



Department for
Business, Energy
& Industrial Strategy

Energy Emergencies Executive Committee Storm Arwen Review

Interim Report

February 2022



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Executive Summary

On the 26 – 27 November 2021, Storm Arwen brought significant and widespread severe weather to the UK, including exceptionally high windspeeds, icy conditions, and deep snow. As a result, just under 1 million households experienced power cuts, 59,101 of whom were without power for over 48 hours and 3,032 for a week or more. Storm Arwen was the worst storm in 10 years in terms of the combination of wind direction, speed and temperature.

From any incident with such a significant impact on the public, lessons must be learnt, and improvements made. On 09 December 2021 the Secretary of State for Business, Energy & Industrial Strategy, the Rt Hon Kwasi Kwarteng MP, launched a review of the electricity industry response to Storm Arwen. He set out three pillars for the review to address: System Resilience, Consumer Protection and Additional Response Support. This Interim Report aims to identify early key findings under these three pillars ahead of the publication of a full report detailing actions and delivery plans on 31 March 2022.

Great Britain has one of the most reliable energy systems in the world, but no electricity system is immune to power disruptions. The industry is well versed in preparing and responding to events such as storms, and to minimise the impact that such events might bring, the sector learns from previous events and incidents to build resilience. This review forms a critical part of that lessons learned process.

Storm Arwen was an exceptionally severe storm, not without precedent in recent decades, but the northerly wind direction made it unusual. Sustained wind gusts of 58 to 69mph were widespread, and Northumberland and Aberdeenshire both saw wind gusts of over 90mph and 100mph respectively.

When Storm Arwen was forecast, the networks stood up their storm response preparations in response to the severe weather warnings for wind. The atypical northerly wind direction caused more damage than wind gusts coming from the prevailing south-west would have done. As a result, Storm Arwen brought unacceptably long power cuts to thousands of households, especially those in rural areas.

The primary causes of damage were from flying debris, falling trees, and strong winds snapping poles and bringing down overhead lines which were also affected by ice build-up. The challenges presented by the prevailing conditions impeded the response by some Network operators and their ability to provide timely and accurate estimated times for restoration to customers, who struggled to communicate with their Distribution Network Operator as customer contact systems were overwhelmed.

The majority of faults occurred on lower voltage overhead lines individually serving only a small number of customers, making the restoration effort resource intensive. Mobile generators proved a critical part of the solution to reducing the length of power cuts and getting some customers back on supply before full repairs could be completed, although they are resource intensive to install and refuel at scale.

Customers found themselves not only without power but also in some cases without water and communications as other essential services lacked full resilience to power loss of this scale.

The Distribution Network Operators were supported in their efforts to restore power by industry-wide mutual aid agreements, resulting in engineers surging to areas most in need. Additional support for the wider storm response was co-ordinated and prioritised by local Strategic Coordinating Groups, who called on Military Aid when their own local resources were overwhelmed.

The Distribution and Transmission Network Operators and Energy Networks Association have engaged positively and constructively with this review to date working with the Department for Business, Energy & Industrial Strategy (BEIS) and other partners through the Energy Emergencies Executive Committee (E3C). Impacts and lessons for Transmission Operators will be a focus of the final review - references to Network Operators in this report refer to Distribution Network Operators unless otherwise specified. BEIS will look to the E3C and its Task Groups to coordinate the delivery and implementation of the resulting actions and recommendations of the final review, as they have successfully done following previous reviews.

Part 1: Context

The Weather: Storm Arwen 2021

On the 26 – 27 November 2021 Storm Arwen brought significant and widespread severe weather to parts of the UK, including exceptionally high windspeeds, icy conditions, and deep snow.

Yellow wind warnings were initially issued by the Met Office three days before the event, on 23 November. The first amber warnings, indicating a risk to life, damage to trees and buildings, and likely power, transport, and communications disruption, were issued at 09:30 on 25 November. The amber warnings were reinforced by a rare red warning for exceptional wind speeds down the east coast of Scotland and northern England issued on the morning of the 26 November.

The storm also resulted in very low temperatures and some significant snow accumulations, particularly in parts of the Pennines. Depths of up to 18cm were recorded in Derbyshire and 12cm at County Durham.

Storm Arwen was an exceptionally severe storm, not without precedent in recent decades, but with features that made it more unusual. Storm Ciara in 2020 was a storm of similar overall strength but with the wind blowing from the more typical westerly direction. Wind gusts of 80-100mph were seen in storms in 2005 and 2013/14, but on those occasions the wind was also south westerly or westerly. The 1953 storm shared the same northerly wind direction as Storm Arwen but saw slightly stronger windspeeds and occurred at a time of spring tides, making the impacts from flooding and storm surges considerably worse than was seen during Storm Arwen. On average, a severe gale day with a northerly wind direction, as seen in Storm Arwen, occurs roughly one day in every eight years.

Sustained wind gusts of 58 to 69mph were widespread, and Northumberland and Aberdeenshire both saw wind gusts of over 90mph and 100mph respectively. The windspeeds in the north-east were exceptional for the area, exceeding 92mph for several hours in exposed locations and peaking at 98mph, the strongest in this area since 1984.

Resilience of the Electricity Network

The electricity network in Great Britain is operated under licence by private companies, who follow the overall direction and high expectations set by government in maintaining high standards of resilience. While government and the Electricity Network Operators are well versed in preparing and responding to events such as storms, no electricity system is immune to power disruptions, particularly from a storm this size. The risk to the electricity network is highest during winter as extreme weather events, in particular high winds, are more likely. Preparations for winter are made annually to minimise the risk of disruption. In the event that

severe weather damages the electricity network, teams of engineers and field staff are deployed to assess, make safe and repair that damage, working in very challenging conditions to restore power as quickly as possible. These teams on the ground are an essential part of our electricity resilience and the high reliability of electricity supply in Great Britain is a testament to their work.

Electricity Transmission and Distribution Network Operators are directed by their licence conditions and are incentivised through regulatory price controls to build and maintain resilient networks – ensuring that Great Britain continues to have one of the most resilient electricity systems in the world. In practice, that means ensuring physical infrastructure is built to cost effectively minimise the risk of disruption caused by severe weather or other risks. There are industry guidelines covering technical specifications that are used to achieve these aims and, although they are not mandated standards, companies are funded to meet them through the regulatory price control and their progress is monitored by Ofgem. Over £1.5 billion has been invested in specific resilience measures since April 2015. Taken together, the suite of legislation and industry standards combine to drive improvements to resilience and minimise the risk of customer disruption. Ofgem, the independent regulator, has powers to review and enforce the conditions under which the networks operate, and they are conducting a separate but parallel review into the Network Operators' response to Storm Arwen.

Previous Severe Weather Lessons

The Energy Emergencies Executive Committee is a partnership between government, the regulator and industry which co-ordinates resilience planning across the energy industry. It ensures a joined-up approach to emergency response and recovery, identifying risks, processes and lessons to manage the impact of emergencies affecting the supply of gas and/or electricity to consumers in Great Britain. E3C has undertaken a number of reviews into major events to drive continuous improvement and sharing of best practice across the electricity industry. Electricity Network Operators also routinely review their own processes and performance following a major electricity disruption, as does Ofgem and the Department for Business, Energy & Industrial Strategy. Significant improvements and innovations have come out of past lessons learned exercises and the tradition of learning and implementing changes in response is well established across the industry.

