Electricity Act 1989 (Sections 36, 37, 62(3) & Schedule 8) Town and Country Planning Act 1990 (Section 90) and the Electricity Generating Stations and Overhead Lines (Inquiries Procedure)(England and Wales) Rules 2007

Application by SP Manweb PLC, dated 2 December 2009 for consent under Section 37 of the Electricity Act 1989 to install and keep installed a 132kV overhead electric line connection from the proposed Llandinam Wind Farm to Welshpool Substation (the "Application")

Proof of Evidence

Of

Dr Andy Beddoes

On

Network Design and Need

SPM/NETWORK/POE/BEDDOES/001A

1. QUALIFICATIONS AND EXPERIENCE

1.1 I am a Lead Design Engineer with ScottishPower Energy Networks ("**SPEN**"), responsible for the design of the SP Manweb plc ("**SP Manweb**") distribution 132kV and 33kV systems in North and Mid Wales. I hold a Bachelor of Engineering Honours Degree, B.Eng (Hons) in Electrical & Electronic Engineering from the University of Manchester Institute of Science and Technology (UMIST – 1991 to 1994).

1.2 I hold a PhD in Electrical Engineering and Electronics from UMIST. I am both a member (MIET) and registered Chartered Engineer (C.Eng) of the Institution of Engineering and Technology.

1.3 Between 1994 and 1997 I was employed by EA Technology, Capenhurst, Chester, as a Post Graduate Research Associate. This was part of a collaborative 3 year DTI / EPSRC research programme between EA Technology and UMIST. My Ph.D was completed within these three years.

1.4 Between 1997 and 2007 I was employed by EA Technology as a Research Engineer and then Senior Consultant. My final role at EA Technology, as a Senior Consultant (2002 to 2007), led me to undertake various 400kV power system analysis, design and network planning activities for large Power Transmission companies such as China Light and Power (CLP) in Hong Kong and Transco in the Philippines. This involved working locally with the engineers and discussions with the respective industry regulator and governments in establishing the necessary future network projects and reinforcement schemes, in order to secure the future capability and security of supply for their respective Transmission networks.

1.5 I joined ScottishPower in 2007 and have held 2 engineering posts within the company. The first of these positions was as Design Engineer and the second as Lead Engineer since 2011. The key activity of both of these roles is as a professional engineer working in

the System Design Group carrying out system design and network planning of the 132kV and 33kV Distribution Networks using a range of analysis and modelling tools.

1.6 As well as the key electrical system design activities, the role also involves collaboration and interaction with colleagues in other departments such as Regulation, Commercial, Environmental Planning, Asset Engineering, Major Projects and Operations and Control.

1.7 This proof of evidence, which I have prepared and provided for this inquiry is true and has been prepared and is given in accordance with the guidance of my professional institution; I confirm that the opinions expressed are true and professional opinions.

2. SCOPE OF EVIDENCE

2.1 The purpose of my evidence is to explain the need case for the proposed 132kV overhead electric line connection from the Llandinam Repowering Wind Farm to the SP Manweb distribution network at Welshpool Grid Substation (the "**Llandinam Scheme**"). My evidence also deals with network design, this being the electrical capability, suitability and performance of the SP Manweb Distribution Network. I attach at Appendix 1 a document to help explain some of the Basic Principles of Electric current and voltage. It may assist the reader of my evidence to have first read Appendix 1.

2.2 The structure of this evidence is as follows:

2.2.1 **Section 3** of this proof sets out the relevant duties on distribution network operators (DNOs), including statutory duties under the Electricity Act 1989 (CD/COM/023), responsibilities as holder of a Electricity Distribution Licence and the relevant electrical network design and security standards adhered to (Engineering Recommendation P2/6).

2.2.2 **Section 4** of my proof details the existing 132kV and 33kV distribution network in the Llandinam area, the demand and generation connected and the particular characteristics of the network.

2.2.3 **Section 5** of my proof outlines the need for the Llandinam Scheme. Power system modelling scenarios and results are presented.

2.2.4 In **Section 6** of my proof I set out the various strategic options that are available to meet this identified need. The option that meets the identified need (as outlined in Section 5) ensuring an efficient, co-ordinated and economical system of electricity distribution, is described.

2.2.5 **Section 7** of my proof describes the Llandinam Scheme.

2.2.6 **Section 8** outlines the main conclusions of this evidence.

3. DUTIES ON DISTRIBUTION NETWORK OPERATORS (DNO)

Introduction

3.1 This section introduces the principal statutory and licence duties and obligations which SP Manweb has to comply with as a DNO.

Distribution Network Operators

3.2 To supply and distribute electricity within an area, an operator is required to hold an Electricity Distribution Licence. SP Manweb is the holder of an Electricity Distribution Licence for the Cheshire, Merseyside, Shropshire, North and Mid Wales area, and as such is the DNO for that area.

Electricity Act 1989

3.3 SP Manweb has a number of statutory duties including:

3.3.1 under Section 9 of the Electricity Act 1989 (CD/COM/023), to develop and maintain an efficient, co-ordinated and economical system of electricity distribution;

3.3.2 again under Section 9, to facilitate competition in the supply and generation of electricity;

3.3.3 under Section 16 of the Electricity Act 1989 (CD/COM/023), to give a supply of electricity and provide a connection to an owner or occupier of any premises by means of electric lines, plant or both; and

3.3.4 also under Section 16 and in addition to SP Manweb giving an electricity supply, SP Manweb has a duty to continue to give such a supply.

3.4 SP Manweb also has other statutory duties, including those related to the environment and the installation of lines and cables (Section 38 and Schedule 9 of the Electricity Act 1989 (CD/COM/023)). These are outlined and considered by other witnesses (See proof of Mr Leavy (SPM/COMPANY/POE/ LEAVY/002A), and the Review of

Needs Case and Alternatives, Volume 5 of the Updated ES (CD/SPM/ES/01) (the "Alternatives paper").

Licence Requirements

3.5 Electricity Distribution Licences are granted subject to various standard conditions. SP Manweb must adhere to these licence conditions, thus demonstrating compliance with the various design and operational standards placed upon it for the design and operation of its Distribution Network.

3.6 These Standards and conditions play a fundamental part of SP Manweb's approach in the design and provision of an electrical connection and have formed an integral part of considering the provision of a connection for the Llandinam Repowering Wind Farm. Such conditions further serve to ensure that a Licensee complies with the necessary responsibilities placed upon it as a Licence holder.

3.7 Condition 12 of the licence (Appendix 2) requires the licensee (SP Manweb), on receiving a request to make a connection, to consider the request as given under Section 16A of the Act (Electricity Act 1989) (CD/COM/023). This was outlined earlier in 3.3.

3.8 Condition 12 provides that on receiving a request for connection then the Licensee (SP Manweb) will enter into an agreement outlining the works required to provide that connection.

3.9 Condition 21 of the licence (Appendix 2) requires compliance with the Distribution Code which is designed so as to permit the development, maintenance and operation of an efficient, co-ordinated and economical system for the distribution of electricity.

3.10 Condition 24 of the licence (Appendix 2) places a responsibility on a Licensee to plan and develop the distribution system in accordance with a standard not less than that set out in Engineering Recommendation P2/6 (ER P2/6), 'Security of Supply' (Appendix 3).

3.11 ER P2/6 is an industry standard document that is produced by the Energy Networks Association for system planning and assessment of network security of supply. The document sets out the minimum levels of security required for distribution networks and is classified in ranges of Group Demand. This document has been adopted by DNOs to ensure consistency across distribution networks with regards to network security of supply.

3.12 Condition 45 of the licence (Appendix 2) requires all licensees who operate transmission or distribution systems to report annually to the industry regulator, Ofgem, on their performance in maintaining system security, availability and quality of service.

3.13 The distribution system must therefore have sufficient flexibility to maintain supplies in the event of planned outages for repair, maintenance, refurbishment and for forced outages due to faults on the system. ER P2/6 thus encompasses these requirements.

3.14 Guidance Note 1 to the Distribution Code (Appendix 4) however states that the security of supply requirements, as set out in ER P2/6, do not apply to the supply connection of a Customer.

3.15 In the context of this evidence ER P2/6 does not therefore apply to the Llandinam Scheme. However, compliance with ER P2/6 to maintain system security, availability and quality of service for the overall network ‘group’ remains as within Condition 24.

