks PLC and London Power Networks PLC

Source: Ofgem; Global Transmission Research