Following lessons identified from the winter storms of 2013-14 (Annex B)¹, industry established the successful national 105 emergency number for reporting a power cut and implemented a series of actions designed to raise public awareness of what to do in the event of a power cut.

Network operators also implemented changes to NEWSAC, the industry mutual aid forum, following lessons learned in 2013/14. These included changing the trigger for the first NEWSAC meeting to be held on receipt of the weather forecast, rather than when the first

¹ Department of Energy & Climate Change, 2014 – Severe Weather - Christmas 2013: A review of Electricity Distribution Industry Performance – https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/287012/DECC_-_Festive_disruption_review_-_Final_2_.pdf

impacts were seen. During Storm Arwen NEWSAC met first on 25 November, ensuring networks had already exchanged information about their preparations and possible requirements before impacts were felt, increasing the immediacy of the response.

Part 2: Storm Arwen in Review

System Resilience

Industry Preparations for Storm Arwen

Ahead of winter 2021, Networks Operators carried out several activities in line with their established pre-winter checks and preparations. These included:

- Delaying major planned outages to increase network resilience.
- Undertaking tree cutting programmes in Autumn 2021 to clear trees from the vicinity of overhead lines.
- Undertaking inspections of substations and overhead circuits ahead of and throughout the winter period.
- Undertaking checks on the availability of key external resources such as helicopters, vehicles, mobile generators or staff with specialist skills.
- Ensure enhanced contingency arrangements are in place, to cover an often busy winter period, which includes having extra staff and resources on duty or stand-by.

The Network Operators are all in receipt of 10- and 5-day advanced weather forecasting, as well as detailed near term forecasts. From 24 November, the networks started to stand up their storm response preparations in response to the severe weather warnings for wind. This involved moving field teams into areas most likely to see impacts, and relocating critical resources, such as reconnaissance helicopters, into the most appropriate locations. The unusual wind direction was not a factor for all Network Operators response thresholds. When their higher wind speed thresholds were triggered by the Red Warning on the morning of 26 November, there was insufficient time to mobilise additional response beyond what was typical for the severe amber weather warnings.

The networks also held a NEWSAC Mutual Aid call on 25 November to highlight concerns and discuss potential resource requests and offers between networks before the weather had caused any impacts. As all network operators had severe weather warnings in their areas and were anticipating impacts, no resources were immediately available. This is in line with normal expectations.

Key Findings

- The forecast of northerly wind was unusual and put the network at more risk to tree damage. Network Operators and partners should review forecasting capabilities, alert levels and thresholds to ensure wind direction as well as speed and duration are taken into account to aid in effective severe weather planning.
- Network Operators should consider increasing the flexibility in their response structures to adapt to weather forecasts that change with limited warning.

Damage

Primary Causes of Damage

The impacts of Storm Arwen were felt across Great Britain's electricity system, with 13 of the 14 network licence areas being affected, although to differing extents. The only network licence area not affected was UK Power Network's London area.

In total, nearly 6,500 faults were recorded by the network operators, predominately to overhead line circuits. On the peak day of the storm, 27 November, Network Operators recorded 2,478 faults, 10 times more on average than a typical day. These faults on the electricity system resulted in just under 1 million customers being without electricity for between 3 minutes and 12 days. This equates to 3.2% of customers across Great Britain experiencing a power cut for more than three minutes as a result of Storm Arwen.

The damage inflicted by Storm Arwen on electricity networks was far more severe in some regions of Great Britain compared to others, with Scotland and Northern England, particularly along the Eastern Coast in regions such as Aberdeenshire, Northumberland and Yorkshire being the most affected.

The high number of fallen and broken trees was due to the high wind speeds from the north, which is not the prevailing wind direction for most of the UK. Trees grow to withstand winds coming from the prevailing direction, which in most cases is from the south-west. As a consequence, Storm Arwen brought down and uprooted/snapped more trees causing more faults on the electricity networks than similar wind speeds from the south-west would have done.

Storm Arwen caused relatively little damage to higher voltage lines, although this varied geographically, largely due to them being supported by more robust lattice towers, rather than wooden poles. The vast majority of faults occurred on the lower voltage lines. The main causes of failure were caused by:

- Trees falling directly onto the overhead lines/wooden poles.
- Flying debris bringing down/getting entangled in the overhead lines or on to equipment within the substations
- Strong winds snapping overhead lines or wooden poles that support them.
- Ice forming around the overhead lines causing them to break under the weight and additional resistance in the sustained high winds.

In some places underground cables are used in place of overhead lines. While more resilient to high winds, they pose other technical challenges, and the cost of undergrounding is between 2 and 20 times more expensive than overhead lines. The decision to invest in underground cables is driven by a balance of risk and costs that is regularly reviewed by operators and the regulator.



Courtesy of Scottish & Southern Electricity Networks

Photo 1: Overhead line damaged by fallen trees during Storm Arwen

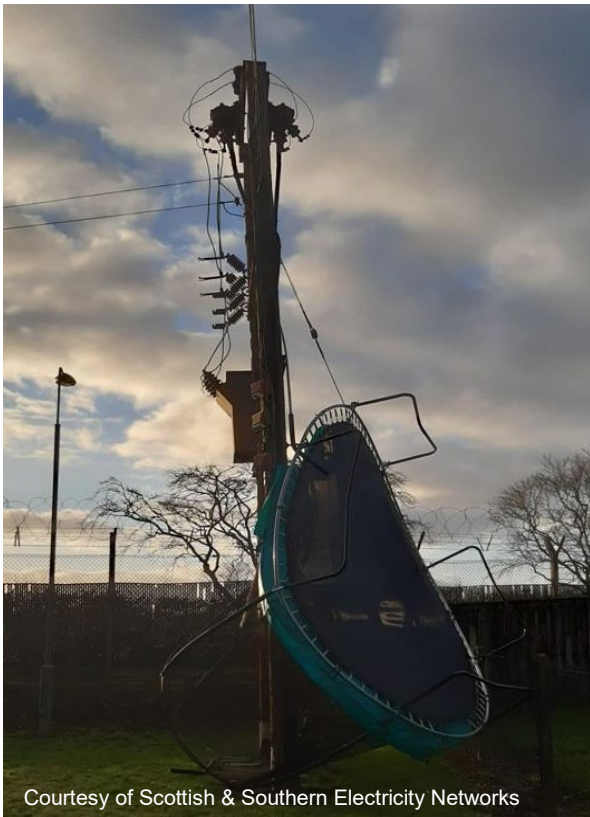


Photo 2 - Damage caused by Storm Arwen (from top left going clockwise: a) debris entangled in overhead line, b) snapped wooden poles, and c) ice/snow pulling overhead line down



Photo 3 – Examples of the difficulties faced by engineers trying to reach the sites of suspected damaged network assets

Impacts to Other Essential Services

In addition to damage to the electricity networks, other essential services such as Communications, Transport and Water, were all impacted by the storm. This was either directly, or as a result of the extended power outages impacting the delivery of these services, due to their reliance on electricity for operation.