Conclusions

3.16 SP Manweb has statutory duties, as holder of a Distribution Network licence for the Cheshire, Merseyside, Shropshire, North and Mid Wales area, to give a supply of electricity to an owner or occupier of any premises by means of electric lines, plant or both.

3.17 The various requirements and duties imposed upon SP Manweb, as holder of an Electricity Distribution Licence, are such as to ensure an efficient, co-ordinated and economical system of electricity

distribution is both provided for new networks and maintained for existing networks.

3.18 SP Manweb is required to facilitate competition in the supply and generation of electricity under section 16 of the Electricity Act 1989 (CD/COM/023).

3.19 SP Manweb must comply with the Distribution Code, and the licence obligations placed within it, when operating its network.

3.20 SP Manweb is also required to offer connections under section 16 of the Electricity Act 1989 (CD/COM/023).

4. THE EXISTING 132 KV AND 33KV NETWORK

Introduction

4.1 This section introduces the existing 132kV and 33kV network and the area in which the current Llandinam connection is provided.

4.2 The ratings of the relevant SP Manweb Distribution Network circuits are provided along with an outline of key Distribution Network topology, demand and embedded generation within the group and the characteristics and dependencies of the network.

4.3 This section also outlines the current need for network reinforcement, via a 3rd Legacy to Oswestry 132kV circuit, to provide the necessary level of P2/6 network security.

The existing 132kV network

Interface with National Grid

4.4 Electricity is primarily generated at large power stations and supplied to customers through an integrated high voltage transmission system operated in England and Wales by National Grid Electricity Transmission plc ("NGET"). The national high voltage transmission system operates at 400kV and 275kV.

4.5 The lower voltage distribution systems are operated by DNOs. As a DNO, SP Manweb takes supplies from NGET at Grid Supply Points ("GSPs"). These supplies are converted from 400/275kV to lower voltages and SP Manweb then distributes electricity around its area at 132kV, 33kV and at lower voltages to customers' premises. The distribution system consists primarily of overhead lines, cables, transformers and substations. It is this lower voltage SP Manweb Distribution Network into which the Llandinam Repowering Wind Farm will connect.

Geographical extent of the area / network

4.6 The relevant parts of the SP Manweb 132kV distribution network are shown geographically in (Appendix 5) and schematically in (Appendix 6). Reference to these will aid understanding of the written information presented in this proof of evidence.

4.7 For the Legacy / Oswestry 132kV distribution system, the SP Manweb GSP interface with NGET is at Legacy GSP substation via two 400/132kV 240MVA supergrid transformers. The whole 132kV network is referred to as the 'Legacy / Oswestry Group'.

4.8 The Legacy / Oswestry group supplies energy to a geographical area which encompasses Legacy, Wrexham, Marchwiel, Oswestry, Whitchurch, Welshpool and Newtown. This area comprises over 130,000 customers. The extent of this area is illustrated in Appendix 5.

Physical Network

4.9 Appendix 6 shows the topology (diagrammatic representation of the connectivity) of the 132kV network for the Legacy / Oswestry group. This shows that there are eleven[1] 132/33kV Transformers which feed the electrical demand of the group.

4.10 Appendix 6 shows that from Legacy to Oswestry there is a double 132kV circuit. This circuit is identified, in accordance with SP Manweb naming convention, as the BK line and supplies energy to four of the eleven 132/33kV Transformers in the group[2].

4.11 The BK overhead line from Legacy to Oswestry is a double circuit construction of type PL16. It was originally built in 1956 with 175mm² Lynx ACSR[3] conductor with a rated temperature of 50°C.

[1] Legacy Local T1 (60MVA) & T2 (45MVA), Brymbo T1 (60MVA), Wrexham T1 (60MVA), Marchwiel T1 (60MVA) & T2 (60MVA) and Whitchurch T1 (45MVA), Oswestry T1 (45MVA), Oswestry T2 (60MVA), Welshpool T1 (45MVA) and Newtown T2 (30MVA).
[2] Oswestry (T1 and T2) Welshpool (T1) and Newtown (T2).
[3] Aluminium Conductor Steel Reinforced (ACSR)

4.12 In 1998 the BK overhead line from Legacy to Oswestry was refurbished with the phase conductors being replaced by Poplar 200mm² AAAC[4] conductor with a rated temperature of 75°C. The rating of each of the two circuits is presented in Table 1 - BK overhead line ratings.

4.13 Circuits within the SP Manweb Distribution Network have associated Summer and Winter ratings. These ratings are such as to ensure that the temperature of the conductor does not exceed its thermal rating. If this rating is exceeded, then there is a risk of failure of the conductor or, for overhead lines, risk of clearance distances between spans being exceeded where conductors would sag to a level lower than the required minimum height clearance.

4.14 As ambient temperatures for the UK in the Winter are typically colder than Summer, Winter circuit ratings are therefore slightly higher than those in the Summer. Furthermore, as the connection of generation to the network offsets the electrical demand, the worst case from a network power flow perspective is Summer minimum demand conditions and maximum generation output. This is made more onerous due to the typically lower Summer circuit ratings.

MVA Rating[5]	**Winter**	**Summer**
Intact	130	115
First Circuit Outage	144	127
Second Circuit Outage	154	136

Table 1 - BK overhead line ratings

[4] All Aluminium Alloy Conductor (AAAC)
[5] Intact refers to a sustained rating 24hrs a day, First Circuit Outage rating is for a 90 Day duration and Second Circuit Outage of for a 24 hour only rating.

4.15 The Legacy to Oswestry circuit also has significant 132kV underground cable sections at either end. The ratings of these are presented in Table 2 - Cable ratings.

MVA Rating[6]	Winter	Summer
Intact	121	103
Cyclic	136	118

Table 2 - Cable ratings

4.16 In addition to the BK line as outlined above, the remaining 132kV circuits south of Oswestry (named EJ, BU and MB) are also of relevance as they connect the Llandinam and general area to the south west of Oswestry to the SP Manweb Distribution network.

4.17 The EJ overhead line from Oswestry to Welshpool is a single circuit of predominantly "Trident" wood pole construction (some of it is wood pole Portal construction, this typically being of a double wood pole construction with a single steel cross arm with conductors suspended underneath the steel cross arm on insulators). It was originally built in 1960 (wood pole Portal sections) with the wood pole Trident sections built in 1980. The line is 27km long with a 175 mm² Lynx ACSR conductor with a rated temperature of 50°C.

4.18 The BU overhead line from Oswestry Grid to Newtown Grid is also a single circuit of predominantly Portal wood pole construction (some wood pole Trident). It was originally built in 1960 (wood pole Portal sections) with the wood pole Trident sections built in 1980. The line is 46km long with a 175mm² Lynx ACSR conductor with a rated temperature of 50°C.

4.19 The MB overhead line from Carno connects to the BU line (at tower number BU263). The MB overhead line is also a single circuit and is

[6] Intact refers to the “Sustained” rating from CRATER (Cable Rater) software with Cyclic rating a 2 in 24hr rating.

wholly of Trident wood pole construction. It was built in 1996 with 175mm² Lynx ACSR conductor with a rated temperature of 75°C and is 26km in length.

4.20 The ratings of the BU and EJ circuits are the same. These ratings are shown in Table 3 – BU and EJ overhead line ratings.

MVA Rating	Winter	Summer
Intact	111	89
First Circuit Outage	123	99
Second Circuit Outage	132	106

Table 3 – BU and EJ overhead line ratings

4.21 The rating of the MB circuit is shown in Table 4 – MB overhead line rating .

MVA Rating	Winter	Summer
Intact	136	119
First Circuit Outage	149	131
Second Circuit Outage	162	141

Table 4 – MB overhead line rating

Principal areas of demand and generation

4.22 Appendix 5 shows that the general area around Llandinam is near to Newtown, with Weshpool further North East towards Oswestry. The EJ and BU 132kV circuits from Oswestry therefore serve to provide the necessary 132kV connection of the area around Llandinam to the SP Manweb 132kV Distribution Network.

4.23 Appendix 6 shows that the BK line supplies energy to four of the eleven 132/33kV Transformers in the group, these being Oswestry (T1 & T2) Welshpool (T1) and Newtown (T2).

4.24 Appendix 6 shows that the Legacy and Whitchurch 132/33kV Transformers, although not directly connected to the BK 132kV Legacy to Oswestry circuit, are connected via interconnection on the 33kV network (illustrated by the green arrows) through the Oswestry 132/33kV Transformers to the BK circuit.

4.25 The BK 132kV Legacy to Oswestry circuit therefore provides support for the load group which is encompassed by Legacy (T1 and T2), Oswestry (T1 and T2), Welshpool (T1), Newtown (T2) and Whitchurch (T1).

4.26 The maximum winter demand for this group is 199.11MVA[7]. Both winter and summer maintenance maximum demands are illustrated in

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[7] Monday 06th December 2010, 17:00

4.39 Table 5 - Legacy / *Oswestry Winter and Summer Maximum Demands*.

Group	Maximum Demand (MVA)	
	Winter	Summer Maintenance Period
Legacy / Oswestry (Legacy / Oswestry / Whitchurch / Newtown / Welshpool)	199	146

Table 5 - Legacy / Oswestry Winter and Summer Maximum Demands

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4.52 *Table 5 - Legacy / Oswestry Winter and Summer Maximum Demands* represents the maximum expected electrical demand which the Legacy / Oswestry group is expected to experience when

the demands for all connected customers are summated. Winter demand is the maximum half hourly demand experienced over the annual period, typically occurring in the winter season for the UK.

4.53 The Summer maintenance period demand is the maximum expected demand for the period from 1st April to end of October (UK Daylight saving). Maintenance works on the SPEN Distribution Network are typically scheduled within this clock change period since the level of electrical demand is typically lower than the Winter annual maximum demand period.

Characteristics of the network

4.54 The SP Manweb distribution network is an interconnected network. SP Manweb is the only UK DNO to run a fully interconnected distribution network, with key benefits being a more 'resilient' network to system outages and interruptions. Appendix 7 illustrates this interconnected philosophy which was first introduced by P. Stowell in 1958[8].

4.55 Appendix 6 shows that although there is interconnection at 33kV for the Legacy, Oswestry, Welshpool, Newtown and Whitchurch areas of demand, the BK 132kV Legacy to Oswestry circuit serves as the main arterial route in the supply of energy for this group, to both local and more widely spread customers.

4.56 As a result of an outage of one of the existing Legacy to Oswestry 132kV BK circuits, the distribution network will experience network overloads beyond that of the network's capability. As outlined in 3.10, SP Manweb must ensure that the Distribution Network complies with ER P2/6 (Appendix 3) as a minimum. This overload represents a non-compliance with ER P2/6 and places the supplies to customers at risk. The ER P2/6 non-compliance is caused by the general load growth within the group over the years.

[8] Manweb Distribution, by P. d'Eyncourt Stowell, Journal of the Institute of Electrical Engineers, Issue 37, Pages 15-21, January 1958.

4.57 SP Manweb has a time limited Ofgem derogation from ER P2/6 for the Legacy / Oswestry group. The introduction of a 3rd Legacy to Oswestry 132kV circuit resolves this ER P2/6 non-compliance and secures network security for the group. Consent for the 3rd Legacy to Oswestry circuit was granted pursuant to section 37 of the Electricity Act 1989 (CD/COM/023) in May 2013 following a public inquiry.

4.58 Appendix 6 shows that the EJ and BU 132kV circuits (supplied via the BK 132kV Legacy to Oswestry circuit) provide connection of the Newtown[9] and Welshpool area to the SP Manweb Distribution Network.

4.59 The group outlined in 4.55, and supplied by the BK 132kV Legacy to Oswestry circuit, encompasses some 85,000 customers. These range from small domestic customers to industrial customers. Four embedded generators are also connected to the network. These are listed in Table 7 - Existing Connected embedded generation.

4.60 Of the embedded generation connected, one is connected to the 132kV network (the remaining generators are connected to the underlying 33kV network). A future embedded generator is planned to connect to the 132kV network in 2016. This is illustrated in Appendix 6 and Table 7 - Existing Connected embedded generation.

4.61 A wide range of other customer types are connected to the SP Manweb Distribution Network. For the Legacy, Oswestry and surrounding Whitchurch area these range from:

4.61.1 Public lighting;

4.61.2 Gas, Water and Telecoms infrastructure;

4.61.3 Offices, shops and factories; and

4.61.4 Schools, GP Surgeries, hospitals and RAF bases.

[9] Newtown being in the locality of the Llandinam area.

The existing 33kV network

Geographical extent of the network

4.62 The relevant parts of the SP Manweb 33kV distribution network are shown geographically in Appendix 5 and schematically in Appendix 6. Reference to these appendices will aid understanding of the written information presented in this proof of evidence.

4.63 It is seen from the appendices listed in 4.62 that the 33kV Distribution Network for the Legacy / Oswestry group radiates out from the main 132kV Distribution Network.

4.64 Appendix 5 and Appendix 6 show that the extremities of the 33kV Distribution Network reach the Llanidloes and Llandinam areas.

4.65 These extremities of the 33kV Distribution Network are some 20km from the nearest 132kV infeed at Newtown Grid, 38km from the 132kV infeed at Welshpool Grid and some 78km from the main 132kV infeed at Legacy Grid.

Physical Network

4.66 Appendix 6 shows the layout of the 33kV network for the Legacy / Oswestry group. For the Llandinam area, there is seen to be some degree of 33kV interconnectivity for those connected customers via a 33kV 'ring' from Newtown Grid. The current Llandinam wind farm is connected to this circuit at 33kV. The total length of this 33kV ring is 45km.

4.67 Appendix 6 also shows that there is a further 33kV ring between the Newtown and Welshpool Grid substations. The total length of this 33kV ring is 55km. The remaining 33kV connected embedded generator (at Tregynon) is located and connected in this area, 8km from Newtown Grid substation.

4.68 Appendix 6 also shows that there is a further ring between Welshpool and Oswestry Grid. This ring is 70km in length and, although it does not have any direct connected generation, it serves to provide some level of interconnectivity at 33kV between the Oswestry, Welshpool and Newtown Grid Substations and the 132kV infeeds illustrated Appendix 6.

4.69 Appendix 5 shows that the majority of the 33kV network around the Newtown and Welshpool area is overhead line construction. Due to the evolution and larger extent of these lower voltage (33kV) networks, a range of conductor types is typically found.

4.70 Typical circuit intact ratings for existing SP Manweb 33kV overhead lines are of the order of 21MVA (Winter) and 20MVA (Summer) with a typical conductor size of 150mm^2

Principal areas of demand and generation

4.71 Appendix 5, and sections 4.66 to 4.69, show and outline the relevant 33kV network for the Llandinam and surrounding areas. It is shown that these smaller areas, connected at 33kV, obtain their connection with the upstream 132kV network at the Newtown and Welshpool Grid substations via 132/33kV transformers.

4.72 The maximum winter demand for these 33kV sub-groups can be ascertained from the demands of the infeeding 132/33kV transformers at Newtown and Welshpool Grid substations. The winter maximum and summer minimum demands are illustrated in Table 6 below.

Group	Maximum Demand (MVA)	
	Winter Max[10]	**Summer Min**[11]
Newtown Grid 132/33kV T2 & Welshpool Grid 132/33kV T1	59.4	21.3
Generator	**Generator Output (MVA) at identified period**	
	Winter Max[10]	**Summer Min**[11]
Penrhuddlan & Llidartywaun (Connected at Llandinam 33kV)	27	14.2
Mynydd Clogau (Connected at Tregynon 33kV)	13.7	8.9

Table 6 Newtown / Welshpool Winter and Summer Maximum Demands

[10] Group Max Demand date - 02/02/2011 17:30
[11] Time at National Grid GB Min timestamp – 07/08/2011 05:30

4.73 Table 6 also illustrates the respective output of the locally connected embedded generation at 33kV for this area at the time of maximum and minimum demand.

Characteristics of the network

4.74 As outlined in 4.54, the SP Manweb 132kV Distribution Network is run as an interconnected network, providing a more resilient network. This philosophy applies to both the 132kV and 33kV SP Manweb Distribution Network.

4.75 The Llanidloes and Llandinam areas, shown in Appendix 6 and discussed in 4.66 and 4.66, are interconnected via a 33kV circuit ring.

4.76 This 33kV ring is connected to the 132kV Distribution Network at Newtown via a 132/33kV transformer (30MVA rating) and provides the electrical supply to the local area.