The loss of public communications networks had minor negative impacts on some Network Operator's systems used to monitor and control some smaller electricity substations. All Network Operators have alternative backup resilient communication channels for operational communications to their larger key substation sites. They also have back-up mobile communications for some of their staff out in the field: as a result, the impact of the telecoms outages was limited to the convenience with which field engineers could communicate. In some areas, telecoms companies were able to support Network Operators with the deployment of their own remote on-site communications to aid the repair of power lines.

These communication network issues also resulted in some customers being unable to report their loss of power to the network operators. They would have also been unable to receive critical information about welfare support available in their area and estimated restoration times beyond radio broadcasting. The Department for Digital, Culture, Media and Sport, alongside Ofcom and telecommunication providers are undertaking a post-incident review to understand disruption to mobile networks and fixed-line services caused by the power outage following Storm Arwen. A key focus of this review will be to explore areas where power resilience can be improved for prolonged power disruption in the future.

In some cases, Network Operators were able to work with telecommunications providers to prioritise restoring communications services that lacked resilient back-up power. One challenge in some cases was the lack of shared emergency response contacts and plans between telecoms and electricity Network Operators which made quick coordination more challenging – these contact details have now been shared and such engagement is noted as best practice for both sectors. Network Operators also raised the concern that telecoms operators are not routinely included in Local Resilience Forums, which may also have impacted on the efficient prioritisation of support. The length of power disruption experienced during Storm Arwen was relatively rare, but raises a question for further exploration on the appropriate level of resilience essential services should have to prolonged power outages.

Key Findings

- In the electricity Distribution Networks, the primary causes of damage overall were from flying debris, falling trees, and strong winds snapping poles and bringing down overhead lines made more vulnerable in some places by ice build-up. The majority of the damage was to lower voltage parts of the network that serve fewer customers per line, thus increasing the resource required to restore customers. These are typically wood pole lines built to withstand lower and less sustained wind speeds and with less clearance from trees than higher voltage lines that carry power to many more people.
- Network operators could not fully assess the scale and volume of damage in the first 48 – 72 hours due to the poor conditions impacting access and safety and customer

telecoms outages. The use of helicopters and scouts with the skills to make safe and assess damage and estimate resources needed for repair was noted as good practice when safe to deploy. Network Operators should review their plans to enable them to quickly and safely assess the extent of network damage earlier in a severe weather event.

- Secondary impacts of the power disruption included disruption to communications, water and transport networks. Essential services should explore possible options to improve resilience to prolonged power outages.
- Telecommunications outages were a feature of the storm that impacted on field staff communications. Where network operators had resilient communications systems, these issues were mitigated. Network operators should continue to work towards a resilient communications system.

Restoration

Fault identification

Network operators have multiple ways of detecting faults on their networks but on the lower voltage networks they are particularly reliant on customer communication to help identify faults. Call centre congestion and telecommunications outages severely limited this source of information, leading to delays in identification of faults and therefore restoration.

Road blockages and snow/icy road conditions made it very difficult for field staff to visually assess the level of damage, and the prolonged period of high winds meant that the network operators' helicopters were grounded and unable to assess the damage from the air until 28 November.

Repair

While nearly 70% of faults were identified on 27 November, subsequent weather, high winds, and poor conditions hampered initial restoration. Repair works to overhead lines could not begin due to ongoing high winds making it too dangerous to carry out work at height. Fallen trees over roads and overhead lines caused access challenges for engineers who had to await specialist clearing crews or clear debris themselves before the repair work could start. Network Operators prioritised the safety of their personnel working in what were very difficult conditions.

Across the networks, over 6,300 engineers and specialists were deployed over the course of 12 days, including overhead line crews, tree cutting specialists and other specialist field staff for operational duties. Work continued long after all customer power was restored to rebuild system resilience and replace temporary repairs with permanent solutions.

The damage resulted in just under a million customers losing their electricity supplies for more than 3 minutes. In the most extreme cases a small number of customers, 40, were without electricity supplies for more than 11 days. Figure A below shows the number of customers off-

supply and without electricity broken down by electricity distribution licence area (see Annex A for geographic locations of licence areas).

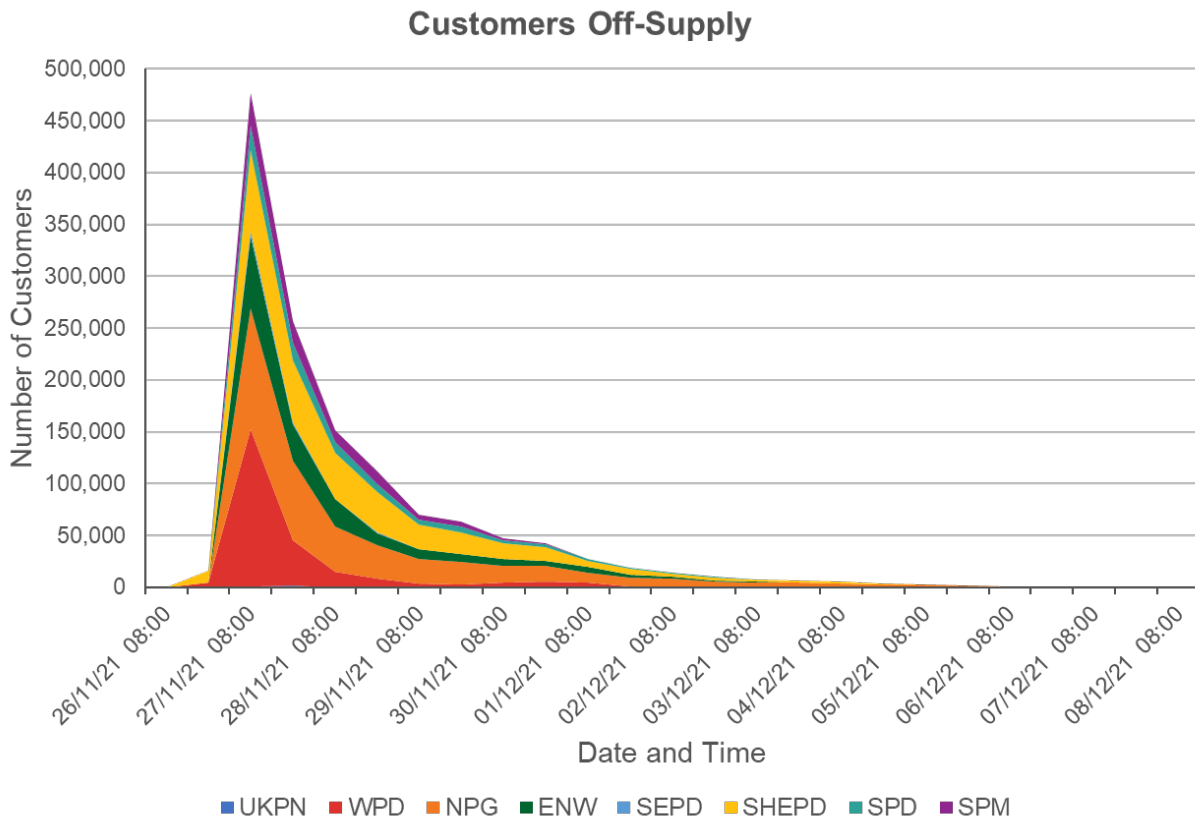


Figure A: Customers off supply as a result of Storm Arwen

In many cases the faults caused by Storm Arwen across the 3-day peak period (26-28 November) were complex with a significant number of overhead lines experiencing multiple faults across one section of the network. This was not always apparent until one fault on the section of line had been repaired, meaning new faults continued to be identified, resulting in estimated restoration times being extended.