4.77 A further 33kV ring, as discussed in 4.66, provides a further level of 33kV interconnection of Newtown to Welshpool. A 132/33kV transformer (60MVA rating) provides the electrical supply to the surrounding Welshpool area.

4.78 The group supplied by the Newtown and Welshpool 132/33kV Grid transformers encompasses some 38,000 customers. Given the more rural area that this 33kV network covers, these customers are typically small domestic, farming and local villages and communities in addition to the towns of Newtown and Welshpool with some localised industrial loads.

4.79 The Newtown / Welshpool 33kV network, discussed in 4.75 to 4.78, has two embedded generators (Mynydd Clogau and Llandinam) connected on the 33kV network. These are shown in Table 7 - Existing Connected embedded generation.

4.80 Table 7 - Existing Connected embedded generation below lists all the existing embedded generation connected in the overall Legacy / Oswestry group, and illustrates future embedded generation connections. Table 7 - Existing Connected embedded generation excludes Llandinam Repowering Wind Farm and so shows the expected connected embedded generation levels before the connection of Llandinam Repowering Wind Farm.

Generator	**Energy Source**	**Installed Capacity (MVA)**	**Connection Voltage (kV)**
Mynydd Clogau	Wind	14.5	33
Llandinam (Penrhyddlan)	Wind	14	33
Llandinam (Llidiartywaun)	Wind	20	33
Carno A & B	Wind	43.2	132
Carno 2	Wind	15.6	132
Total		**107.3**	

Future (Tir Gwynt)	Wind	30	132
Total (Including future)		(137.3)	

Table 7 - Existing Connected embedded generation

The third Legacy to Oswestry circuit

132kV reinforcement required

4.81 Reinforcement of the 132kV network is necessary in order to establish the required ER P2/6[12] (Appendix 3) level of security of supply to some 85,000 customers within the Legacy / Oswestry area.

4.82 As highlighted above, the existing BK 132kV Legacy to Oswestry circuit plays a pivotal role in providing supply security, which not only serves just the local Oswestry area, but the wider geographic area of the Welshpool, Newtown and Whichurch areas. The area affected by this reinforcement need is illustrated in Appendix 6.

4.83 The Legacy to Oswestry 132kV BK overhead line serves as the main arterial route in the supply of energy for the Legacy, Oswestry, Welshpool, Newtown and Whitchurch areas.

4.84 The two significant contingencies that can therefore affect this load group are the loss of either of the existing Legacy to Oswestry 132 kV BK circuits.

ER P2/6 non-compliance – First Circuit Outage

4.85 Computer modelling of the system, loaded with the winter maximum demand, shows that a First Circuit Outage (FCO) of the Legacy to

[12] ER P2/6 Table 1 – Demand Class D requires all of the group demand to be maintained in the event of a circuit outage

Oswestry BK Circuit 1 results in the overload shown in Table 8 – Overload for Legacy / Oswestry group for an FCO of Legacy to Oswestry Circuit 1.

From	To	Nominal Voltage (kV)	Rating (FCO) MVA	Power Flow (MVA)	Loading (%)
Legacy (Circuit 2)	Oswestry (Circuit 2)	132	136	143	105.1

Table 8 – Overload for Legacy / Oswestry group for an FCO of Legacy to Oswestry Circuit 1

4.86 ER P2/6 (Appendix 3) requires, for this level of network demand, that all the group demand be immediately supplied.

4.87 Table 8 – Overload for Legacy / Oswestry group for an FCO of Legacy to Oswestry Circuit 1 shows that this ER P2/6 FCO requirement cannot be achieved due to the circuit overload of the remaining Legacy to Oswestry 132kV circuit.

4.88 The Legacy / Oswestry group currently has a time limited[13] derogation from ER P2/6, granted by Ofgem on 7 March 2011, for non-compliance with Licence Condition 24 (Appendix 2). This derogation has subsequently been granted, by Ofgem on 30th September 2013, with an extension until 30th September 2015.

ER P2/6 non-compliance – Second Circuit Outage

4.89 The ER P2/6 (Appendix 3) requirements for the occurrence of a Second Circuit Outage (SCO) assume that the first circuit outage is an arranged or maintenance outage. As such it would not occur at

[13] 30th September 2013

winter peak loading since the arranged outage would have been scheduled during the summer time when the daily loading maxima are less.

4.90 The worst case scenario for the Legacy / Oswestry group would be a loss of both the existing 132kV Legacy to Oswestry BK Circuits (1 & 2).

4.91 Under this SCO scenario, for the loss of both Legacy to Oswestry 132kV circuits (one circuit out for planned maintenance and the other an unplanned outage or fault), modelling shows that voltage collapse occurs. This arises as it is no longer possible to support the network demand through the remaining connected network.

4.92 With this scenario, the network group would go into cascade failure and effectively collapse. This would place approximately 85,000 customers in the group 'off supply' with load recovery problematic. This network area is illustrated in Appendix 6 and shows that the Newtown / Welshpool area would be particularly affected due to its location at the extremities of the network.

4.93 In order to return supplies to customers, large areas of the 33kV network would need to be disconnected in order to establish supplies to others. Some areas, principally those at the extremities of the network, would have to remain off supply until restoration of one of the 132kV BK circuits could be established and/or deployment of mobile generation.

Cause and timing of the need

4.94 The ER P2/6 (Appendix 3) non-compliance is caused by the general load growth within the group over previous years. The very low levels of security contribution offered by the generation connected in the group leads the Legacy / Oswestry group to be non-compliant with ER P2/6.

4.95 The margin of ER P2/6 non-compliance for the Legacy / Oswestry group will increase further as the load increases and so the non-compliance needs to be resolved as soon as possible. As the demand in the group continues to increase, the risk to connected customers of a loss of supply will also increase.

4.96 In order to resolve the failure to comply with ER P2/6, additional network capacity is required in the Legacy / Oswestry group to help support the network and provide mitigation against an outage of the existing Legacy to Oswestry 132kV circuits.

Resolution of the ER P2/6 non-compliance

4.97 The most economic and efficient means of mitigation of the ER P2/6 (Appendix 3) non compliance is achieved with the introduction of an additional 132kV circuit between Legacy / Oswestry.

4.98 Consent for the 3rd Legacy to Oswestry 132kV circuit was granted in 2013. Construction of the circuit is expected to be completed in mid 2015. This will resolve the ER P2/6 non-compliance and provide future secure capacity in a developing area.

Conclusions

4.99 The BK 132kV Legacy to Oswestry circuit is pivotal in providing security of supply to both locally connected customers and, due to the networks interconnectivity and large geographical area, more widespread customers in the Whitchurch, Wrexham, Newtown and Welshpool areas.

4.100 In addition to the BK circuit, the remaining 132kV circuits south of Oswestry (EJ, BU and MB) are also of relevance as they connect the Llandinam and general area to the south west of Oswestry to the SP Manweb Distribution Network.

4.101 The overall Distribution Network in the Legacy / Oswestry area has up to approximately 140MVA of wind generation connected (across the 132kV and 33kV network).

4.102 For the Llandinam area, there is some degree of 33kV interconnectivity via a 33kV 'ring' from Newtown Grid. The current Llandinam 34MVA wind farm is connected to this circuit at 33kV. This location is close to the edge of the existing SP Manweb Distribution Network.

4.103 The introduction of the 3rd Legacy to Oswestry 132kV circuit provides for up to three 132kV circuit infeeds into the Oswestry area. When taking into account the loss of one of these circuits under N-1[14] outage conditions, then two 132kV infeeds will remain (compared to only one circuit before the introduction of the 3rd Legacy / Oswestry 132kV line). This is a significant improvement of the group's security of supply since all of the required demand can be sustained on these circuits without risk of their overload.

[14] N-1 signifies a fault or an arranged Circuit outage.

5. THE NEED FOR THE LLANDINAM SCHEME

Introduction

5.1 This section introduces and explains the need for the Llandinam Scheme and that additional network infrastructure is required in order to accommodate the connection of the Llandinam Repowering Wind Farm to the SP Manweb Distribution Network.

The need for the Llandinam Scheme

Statutory Duties

5.2 As outlined in Section 3, and further explained in the evidence of Mr Leavy (SPM/COMPANY/POE/LEAVY/002A) and in the Alternatives paper at section 1 (Volume 5 of the Updated ES (CD/SPM/ES/01)), there are various statutory duties placed upon DNOs, these include the duty under Section 16 of the Electricity Act 1989 (CD/COM/023), to give a supply of electricity to an owner or occupier of any premises by means of electric lines, plant or both on request.

Background

5.3 It is under these duties that SP Manweb, upon receipt of a request for connection to the SP Manweb Distribution Network from CeltPower Ltd, was asked to provide a new stand alone connection for the Llandinam Repowering Wind Farm (grid reference 304746, 283700) for up to 90MVA of capacity. The location of the Llandinam Repowering Wind Farm is illustrated in Appendix 8.

5.4 CeltPower Ltd is planning to replant the existing Llandinam wind farm, located in Powys, Mid Wales. There are currently 102 Mitsubishi turbines which provide an installed generation capacity of up to the sites' agreed combined 34MVA connection, as listed in Table 7 - Existing Connected embedded generation.

5.5 It is planned to decommission the existing 102 Mitsubishi turbines and replace them with 42 new turbines. The application for repowering was submitted in May 2008.

5.6 In April 2013, following stakeholder feedback, CeltPower Ltd revised the proposal to continue to decommission the existing 102 turbines but reduce the new installation to 34 new turbines from the original 42.

5.7 The current connection arrangements for the existing Llandinam wind farm to the SP Manweb Distribution Network are illustrated in Appendix 6. This shows the Llandinam 33kV SP Manweb substation, with two points of connection (Llidiartywaun – 20MVA and Penrhuddlan – 14MVA).

5.8 The customer, CeltPower Ltd, owns the two 33kV overhead lines (each approx 4km long) between the Llandinam SP Manweb substation and the customer's substation at Bryn Dadlau.

5.9 This 33kV connection provides Llandinam wind farm with an unfirm[15] connection to the 33kV SP Manweb Distribution Network in order to export the agreed 34MVA of contracted generation capacity.

33kV capacity issues

5.10 It was discussed earlier in 4.66, as illustrated in Appendix 6, that the Llandinam area is connected on a 33kV ring from Newtown Grid substation. The ring is 45km in length with the Llandinam 33kV substation 1/3rd and 2/3rd along the ring from Newtown Grid. This can be seen geographically in Appendix 5.

5.11 The shorter of the two 33kV looped circuits back to Newtown Grid, from Llandinam 33kV substation, will have a tendency to carry more power from the connected Llandinam generation than the longer circuit route. This is due to the circuit's relatively lower circuit

[15] An 'unfirm' connection is a connection which, under first circuit outage conditions, would require the customer to either disconnect or constrain their contracted levels of demand and/or generation under such conditions. A simple example would be a single circuit to a connected customer which would be classed as 'unfirm' since it is a single connection.

impedance between Llandinam and Newtown Grid (compared to the longer circuit having a subsequent higher circuit impedance).

5.12 Typically, as illustrated in Appendix 9 (Load Flow results – IPSA Power System analysis), the shorter 1/3rd route will carry approximately 2/3rd of the generation from Llandinam towards Newtown. The ratings of the 33kV circuits (up to 23MVA) are such that the current Llandinam contracted generation capacity (34MVA) can just be accommodated on the local 33kV network at Llandinam feeding into the Newtown ring.

5.13 Any additional generation at Llandinam will result in the overload of the local 33kV network. This places supplies at risk and is not acceptable given SP Manweb's statutory duties and licence obligations illustrated above, particularly the maintenance of an efficient, co-ordinated and economical system of electricity distribution

5.14 The Llandinam Repowering Wind Farm can therefore not be accommodated within the local 33kV Distribution Network around the Llandinam and surrounding 33kV network due to 33kV thermal issues / circuit overloads which would result from such a proposed connection of additional generation.

Next available network location

5.15 The connection of some 90MVA of generation capacity is typically achieved at 132kV rather than 33kV. The connection of 90MVA at 33kV alone would require 5 x 33kV circuits and an equivalent number of circuit breakers at either end. This would be less efficient and more expensive than a single 132kV circuit connection.

5.16 As illustrated in Appendix 5 and Appendix 6, the nearest 132kV connection point to Llandinam is either Carno or Newtown Grid.

Carno Grid

5.17 Table 7 - Existing Connected embedded generation shows that there is some 58.8MVA of generation associated with the connection at Carno Grid substation. As illustrated in Appendix 6, a further 30MVA is to be connected to the Carno circuit from the future contracted connection of Tir Gwynt wind farm. This gives a total generation connection onto the Carno MB 132kV circuit of 88.8MVA.

5.18 As illustrated in Table 4 – MB overhead line rating , the Summer intact rating for the circuit is 119MVA, indicating some available capacity. However, it is not possible to connect any additional generation to the Carno 132kV MB circuit due to thermal issues and lack of circuit capacity on the upstream BU line from Oswestry to Newtown (which the Carno 132kV MB circuit connects into).

5.19 As illustrated in Table 3 – BU and EJ overhead line ratings, the Summer intact rating for the BU circuit is 89MVA. The system analysis results, illustrated in Appendix 9, show that under Summer minimum load and maximum embedded generation conditions, the BU circuit from Oswestry would experience circuit overloads[16] as a result of the connected embedded generation. It is therefore not possible to connect any further generation into the existing BU or MB 132kV circuits.

Newtown Grid

5.20 As illustrated in Appendix 6, the BU 132kV line connects Oswestry to Newtown. As discussed above, the 132kV MB line from Carno connects into the BU Oswestry to Newtown 132kV line.

5.21 As discussed above and illustrated in Appendix 9, the 132kV BU Oswestry to Newtown line would experience circuit overloads as a result of the connected and contracted embedded generation.

[16] An embedded generator constraint scheme is applied at Oswestry to prevent 132kV thermal issues, The thermal issue illustrated in Appendix 9 for the BU circuit would therefore be managed as appropriate under the constraint scheme. The connection of additional generation would only serve to exacerbate these overloads.

5.22 With the current connected 33kV embedded generation (Llandinam and Mynydd Clogau), Appendix 9 shows that Newtown Grid experiences a reverse power flow from the underlying 33kV network through the Newtown 132/33kV grid transformer and up towards Oswestry on the 132kV BU Oswestry to Newtown circuit.

5.23 Appendix 9 therefore again shows that the 132kV BU circuit cannot accommodate any further embedded generation at Newtown Grid, or any location along its route, as this would only serve to exacerbate the illustrated circuit overload.

Welshpool Grid

5.24 With the BU and MB line not able to accommodate additional embedded generation, as discussed in 5.17 to 5.23, Appendix 5 and Appendix 6 illustrate that the next nearest 132kV connection point to Llandinam is Welshpool Grid ~30km away.

5.25 Appendix 9 shows that under Summer minimum load and maximum generation conditions there is, as with the BU and MB lines, a reverse power flow from Welshpool towards Oswestry via the 132kV EJ line. Any additional generation connected to the 132kV EJ line would therefore add to this power flow back towards Oswestry.

5.26 This power flow however is relatively small compared to the rating of the line (within the circuit's rating). With a power flow of approximately 12MVA for the EJ 132kV circuit (under minimum load, maximum generation conditions as shown in Appendix 9), then this would suggest a remaining available circuit capacity of around 77MVA for the EJ circuit (89[17]-12MVA).

5.27 It must be remembered that the power flows in Appendix 9 include the current Llandinam 33kV connection and so around 30MVA of the requested 90MVA generation capacity is already accounted for in the power flow results.

[17] EJ circuit summer rating .

5.28 This would suggest that an additional 60MVA (90 – 30MVA) of capacity would be required by the 132kV EJ line in order to accommodate the 90MVA of generation required from the Llandinam Repowering Wind Farm. With 77MVA circuit capacity potentially available, as outlined in 5.26, then an additional 60MVA of generation could be accommodated on the EJ 132kV line at Welshpool Grid without introducing thermal issues.

5.29 With an EJ circuit rating of 89MVA (illustrated in Table 3 – BU and EJ overhead line ratings, Appendix 9 shows that the connection of 90MVA of generation at Welshpool Grid (with the present 33kV Llandinam connection removed), gives a resultant EJ 132kV circuit flow of 77MVA. This confirms that 90MVA of generation can be accommodated on the EJ 132kV line at Welshpool Grid without introducing circuit thermal issues.