By the morning of the 29 November 84.1% of customers had their supplies restored. By afternoon of 03 December, this rose to 99.0% of customers that had been impacted, but it took a further five days to restore the remaining 1% of customers.

In total, 59,101 were without electricity supplies for more than 48 hours. Of these, over 11,369 were without electricity supplies for five days and just over 3,000 customers who were off supply for more than a week.

Figure B below provides a breakdown of the number of customers off supply for more than 48 hours.

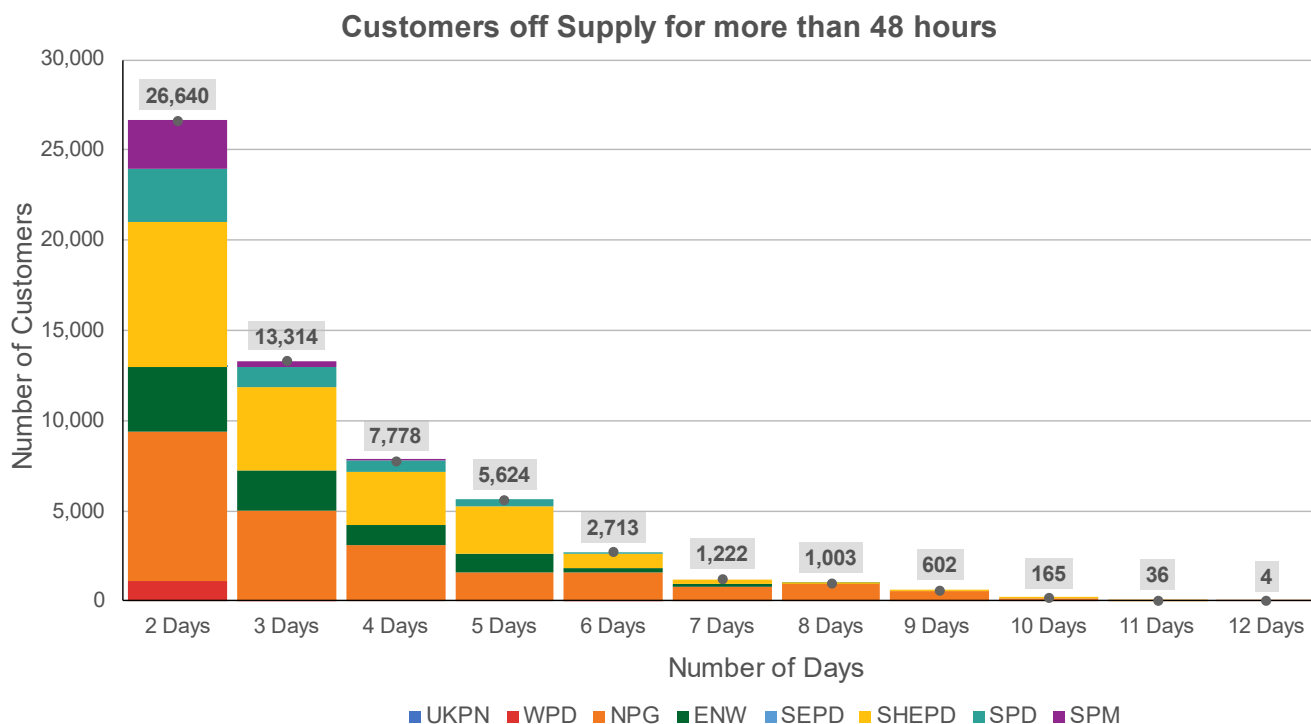


Figure B – Length of electricity disruption experienced by customers off for more than 48 hours by Network Operator.

Network Operators have a range of tools to restore customers as quickly and safely as possible. During Storm Arwen, as customers remained off for extended periods, network operators had to implement short-term solutions such as the deployment of mobile generators, to provide electricity to regions affected by particularly complex faults requiring lengthy restoration time and effort. By 28 November, 253 mobile generators were in use distribution networks, rising to 664 generators by the 03 December. While an effective short-term solution, safely providing and refuelling enough generators for all of those affected by Arwen for a prolonged period would not be possible, therefore prioritisation of these was essential.

Key Findings

- Mobile generators are a critical part of the solution to reducing the length of power cuts and getting customers back on supply before full repairs can be completed. There are limitations to the value and practicality of their use. The number accessible to Network Operators and the strategies for resourcing and deploying enough generators should be reviewed by the industry.
- Storm Arwen brought unacceptably long power cuts to some households, especially those in rural areas. Strategies to reduce the length of time a small number of customers remain off supply for following severe and widespread power disruption need to be enhanced.

Consumer Protection

Communication: Method

Network Operators began pro-active messaging from Wednesday 24 November to the public via social media and websites, including the creation of dedicated Storm Arwen webpages. Messaging detailing the Network Operator alert levels and preparedness included:

- Webpages with advice on what customers should do in a power cut, promoting the 105 emergency number, and details for how vulnerable customers can sign-up for the Priority Services Register (PSR) if eligible.
- Specific bulletins and emails to key stakeholders.
- Media statements and social media posts.
- Texts, voice messages, and/or emails to customers to raise awareness.
- Notification emails to industry, government, and regulatory partners.

The Energy Networks Association also issued tweets highlighting the 105 emergency number for customers to use to contact their relevant Distribution Network Operators and activated the storm banner to point customers to areas where they could find further information.

The scale of the storm and damage, resulted in high call and contact volumes, which challenged technical and resource capacities for some Network Operators as shown in Table 1. Where possible calls were rerouted, and additional staff deployed to answer calls. For example, SSEN were able to readily re-route calls for outages in Scotland to their lesser impacted Southern England offices due to the configuration of the organisation.

All affected Network Operators experienced periods where available call centre staff were overwhelmed by the number of calls, leading to extended call wait times, and abandoned calls. The volume of contacts and calls also overwhelmed the capacity of call management systems as well as other digital contacts points, such as websites, for Northern Powergrid. Northern Powergrid's website became unresponsive from 21:15 on 26 November until 12:30 on 27 November which is likely to have increased call volumes and waiting times. Northern Powergrid deployed additional web nodes and a queue-based system to better manage website traffic as the response progressed.