5.30 The removal of the current Llandinam 33kV connected generation serves to reduce the risk of thermal overloads for the 132kV BU line (as outlined in 5.23). This is as a result of removing the embedded generation push from the current 33kV connection at Llandinam which would otherwise flow back to Oswestry via the 132kV BU Newtown to Oswestry circuit.

5.31 N-1 outages (disconnection of a single circuit due principally to fault) on the Legacy to Oswestry BK circuits result in the trigger of a generation constraint scheme in order to mitigate potential thermal circuit issues. As mentioned in 4.88, a derogation is in place for the Legacy / Oswestry group for this non-compliance with Licence Condition 24 (Appendix 2). The installation of the third Legacy to Oswestry circuit however, as outlined in 4.97 to 4.98, will resolve the circuit thermal issues and reduce the dependency on a generation constraint scheme.

Conclusions

5.32 SP Manweb has statutory duties, as holder of a Distribution Network licence for the Cheshire, Merseyside, Shropshire, North and Mid Wales area, to give a supply of electricity to an owner or occupier of any premises by means of electric lines, plant or both.

5.33 Furthermore SP Manweb is required, on receiving a request to make a connection, to consider the request as given under Section 16A of the Act (Electricity Act 1989) (CD/COM/023). On receiving a request for connection, the Licensee (SP Manweb) will enter into an agreement outlining the works required to provide that connection.

5.34 Under these duties, SP Manweb, upon receipt of a request for connection to the SP Manweb Distribution Network from CeltPower Ltd, was asked to provide a new stand alone connection for the Llandinam Repowering Wind Farm for a capacity of up to 90MVA.

5.35 The existing Llandinam wind farm has an unfirm connection to the existing 33kV SP Manweb Distribution Network, and exports up to an agreed 34MVA of connected generation capacity from some 102 wind turbines.

5.36 The Llandinam area is connected on a 33kV ring from Newtown Grid substation. With typical 33kV circuit ratings of up to 23MVA, 90MVA of embedded wind generation cannot be accommodated within the local 33kV Distribution Network around the Llandinam and surrounding 33kV network due to 33kV thermal issues.

5.37 The connection of some 90MVA of generation capacity is typically achieved at 132kV rather than 33kV. The connection of 90MVA at 33kV alone would require 5 x 33kV circuits and an equivalent number of circuit breakers at either end. This would be less efficient and more expensive than a single 132kV circuit connection.

5.38 The nearest 132kV connection point to Llandinam is Carno or Newtown Grid. The combination of existing wind generation

connected in this area (up to 88.8MVA), and the rating of the existing 132kV circuits, is such that any additional generation cannot be accommodated at Carno (MB Line) or at Newtown (BU Line).

5.39 The EJ circuit from Welshpool to Oswestry does not have any direct connected embedded generation. Power flows indicate that there would be sufficient capacity on the EJ 132kV circuit to accommodate up to 90MVA of direct connected generation without introducing thermal issues. The current 34MVA of generation at Llandinam would however have to be removed from the 33kV network in order to minimise circuit thermal issues.

5.40 A connection into Welshpool meets the connection request of the customer, as outlined in 5.3.

6. STRATEGIC OPTIONS TO MEET THE NEED

Introduction

6.1 This section explains the strategic options available which were considered in order to deliver a connection to the Llandinam Repowering Wind Farm.

6.2 The ability of these options to provide a suitable connection is discussed.

6.3 The option which meets the needs of the current and future network, whilst ensuring an efficient, co-ordinated and economical system of electricity distribution, is explained.

6.4 Further information on these options, and their consideration against other criteria such as cost, environmental and landscape impacts, is given in the evidence of Mr Paalman(SPM/ENGINEERING/POE/PAALMAN/003A), Miss Berry (SPM/PLANNING/POE/BERRY/011A), Mrs Gibson (SPM/LANDSCAPE/POE/GIBSON/006A) as well as the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01))

6.5 Further information on the options considered to meet the design need is given in section 2.3 of the Alternatives paper.

Strategic options available to meet the need

Accommodate on existing 33kV customer connection using current 33kV infrastructure

6.6 As shown in 4.66, and illustrated in Appendix 6, the current Llandinam 33kV connection is connected on a 33kV ring from Newtown Grid substation.

6.7 The agreed export capacity of Llandinam's current 33kV connection at Llandinam substation is 34MVA.

6.8 As discussed in 5.12, and shown in Appendix 9, the current installed generation capacity at Llandinam is accommodated on the 33kV Newtown ring.

6.9 The connection of 90MVA of generation at Llandinam Repowering Wind Farm (compared to the current 34MVA of agreed export), using the existing 33kV customer connection will introduce severe 33kV circuit overloads on this 33kV Newtown ring and introduce voltage issues.

6.10 Such high overloads would trigger the circuit overload protection and disconnect the overloaded 33kV circuits. This would place existing customer supplies within the group at risk and is considered to be, as discussed in 3.8, a breach of Licence Condition 21 (Appendix 2).

6.11 The connection of any additional generation at Llandinam Repowering Wind Farm, using the existing 33kV customer connection and infrastructure, cannot be accommodated on the current 33kV network infrastructure.

Accommodate on existing 33kV customer connection using current and new 33kV infrastructure

6.12 As discussed in 6.6 to 6.11 above, the limited number of 33kV circuits in the area constrains the capacity of the 33kV network, meaning that there is not the additional capacity to accommodate the required level of proposed generation (90MVA) from the Llandinam Repowering Wind Farm.

6.13 Additional 33kV circuits could be introduced in order to provide the additional capacity within the local 33kV network around Llandinam.

6.14 Considering typical 33kV circuit ratings, the connection of some 90MVA of embedded generation at Llandinam would require 5 x 33kV circuits. This would provide for the required level of connection capacity and provide a level of connection security for the wind farm.

6.15 These circuits would need to be connected to the nearest 132kV infeed at Newtown Grid, 12km away from Llandinam. This would suggest 60km of 33kV circuit would be required.

6.16 The substations at both Llandinam and Newtown Grid would have to be increased in size in order to accommodate such circuits and their additional circuit breakers. The extension of Newtown Grid substation would require additional land and necessary permissions. This is also outlined in the evidence Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A) and the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)).

6.17 Furthermore, as discussed in 5.22, the 132kV BU circuit would need to be reinforced / rebuilt to accommodate the generation power flows on the 132kV network. Due to the strategic importance of this circuit, it is considered that this circuit would need to be rebuilt. This is also outlined in the evidence of Mr Paalman and the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)).

6.18 As also discussed in 5.22, the current 30MVA Grid Transformer at Newtown Grid Substation would need to be changed in order to accommodate the increased power flow as a result of the connection of such increased levels of generation.

6.19 Furthermore, the electrical circuit losses of such a connection at 33kV would be greater than those for a single 132kV connection of similar distance.

6.20 The introduction of additional 33kV circuits to provide capacity is therefore not considered to be a feasible solution which meets the needs of the current and future network. It does not demonstrate the maintenance of an efficient, co-ordinated and economical system of electricity distribution. Furthermore, potential engineering and environmental concerns associated with routeing 5 new overhead lines also result in this option not being satisfactory. These conclusions are borne out in the evidence of Mr Paalman

(SPM/ENGINEERING/POE/PAALMAN/003A) and the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)).

Accommodate on existing 132kV network – Carno Grid / Circuit

6.21 As discussed in 5.13, given that a connection (as outlined in 6.6 to 6.11) within the local 33kV network is not viable, the nearest 132kV connection point is Carno Grid and its respective MB circuit (see Appendix 5 and Appendix 6).

6.22 Carno Grid substation is 15km from Llandinam, although the nearest point to the Carno 132kV MB circuit is 12km.

6.23 As outlined in 5.17, there is 58.8MVA of generation associated with the current connection at Carno Grid substation. As shown in Table 7 - Existing Connected embedded generation, and illustrated in Appendix 6, a further 30MVA is to be connected to the Carno MB 132kV circuit from connection of Tir Gwynt wind farm. This gives a total contracted generation connection onto the Carno 132kV MB circuit of 88.8MVA.

6.24 As illustrated in Table 4 – MB overhead line rating , the Summer intact rating for the circuit is 119MVA indicating some available capacity. However, it is not possible to connect any additional generation to the Carno 132kV MB circuit due to thermal issues and lack of circuit capacity on the upstream BU line from Oswestry to Newtown (which the Carno 132kV MB circuit connects into).