Network Operators learnt a number of lessons about improving customer communications following the 2013/14 storms, most of which have had a beneficial impact on communication strategies (see Annex B). Two of the actions, however, bear repeating in light of the customer experience during Storm Arwen. Network operators will need to review their telephony platforms again to ensure customers are not force disconnected and stress test their overall customer contact system capacity against an updated reasonable worst-case scenario.

Network Operator		Total calls during Storm Arwen taken reporting or in relation to a power cut	Average calls per day during Storm Arwen taken reporting or in relation to a power cut	Maximum calls in one day during Storm Arwen	Average number of staff per day taking customer helpline calls during Storm Arwen	Minimum average time to answer by an agent (s)	Maximum average time to answer by an agent (s)	Total abandoned calls during Storm Arwen	Percentage increase of the maximum calls in one day during Storm Arwen compared to average	Percentage increase of maximum call agents receiving calls during Storm Arwen compared to an average weekday
Electricity North West		77,223	9,653	32,297	15	7	2,054	8,177	(+)3,570%	(+)194%
Northern Powergrid		64,337	8,042	21,955	35	7	6,408	27,859	(+)2,800%	(+)46%
Western Power Distribution		98,745	12,343	58,594	47	2	565	14,848	(+)2,504%	(+)55%
UK Power Networks		2,016	1,008	1,459	42	2	4	5	(+)12%	No sig. change
Scottish Power Energy Networks		137,813	17,227	55,594	37	4	948	33,171	(+)3,871%	(+)64%
SSEN*	North (Scotland)	105,390	13,174	39,759	22	0	2,808	14,100	(+)15,803%*	(+)817%*
	South (England)	18,468	2,309	5,549	14	0	597	2,791	(+)362%*	(+)189%*

*SSEN show a larger increase in calls taken and cell centre staffing during Storm Arwen due to their relatively lower call volumes and resourcing in a normal weekday due to their operating area.

Table 1 – Customer call volumes and response times over disruption by Distribution Network Operator.

Communication: Content

As well as the technical challenges, accuracy of the information provided on estimated times for restoration was variable. From 27 – 29 November, all Network Operators with customers off supply were communicating expected restoration times to customers to be between 1- 2 days. These times were reasonably accurate for the majority of customers. However, some customers were still off supply 10 or 11 days later in some areas. It wasn't until 02 – 03 December when Network Operators started to provide more realistic expected restoration times for these customers.

In particular, Northern Powergrid did not share final expected restoration times with Government or customers until 01 December, at which time they estimated restoration would be complete by 03 December, this date then continued to be pushed back one day at a time for many customers for several days. All Northern Powergrid customers were restored on the 09 December.

The scale of storm damage, the remote locations, and the critical need to ensure the safety of their staff, all impacted Network Operators ability to determine accurate expected restoration time, affecting customers ability to make informed decisions about their welfare.

Unless the level of uncertainty in fault restoration assessments can be reduced earlier in an event, despite challenging weather conditions, restoration estimates offered to customers and

response partners is a matter for judgement and careful calibration. The event has shown that estimates that prove to be overly optimistic are more damaging to consumer confidence and behaviour than more conservative assessments, and future communication strategies will need to take this into consideration.

Key Findings

- Estimated times for restoration were optimistic given the scale and complexity of faults as well as the difficulty in adequately assessing fault data. The way in which these moving estimates were communicated to customers made it difficult for households and Local Resilience Forums to make informed decisions about their welfare. Network Operators' customer communication strategies should be reviewed.
- Wait times for some customers to contact their network operator were unacceptably high, suggesting that more needs to be done to manage customer communications effectively during severe events, including providing additional surge and technical capability to customer contact centres and sharing best practice models. The 105 emergency number proved the successful embedding of lessons since 2013/14, although some related lessons from the 2013/14 review should be updated and repeated.

Welfare Support

Network Operators have comprehensive arrangements in place to ensure that customers affected by supply interruptions receive appropriate welfare support. Whilst subject to certain requirements relating to the information which should be provided to customers in vulnerable situations during supply interruptions, all six Network Operators seek to fulfil further expectations in terms of what welfare support should be delivered. This has been demonstrated in previous disruptive events, for example as noted following the [Winter 2013/14 storms](#), and for Storm Arwen.

Under the Civil Contingencies Act (2004), network operators are required to liaise with Local Authorities, Strategic Coordinating Groups (SCGs), and third parties (such as the British Red Cross), to share information about vulnerable customers and work together to provide welfare support.

Provisions made during Storm Arwen include the following:

- Setting up welfare units to central locations within affected communities.
- On average 434 generators were in use on the network every day from the 26 November to 8 December, supplying temporary generation for community hubs, welfare centres and customers.
- Distributing over 193,000 hot meals/meal vouchers.
- Organisation and payment for alternative accommodation for over 1,800 households.
- Network Operators identified especially vulnerable customers via the Priority Services Register (PSR), which is a free and voluntary system to ensure that welfare support can be targeted to those that need it most.

Network Operators provided welfare support to all customers, prioritised in the first instance to the most vulnerable customers. As the length of time without power extended, and especially given the cold weather conditions and the loss of other essential services such as water supply and communications, Network Operators moved to provide all remaining customers off supply with the full level of welfare support. Many more households were offered alternative accommodation than accepted the offer. Network operators noted a reluctance from many customers to leave their homes, either due to uncertain restoration times, preferring to stay with family and friends, staying with pets, or protecting their homes especially after storm damage.

The timescales in which welfare provisions were offered to customers varied significantly across the different network operators with hotels being offered to all customers from the start of disruption by Northern Powergrid. SSEN focussed on reimbursing hotels for vulnerable customers from 26 November and expanding this offer to all customers from 29 November. There is no standard guidance or timescale to provide this none-obligated welfare. The lack of consistency in approach resulted in different outcomes for some customers depending on geographic location rather than specific customer needs.

Table 2 below illustrates the different welfare approaches taken by the Network Operators to Storm Arwen. The Network Operators who deployed most welfare support to customers correlates with customers experiencing longer restoration times.

Network Operator	Average generator units in use per day during outages	Average amount of temporary generation (in kVAs) in use per day during outages	Total hot meals distributed to customers off supply	Total meal vouchers or equivalent distributed to customers off supply	Total customers (i.e. households) that were in alternative accommodation	Total PSR Customers (i.e. households) that were in alternative accommodation	
Electricity North West	73	2,061	13,696	39	142	65	
Northern Powergrid*	139	14,722	22,180	0	348	0*	
Western Power Distribution	36	3,274	0	0	0	0	
UK Power Networks	2	250	0	39	0	0	
Scottish Power Energy Networks*	157	6,905	0	64,174	346	0*	
SSEN	North (Scotland)	38	2,052	93,242	0	345	181
	South (England)	11	1,890	0	17	0	0

*Northern Powergrid and Scottish Power Energy Networks do not differentiate between total and PSR customers for alternative accommodation and figure is only where they were booked via an external provider and does not include reimbursements.

Table 2 – Welfare provided to customers over disruption by Distribution Network Operator Licence Area.