6.25 In order to accommodate an additional 90MVA of generation, reinforcement / rebuilding of the MB circuit would have to be considered, but additional upstream 132kV circuit reinforcement (BU 132kV Oswestry to Newtown circuit) would also be necessary in order to accommodate any additional generation to the Carno MB 132kV circuit.

6.26 Reinforcement of the 132kV Oswestry to Newtown circuit would involve additional costs and, given the strategic importance of this

line, it is likely that there would be a requirement for a separate off-line build of a second line (rather than piecemeal rebuild of the existing circuit). It is therefore considered that this circuit would need to be rebuilt. These conclusions are borne out in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A) and section 2.3 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)).

6.27 The introduction of additional generation onto the Carno 132kV MB circuit is therefore not considered a feasible solution which would meet the needs of the current and future network, and does not demonstrate the maintenance of an efficient, co-ordinated and economical system of electricity distribution with up to some 83km of new overhead line to be established for such a connection. These conclusions are borne out in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A) and section 2.3 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)).

Accommodate on existing 132kV network – Newtown Grid

6.28 As discussed in 5.16, Newtown Grid (12km from Llandinam) is also one of the nearest 132kV connection points to the Llandinam Repowering Wind Farm. This is illustrated in Appendix 5 and Appendix 6.

6.29 As shown in Appendix 6, the 132kV infeed at Newtown Grid is provided via the BU 132kV circuit from Oswestry with the Carno MB 132kV circuit connecting into the BU circuit.

6.30 As discussed in 5.21 and 5.22, and illustrated in Appendix 9 with the current level of contracted generation connected into the BU circuit, any additional embedded generation (at Newtown or any location along its route) cannot be accommodated due to thermal circuit issues. It is therefore not possible to accommodate any additional generation onto the existing Newtown Grid 132kV BU circuit.

6.31 As outlined in 6.26, reinforcement of the 46km BU 132kV Oswestry to Newtown circuit would involve additional costs and, given the strategic importance of this line, it is likely that there would be a requirement for a separate off-line build of a second line (rather than piecemeal rebuild of the existing circuit). It is therefore considered that this circuit would need to be rebuilt. These conclusions are borne out in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A) and section 2.3 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)).

6.32 The introduction of additional generation onto the Newtown Grid 132kV BU circuit is therefore not considered a feasible solution which meets the needs of the current and future network, and does not demonstrate the maintenance of an efficient, co-ordinated and economical system of electricity distribution. These conclusions are borne out in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A) and section 2.3 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)).

Accommodate on existing 132kV network – Welshpool Grid

6.33 As discussed in 5.24, with the 132kV BU and MB circuits at thermal capacity and not able to accommodate additional embedded generation, and rebuilding / reinforcement of the 132kV circuits not considered appropriate (as concluded in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A) and section 2.3 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)), the next nearest 132kV connection point to Llandinam Repowering Wind Farm is Welshpool Grid, approximately 30km away. This is shown in Appendix 5 and Appendix 6.

6.34 As illustrated in Appendix 6, Welshpool Grid is connected to the 132kV network at Oswestry via the EJ line. As highlighted in 5.26 and Appendix 9 the power flow on the circuit is approximately 12MVA. This would suggest an available circuit capacity of around

77MVA for the EJ circuit from its 89MVA rating (as shown in Table 3 – BU and EJ overhead line ratings).

6.35 It must be remembered however that the power flows considered in 5.26 include the current Llandinam 33kV connection and so around 30MVA of the requested 90MVA generation capacity is already included in these power flows. As discussed in the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01), the existing 33kV connections at Penrthyddlan and Llidartywaun are to be removed prior to energisation of the new 132kV connection.

6.36 Appendix 9 shows that the 132kV power flows with 90MVA of embedded generation connected into Welshpool (with the present Llandinam 33kV connection removed) results in a power flow[18] of 77MVA on the Welshpool to Oswestry EJ 132kV circuit. This is within the circuits rating of 89MVA.

6.37 The connection of the Llandinam Repowering Wind Farm 90MVA generation into Welshpool is therefore possible (with the exiting 33kV connection for Llandinam removed) and utilises the spare network capacity in the existing Distribution Network.

6.38 Unlike the other options considered thus far, this connection does not necessitate the reinforcement / rebuilding of existing SP Manweb Distribution Network infrastructure.

6.39 Welshpool Grid is therefore considered to be the nearest available location in order to provide a connection to the existing SP Manweb Distribution Network for the Llandinam Repowering Wind Farm.

6.40 The connection into Welshpool makes efficient use, as illustrated in 5.29, of the available network capacity within the SP Manweb Distribution Network.

6.41 Furthermore, as discussed in 5.29, the removal of the Llandinam 33kV connected generation serves to reduce the risk of thermal

[18] For minimum summer demand, maximum generation conditions.

overloads for the existing generation connected on the BU line. This is as a result of removing the embedded generation push from the current 33kV connection at Llandinam which would otherwise flow back to Oswestry via the 132kV BU Newtown to Oswestry circuit.

6.42 As discussed in section 2.3 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)), the introduction and connection of additional generation at Welshpool grid, utilising the 132kV EJ circuit (using the currently available network capacity), is a feasible solution which meets the needs of the current and future network and demonstrates an efficient, co-ordinated and economical system of electricity distribution.

6.43 This is considered to be in direct accordance with SP Manweb's statutory duties as highlighted earlier in section 3. These conclusions are borne out in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A) and section 2.3 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)).

Alternative existing 132kV network infeeds (Aberystwyth / Rhydlydan/ Trawsfynydd)

6.44 In order to connect the Llandinam Repowering Wind Farm, it has been shown that a connection to the more widespread 132kV network is required since there is no capacity on the local 33kV or nearby 132kV network around the Llandinam and Newtown areas.

6.45 Aberystwyth, Rhydlydan and Trawsfynydd are all existing locations (other than those considered previously e.g Welshpool and Newtown) from where an alternative 132kV infeed could be obtained.

6.46 Aberystwyth / Rhydlydan are a similar distance away (up to 30km) from Llandinam Repowering Wind Farm compared to Welshpool. However the current connection of Cefn Croes wind farm (60MVA) at Rhydlydan, and the same 132kV circuit ratings to that given earlier

result in no circuit capacity being available for the connection of an additional 90MVA of embedded generation.

6.47 Furthermore, Aberystwyth / Rhydlydan is connected to Western Power's Distribution Network at Swansea North whereby capacity restrictions are placed on this interconnection during various periods. It is understood that the neighbouring WPD interconnection is at capacity with already committed connections.

6.48 These restrictions are beyond the control of SP Manweb with any necessary network reinforcement of the neighbouring WPD interconnection likely to be uneconomic compared to the Llandinam Scheme. A connection from Llandinam Repowering Wind Farm to Aberystwyth / Rhydlydan would also involve navigation of the Cambrian mountain range.

6.49 Trawsfynydd is some 60+km away from the Llandinam Repowering Wind Farm compared to the 30km from the Llandinam Repowering Wind Farm to Welshpool.

6.50 These alternative 132kV infeeds are therefore either not technically viable from a capacity perspective and/or are more expensive and less efficient than the Llandinam Scheme.

6.51 Furthermore, it is considered that, due to their longer distances or navigation of the Cambrian mountain range, these alternatives would be more challenging environmentally to establish an acceptable corridor.

6.52 Such solutions do not, therefore, offer any material advantages over the Llandinam Scheme. These conclusions are borne out in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A).

Alternative network 400kV infeeds

6.53 Establishing a new 400 kV substation at Llandinam Repowering Wind Farm would require National Grid to construct a new 400 kV overhead line into the Llandinam area and construct a 400/132 kV substation.

6.54 The completion of these works would have a significant lead time and would not provide a connection for at least an estimated 5 years or more. This is due to the significant works involved in establishing a 400kV connection into the area. There would also be environmental challenges with such a solution.

6.55 The nearest 400kV connection from Llandinam Repowering Wind Farm would be north west of Shrewsbury, approximately 55+km in distance. Such a long connection at 400kV would be more expensive than the shorter Llandinam Scheme.

6.56 A sole 400kV connection for Llandinam Repowering Wind Farm would also provide a less efficient electrical solution since the connected generator's power flow would be up into the 400kV transmission network before dissipating back down into the local Distribution Networks at the lower voltages. This would result in system losses across the various voltages and transformation levels which would not otherwise have been present.