Key Findings

- Network operators offer a variety of welfare support to their customers that is beyond any regulated requirement – as a result this offer can vary in scope and timeframe. Network operators also vary in their communication of available welfare support alongside estimated restoration times which may affect customer uptake. A degree of consistency delivered via enhanced industry guidance could mitigate against substantial differences in support offered.

Compensation

Network Operators communicated compensation arrangements to customers following the storm via information available on their websites, social media, letters or by providing a helpline and e-mail contact. There was no consistency in how quickly and effectively these arrangements were communicated to customers, which may be an area for identifying best practice guidance.

Levels of Compensation

Ofgem, the independent regulator for the UK's energy networks, sets Quality of Service Guaranteed Standards that all Network Operators must meet. These service levels establish rules on how quickly network operators must restore power, and on compensation payments to consumers if the standards are not met. Network Operators pay compensation in line with these service levels. Compensation payments are issued by cheque in line with regulations and to avoid data protection risks associated with requesting and handling customer bank details.

According to Regulation 7 of Ofgem's Guaranteed Standards, Storm Arwen is classified as a Category 2 Storm. Electricity customers affected by Storm Arwen are therefore entitled to £70 compensation for the first 48 hours they were without power, and a further £70 for each 12-hour period thereafter. The Standards specify that customers are eligible to compensation up to a cap of £700, however Network Operators voluntarily agreed to remove the cap for this incident to allow customers affected by Storm Arwen to claim for every day they were without power.

In recognition of the exceptional impact of the storm, three network operators, SP Energy Networks, SSEN and Western Power Distribution, increased the compensation payments to all affected customers received as a gesture of goodwill, on top of those required by Ofgem's Quality of Service Guaranteed Standards. Northern Powergrid is issuing additional goodwill payments to customers on a case-by-case basis that exceeds the amount required by the Guaranteed Standards. The average compensation payment issued by network operators as of 24 January was £316.13 per customer who was eligible. The amount of additional compensation, above that set out in the Guaranteed Standards, varies per operator.

Some network operators also offered compensation to customers for additional incurred expenses. For example:

- Electricity North West provided reimbursements for customers who used additional fuel sources, food deliveries or booked themselves into accommodation if they could not access Electricity North West's own support.
- Northern Powergrid provided welfare support reimbursement payments to customers who were still off supply on 29 November or later, for reasonably incurred costs, such as alternative accommodation, food or where a customer arranged their own back-up generation.
- SP Energy Networks have committed to paying additional reasonable compensation or claimed reimbursement costs by the end of January 2022.
- SSEN North (Scotland) accepted expenses claims from customers covering items such as £15 per day food allowances, hotel accommodation and other reasonable expenses.

Mechanism for receiving Compensation

87,935 compensation payments are due to be paid in relation to disruption caused by Storm Arwen. The majority of customer compensation payments (63,760/ 72.5%) were issued before Christmas Day, totalling just over £18.1 million. 77,501/88.1% of these payments had been issued as of 24 January, totalling just over £24.5 million. A remaining 10,434 payments were outstanding as of 24 January.

On 6 December, the Secretary of State wrote to network operators and Ofgem, setting his clear expectation that Network Operators should make every effort to deliver any remaining compensation to affected customers swiftly and without delay, considering the burden making a detailed application might place on impacted customers. 27.5% of payments were not issued by Christmas, indicating unacceptable issues for customers with the compensation payment system and process.

All Network Operators moved to issue compensation automatically for all customers following Storm Arwen. For those customers whose details they did not possess, Network Operators relied on sourcing this from energy suppliers. There were barriers in place to receiving this information from other routes, such as via Local Authorities. The need to identify and verify appropriate customer details was cited as the primary cause for payments that were not issued by 25 December 2021.

Key Findings

- Network Operators confirmed to government in response to a letter from the Secretary of State that they would be automatically issuing compensation payments instead of waiting for customer applications on the 08 and 09 December, but not all payments were made before Christmas 2021. The lack of customer details, normally accessed through claims by impacted customers or via their energy suppliers, was the main challenge. New processes should be established to ensure payment of compensation to affected customers occurs without delay.

- Some customers were not aware of their compensation entitlement and method of claiming. Network Operators should review their communications strategies to ensure this information is pro-actively provided in a timely manner during disruption events.
- All network operators have paid or are in the process of paying the statutory compensation required by Ofgem to their impacted customers, but most have also offered (differing) levels of additional compensation based on the extended length of disruption. There is no guidance or agreed industry standard on such goodwill payments, leading to varying outcomes for customers dependent on licence area.
- During Storm Arwen network operators voluntarily agreed to lift the £700 cap that normally applies to Network Operators compensation obligations to customers who experience long term power disruption. The application of this cap on compensation should be reviewed, given the impact on customers of extended power cuts.

Additional Response Support

Industry Mutual Aid Arrangements

NEWSAC is an industry organised mutual aid agreement between the electricity network operators across the UK. During events of system stress or an emergency response, such as Storm Arwen, NEWSAC organises and deploys field staff, specialists, equipment, and spare assets to areas most in need.

During Storm Arwen, the industry prioritised resources initially across the whole of Great Britain to the areas most affected by the storm. Network operators from Northern Ireland, Republic of Ireland and the Isle of Man provided resource alongside the British network operators who had experienced less issues due to Storm Arwen, releasing further staff such as overhead line crews and equipment, to aid impacted areas.

Over the course of Storm Arwen, 630 additional staff were deployed through NEWSAC to support the repair and restoration work over 13 days. This is an increase of over 11% of staff deployed.

The specialist skillset for such roles required to repair faults and aid restoration of customers off-supply is finite, therefore NEWSAC's effective activation and mobilisation reduced restoration timelines significantly and ensured that existing crews were able to appropriately rest during an intense working period in difficult conditions.

Key Finding

- The NEWSAC process was extremely successful in ensuring prioritisation of specialist technical resource across the whole of the UK, to areas that needed it most, and led to a reduction in restoration times for many customers. Consideration of whether this principle could be used in other areas to aid future responses may be useful, such as expanding the scope to include contact centre or welfare support staff or bring in other utilities.

Local Response

The operational response to major incidents, such as Storm Arwen, is coordinated at the local level through Strategic Coordinating Groups or Tactical Coordination Groups which are the response mechanisms of Local Resilience Forums in England and Wales, and Regional or Local Resilience Partnerships in Scotland in accordance with the Civil Contingencies Act 2004. Blue light services, Local Authorities, Utilities, welfare partners and other relevant organisations take part in regular meetings at tactical and strategic levels to direct and prioritise resources and identify further risks throughout the response. Local Resilience Forums and Partnerships are responsible for the civil contingencies response to any incident in their geographic area; utilities companies such as electricity network operators are part of this response, but not responsible for the overall multiagency coordination.

Preparation

Network Operators and Local Authorities maintain regular engagement with one another throughout the year on contingency plans, which they also exercise regularly in accordance with their duty to prepare for emergencies under the Civil Contingencies Act (2004).

Some evidence suggests that face-to-face exercising of response plans has decreased as a result of Covid-19. Network Operators also indicated that exercising may not have covered events as long lasting as the power disruption caused by Storm Arwen, which may have resulted in a lack of familiarity with the challenges posed by extended loss of power.

Response

Local Resilience Forums and Partnerships stood up their response mechanisms for Storm Arwen, and major incidents were declared in Northeast Scotland on 29 November, Durham and Darlington on 01 December, Cumbria Constabulary on 26 November, and Northumbria County Council on 03 December. Local response timelines and escalation thresholds varied between regions, and early evidence suggests there were different levels of preparedness, coordination, and situational awareness present in different parts of Great Britain.

In all areas, Local Authorities required specific data detailing customers impacted from the Network Operators in order to target their support in the most efficient way possible. In some cases, this level of data was more detailed than anticipated by Network Operators, which posed logistical challenges to sharing the information in a timely manner. There were additional barriers to information sharing in both directions such as the important need to safeguard personal information. Taken together, these challenges surrounding efficient information sharing impacted the effectiveness of the local response. Network Operators and Local Authorities with a pre-established understanding of the data were better able to effectively coordinate.

Early evidence suggests that in some areas there was confusion over the division of responsibilities for welfare provision between Network Operators and the relevant Local Authority, and what information was needed to support that provision. The Strategic Coordinating Group (SCG) is responsible for coordinating welfare support to communities impacted by major events supported by the Network Operators where support is required during power disruption.

Adequate resourcing within a Network Operator to support the SCG was noted as best practice, particularly embedding sufficient staff within the local response structures. Where such resource was stretched, the ability of the SCG and Network Operator to work effectively together to manage the impacts of the storm was compromised.

Key Findings

- The level and format of information required from Network Operators by Local Resilience Forums and Partnerships to aid the coordination of the welfare response proved challenging for some to provide in a timely manner, reducing the effectiveness of the local response. Agreements between each Local Resilience Forum and Partnership and relevant Network Operator on the information needed, and timescales

in which these can be provided should be sought in advance and factored into system planning.

- Early evidence suggests that there was a lack of shared understanding in some areas between Network Operators and local partners of roles and responsibilities during severe weather events involving major electricity disruption. Regular engagement during BAU times mitigated this to some extent, but a broader discussion is required to promote a clear and common understanding of response and welfare support resources and responsibilities during major disruptive events.

Central Government Response

The Department for Business, Energy & Industrial Strategy is the Lead Government Department for Energy disruption, therefore coordinated the response from a Central Government level. The Government responded to the disruption swiftly once the extent of the damage and likelihood of extended restoration times was established. BEIS undertook frequent engagement with the Network Operators, using established strong relationships and processes, seeking assurance that all was being done to restore power as quickly as possible.

BEIS engaged with the Scottish Government throughout the response to discuss impacts and any coordination necessary given the high impact in Scotland. Other engagement included with the Department for Levelling Up, Housing and Communities and the main affected Local Resilience Forums to understand in detail the issues they were facing.

Industry Reporting

During Storm Arwen, Network Operators provided updates to Government on their restoration progress, including customer support arrangements and communications. It was notable that SSEN provided particularly clear, consistent, and proportionate information to Government during Storm Arwen, as similarly found in the Christmas 2013 disruptive event.

Industry reporting to government began on the evening of the 26 November with data being received from Network Operators at 08:00, 12:00 and 16:00 each day, including over the weekend of the 27 and 28 November. From 04 December this was reduced to twice daily reports, due to the slower pace of customer restorations and the smaller number of impacted customers.

In the reports, BEIS asked Network Operators to provide accurate information on the number of customers off supply and those that had been restored. Network operators were also asked to provide a number of metrics around their restoration and welfare efforts, in addition to specifying any further support they required, including any from government. While much of this was part of established reporting arrangements, the Secretary of State for Business, Energy & Industrial Strategy, his ministerial team, and officials made additional requests for information. This was necessary to aid understanding of the challenges facing Network Operators as restoration times continued to be pushed back. The timeframe in which this data was required and additions to information needed throughout the response led to some inconsistencies and delays in the data being provided to BEIS.

Network Operators were stood down from reporting once it was apparent that there were no impacts in their area, or that everyone had been restored.

Military Aid to the Civil Authorities

Safety priorities mean that only suitably qualified engineers can work on electricity network infrastructure. Military resource cannot directly support the restoration of electricity supplies, but at the request of Local Resilience Forums and Partnerships can provide logistical and welfare support to major incident responses as a last resort. Military aid should only be sought where the local response, including industry, is unable to provide the desired support itself, is unable to seek mutual aid from another region or provided by central government, or where a commercial option is unavailable. Local contingency plans for long term power disruption include relevant guidance to inform decision making in light of the need to exhaust other available sources of support before requesting Military Aid.

Between 02 December and 08 December, 306 military personnel were deployed in Northumbria in England, and the Grampians in Scotland. All units were deployed within 24 hours of the Ministry of Defence receiving a Military Aid request from the Local Authority. Military personnel conducted welfare checks and delivered humanitarian support to disconnected customers, including performing proof of life checks on vulnerable customers.

Key Findings

- Network Operators reported specific data indicating restoration progress to the Department for Business, Energy & Industrial Strategy at regular intervals throughout the response, with the data requiring changing as the response progressed. Providing accurate data within this timeframe and with short notice for additional information was challenging for the Network Operators and led to inconsistencies and revisions being needed. The Department for Business, Energy & Industrial Strategy has reviewed the data required in consultation with industry to agree a more streamlined and accurate process in advance of future storms.
- While military aid is not able to assist in the restoration of the electricity network, the military were valuable in providing welfare support to the areas where it was requested, and this plus other logistical areas where military support is effective when all other options have been exhausted should be reflected in response plans.

Next Steps

A final report is due to be submitted to the Secretary of State at the end of March 2022. In the interim, this review will continue to work on the issues identified above to identify lessons learned and recommendations for the prevention and management of future power disruption events.

Annex A - Distribution Network Operators



Annex B: Summary of the Severe Weather-Christmas 2013 DECC Report of Action Completion

Action	Status	Outcome
F1: Network Operators will hold a workshop to share their approaches and discuss best practice on weather forecasting and escalation triggers	Complete	<p>ENA produced a Good Practice Guide for receiving and reacting to weather forecasting</p> <p>DNOs reviewed their own procedures and all organisations now receive of a 10 day summary forecast, as well as the 5 day more detailed forecast</p>
C1: Network Operators to ensure their telephony platform does not force disconnect callers	Complete	DNOs reviewed their telephony and confirmed their platforms will not force disconnect callers.
C2: Network Operators to hold a workshop to consider the development of a “reasonable worst case scenario” for call volumes	Complete	The Electricity Task Group (ETG) held a workshop for DNOs on 19 March 2014 to develop a national ‘reasonable worst case scenario’ for a number of different potential disruptive events.
C3: Network Operators actively review and stress test their telephony systems to ensure adequate call receiving capacity / transmission to manage extreme events	Complete	<p>DNOs reviewed their telephony systems against their own worst case scenarios developed under action C2.</p> <p>All DNOs stress tested their systems, with different loading scenarios.</p>
C4: Electricity Northwest to review its telephony platform capacity and processes to ensure that it is meeting customer expectations in the context of the reasonable worst case scenario for call volumes	Complete	Electricity North West altered its telephony platform in line with customers’ expectations and to ensure that emergency safety issues and vulnerable customers are identified on entering the automated system and redirected to a customer service representative as a priority.
C5: UK Power Networks should ensure appropriate capacity upgrades are identified and implemented	Complete	UK Power Networks (UKPN) identified and implemented appropriate capacity upgrades prior to the publication of DECC’s Severe Weather Christmas 2013 report.
C6: Network Operators will hold a workshop to share practices to social media engagement and	Complete	This action was taken forward by the Communications Task Group (CTG) of E3C.

Action	Status	Outcome
<p>Network Operators will each develop a social media engagement and resource strategy and stress test this for use during disruptive events to ensure effective use of available tools / systems</p>		<p>Each DNO developed a social media strategy, based around the recommendations from the Good Practice Guides.</p> <p>DNOs ensured the resilience of their social media communication in a number of different ways specific to their own operating mode.</p>
<p>C7: Northern Powergrid shall submit a data flow change request to Genserv on behalf of the other Network Operators to initiate the release of customer contact details for use during disruptive events. Network Operators shall ensure that, in advance of winter in October 2014, they have, where available, obtained the telephone contact details of customers from energy suppliers.</p>	<p>Complete</p>	<p>All energy suppliers made available land line and mobile telephone contact details of customers they hold, to all DNOs in September 2014, so that they can be used during disruptive events to improve direct communication with customers.</p>
<p>C8: Network Operators will review and test their processes and systems to ensure that they are capable of allowing field staff to efficiently and effectively provide timely and accurate updates to network customers contact centres.</p>	<p>Complete</p>	<p>All DNOs completed their review and confirmed their readiness.</p>
<p>C9: Network Operators will develop and implement a common framework that clarifies standards expected around the identification and provision of a restoration time to customers and its subsequent proactive update in the manner agreed with the customer.</p>	<p>Complete</p>	<p>ETG produced a Good Practice Guide which sets minimum standards for the provision of supply restoration information to its customers during emergency events.</p> <p>DNOs made changes to their processes to incorporate the best practice that was not yet undertaken within their existing framework.</p>
<p>C10: Network Operators should take steps to identify the levels of recognition amongst customers, and address any gaps using appropriate communications</p>	<p>Complete</p>	<p>DNOs undertook differing initiatives in order to improve the customer awareness of their organisation.</p>

Action	Status	Outcome
strategies, including making sure that, whilst a national power outage number is developed, each Network Operator's customers are aware of the correct phone number to call in the event of disruption to power supplies.		It is recognised that this is an on-going action that requires continuous effort by the industry.
N1: Network Operators (led by the Energy Networks Association) will develop a single national number for customers to call during a power disruption.	Complete	<p>ENA has established a Single Emergency Number (SEN) Project Board with associated task groups to take this project forward</p> <p>The project is due for completion in April 2016.</p> <p>To note: action completed after summary report.</p>
N2: ENA to produce implementation plan for single national number agreed with Network Operators and by DECC.	Complete	<p>The Project Initiation Document (PID) was approved by the Project Board on 21 May 2014.</p> <p>An Invitation to Tender was issued and Ofcom have been engaged regarding the case for the three digit number</p> <p>To note: action completed after summary report.</p>
R1: Network Operators will hold a workshop to share their resource and contractor management strategies.	Complete	<p>ETG held a meeting on 24 April 2014 and discussed their overall management strategies.</p> <p>ETG have developed a forward looking model where the adequacy of resources can be reviewed from time to time.</p>
R2: Network Operators will review their contracting arrangements and their dependence on them to ensure the rapid availability of adequate resources to deliver resilience particularly over extended holiday periods.	Complete	Each DNO reviewed its resourcing arrangements, looking both at total numbers of staff and the division between direct labour and contractors.

Action	Status	Outcome
R3: Network Operators will review their contact centre resourcing arrangements to ensure adequate and trained capability is available under the reasonable worst case scenario.	Complete	All DNOs have reviewed their contact centre resources, with a number significantly augmenting the pool of available call takers.
R4: UK Power Networks will review the resourcing strategy of its contact centre to ensure it has sufficient flexibility to upscale during a disruptive event.	Complete	UKPN implemented a Vodafone/ Redwood storm platform to be able to take customer calls from anywhere within the building.
R5: The NEWSAC Mutual Aid protocol should be reviewed and if appropriate, updated to ensure it is adequately proactive, and criteria around strategic prioritization are clear.	Complete	<p>The new wording of the NEWSAC documents was formally approved in September 2014.</p> <p>The new wording of the NEWSAC documents was formally approved in September 2014.</p> <p>The NEWSAC Review Group proposed improvements to the NEWSAC core documentation</p>
M1: Energy Networks Association to co-ordinate a campaign to raise awareness of the role of the Network Operator, complementing individual awareness raising efforts by each Operator.	Complete	<p>Individual DNOs carried out a significant amount of work within their regions to inform customers about their role, including general safety messaging and their services to domestic and business customers.</p> <p>ENA launched and publicised the Single Emergency Number with a national awareness campaign.</p>
M2: Energy Networks Association to develop a scalable, proactive national media engagement strategy for use during disruptive events with a national impact.	Complete	ENA put together Incident Protocols which are a guide for those involved in handling the communications around an incident and the relationships between ENA, its members and other stakeholders.
M3: DECC to produce a clear scope and requirements for reporting during disruptive events, setting out roles of organisations, and information required.	Complete	A reporting requirements template, together with DNO preparations reporting template and incident/ reporting flow chart was finalised and circulated at ETG and relevant stakeholders on 6 June 2014

Action	Status	Outcome
W1: Network Operators will hold a workshop to share strategy and approach to welfare provision and deployment learning and identify best practice.	Complete	<p>All DNOs attended workshops which took place on 23 May and 18 June 2014.</p> <p>A Good Practice Guide has been published on Welfare provision and all DNOs have internally reviewed their current processes in light of the Good Practice Guide to ensure they meet the requirements</p>
W2: Network Operators will review arrangements with the British Red Cross and/ or similar providers ensuring where appropriate contracts exist.	Complete	All DNOs reviewed their arrangements with welfare providers. Where necessary, DNOs introduced new arrangements to improve welfare support.
W3: Network Operators should consider establishing framework agreements with local service providers to supplement existing welfare arrangements.	Complete	All DNOs reviewed their arrangements with welfare providers. Where necessary, DNOs introduced new arrangements to improve welfare support.
G1: Network Operators will review their internal processes for notifying eligible customers of goodwill payments, and ensuring these are paid efficiently	Complete	DNOs reviewed their internal processes for notifying eligible customers of goodwill payments and the payment mechanisms through which these are made.
MA1: DECC will pass feedback on engagement challenges into the appropriate body of central Government	Complete	DECC held discussions with DCLG on effective engagement with local responders during a disruptive incident

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