6.57 The Llandinam Scheme makes more efficient use of the existing and available local Distribution Network capacity, whilst providing for the delivery of a timely connection. These conclusions are borne out in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A), Mr Leavy (SPM/COMPANY/POE/LEAVY/002A) and section 2.3 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)).

Alternative network 400kV infeeds – Mid Wales

6.58 Within Mid Wales, wind farm developers are seeking to obtain connections to the electrical network for numerous locations in and around the Tan 8[19] (CD/COM/016) areas for a range of onshore wind farm sites.

6.59 Due to the number and size of these developments and the lack of existing significant electrical infrastructure in the area, the connection of these proposed wind farms necessitates the need for the development of significant new electrical infrastructure.

6.60 SP Manweb is currently involved with the connection of several onshore wind farms in the Mid Wales area via the SP Mid Wales Connections Project. These new connections involve a significant level of new 132kV and 400kV infrastructure.

6.61 These connections have seen National Grid indicate its commitment in the provision of a 400kV Grid Entry Point (GEP) into Mid Wales in order to provide a connection for the future Mid Wales wind farms.

6.62 The location of the GEP substation has been subject to much speculation over the last few years.

6.63 At the time of Llandinam Repowering Wind Farm requesting a connection to the SP Manweb Distribution Network (2007) the provision of a Mid Wales GEP had not been contractually established between National Grid and SP Manweb, with Llandinam Repowering Wind Farm requesting a connection to the existing SP Manweb Distribution Network.

6.64 The location of the GEP area as Cefn Coch was only confirmed last year[20] with a more detailed announcement on the draft route and

[19] TAN 8, launched in 2005 as planning guidance Technical Advice Note TAN 8 (by the then Welsh Assembly Government) identified seven Strategic Search Areas (SSAs) in Wales
[20] July 2012

substation site location within Cefn Coch announced only very recently[21].

6.65 In considering whether the SP Mid Wales Connections Project would provide a suitable 132kV connection for the Llandinam Repowering Wind Farm (further explained in section 6 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01))), it is worth noting that the distance from the Llandinam Repowering Wind Farm to the proposed GEP substation is not significantly different to that of the Llandinam Scheme.

6.66 However, the integration of the Llandinam Repowering Wind Farm into the SP Mid Wales Connections Project would necessitate, due to existing contracted Mid Wales generation, the installation of an additional 132kV circuit / infrastructure between the GEP hub substation and SSA C[22] (wood pole or steel tower line) to ensure that suitable circuit capacity is provided. This is further explained in section 6 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)) and the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A).

6.67 In considering the integration of the Llandinam Repowering Wind Farm into the SP Mid Wales Connections Project, as discussed further in section 6 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)), it is concluded that an additional circuit between the GEP hub substation and SSA C that could accommodate the Llandinam Repowering Wind Farm would, depending upon the routeing corridor used:

6.67.1 Involve increased / significant environmental concerns compared to the two current sets of proposals;

6.67.2 Be a more expensive solution;

6.67.3 Add additional increased unnecessary transmission losses;

[21] September 2013
[22] Mid Wales TAN 8 Strategic Search Area C (SSA C)

6.67.4 Require additional infrastructure at Cefn Coch (132kV Bay and 400/132kV Supergrid Transformer/s) to accommodate the additional generation;

6.67.5 Provide for unnecessary excess capacity;

6.67.6 Introduce project delays and provide a connection at a later date to that which the Llandinam Scheme can provide; and

6.67.7 Fail to utilise existing capacity within the SP Manweb Distribution Network.

6.68 There remains some level of risk and uncertainty associated with the mid Wales GEP, especially given the complexities and extent of the activities associated with the SP Mid Wales Connections Project and associated infrastructure, together with environmental and landowner considerations.

6.69 SP Manweb therefore considers that including the Llandinam Repowering Wind Farm connection in with the SP Mid Wales Connections Project is not an available or suitable alternative. These conclusions are borne out in section 6 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)).

6.70 When compared to the Llandinam Scheme, it is considered that alternative 400kV options considered, as outlined in section 6 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)), are not viable solutions which meet / or provide for either:

6.70.1 the needs of the current and future network;

6.70.2 the maintenance of an efficient, co-ordinated and economical system of electricity distribution;

6.70.3 the requirement for additional transmission infrastructure;

6.70.4 reduced transmission losses;

6.70.5 utilisation of existing capacity within the SP Manweb Distribution Network; or

6.70.6 the delivery of a timely / earliest connection date and least cost option for the customer.

The selection of the Llandinam Scheme

6.71 Welshpool Grid is considered to be the nearest suitable available location in order to provide a connection to the existing SP Manweb Distribution Network for the Llandinam Repowering Wind Farm.

6.72 The connection into Welshpool Grid makes efficient use of the available network capacity within the SP Manweb Distribution Network, and provides for some capacity benefits at Legacy and within the Distribution Network which none of the other solutions provide for.

6.73 Alternative 132kV solutions are considered to either:

6.73.1 not be technically viable from a capacity perspective;

6.73.2 have a greater environmental impact;

6.73.3 be more expensive or less efficient connections than the Llandinam Scheme; or

6.73.4 not demonstrate the maintenance of an efficient, co-ordinated and economical system of electricity distribution.

6.74 Alternative 400kV solutions are considered to either:

6.74.1 provide a connection at a later date to that which the Llandinam Scheme can provide;

6.74.2 introduce increased environmental concerns and unnecessary impacts;

6.74.3 require unnecessary additional infrastructure and provide unnecessary network over capacity;

6.74.4 fail to utilise existing capacity within the SP Manweb Distribution Network; or

6.74.5 be more expensive and/or less efficient than the Llandinam Scheme.

6.75 The introduction and connection of additional generation at Welshpool grid, utilising the 132kV EJ circuit, is therefore a feasible solution which meets the needs of the current and future network, utilises existing capacity within the SP Manweb Distribution Network and demonstrates an efficient, co-ordinated and economical system of electricity distribution whilst providing the most economic and earliest connection date for the customer. It is considered that this solution best meets SP Manweb's statutory duties. These conclusions are borne out in section 6 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)) and in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A) and Mr Leavy (SPM/COMPANY/POE/LEAVY/002A).

Conclusions

6.76 The various network options to meet the need for the provision of a connection for the Llandinam Repowering Wind Farm have been presented.

6.77 The connection of up to 90MVA of generation at Llandinam Repowering Wind Farm, using the existing 33kV customer connection and network, cannot be accommodated due to 33kV circuit thermal and voltage issues. Such a connection would place existing customer supplies within the group at risk and breach Licence Condition 21 (Appendix 2).

6.78 The introduction of additional 33kV circuits to provide local capacity is not considered a feasible solution with, as discussed in 5.22, the

132kV BU circuit also requiring to be reinforced / rebuilt. It is considered that this does not meet the needs of the current and future network, and does not demonstrate the maintenance of an efficient, co-ordinated and economical system of electricity distribution.

6.79 The connection of up to 90MVA of generation at Llandinam Repowering Wind Farm, to the nearest 132kV network at Carno or Newtown (using the existing MB of BU circuits respectively) is not possible due to the existing level of embedded generation connected within the local network. Reinforcement / rebuilding of either the MB and/or BU 132kV circuits would also be necessary in order to accommodate any additional generation. This was considered but would again involve additional costs as it is considered that these circuits would need to be rebuilt.

6.80 The introduction of additional generation onto the Carno 132kV MB circuit or the BU circuit is therefore not considered a feasible solution which meets the needs of the current and future network, and does not demonstrate the maintenance of an efficient, co-ordinated and economical system of electricity distribution.

6.81 The connection of up to 90MVA of generation at the Llandinam Repowering Wind Farm, to the next nearest existing 132kV network at Welshpool (using the existing EJ circuit) is considered feasible since circuit capacity is available.

6.82 The connection into Welshpool makes efficient use, as illustrated in 5.29, of the available network capacity within the SP Manweb Distribution Network

6.83 Other existing 132kV network infeeds at Aberystwyth, Rhydlydan and Trawsfynydd were considered. These however are either not technically viable from a capacity perspective and/or are more expensive and less efficient than the Llandinam Scheme. They

therefore do not offer any material advantages over the Llandinam Scheme.

6.84 Alternative 400kV infeeds were considered. They are however not considered to be any more beneficial than that of the Llandinam Scheme as they either:

6.84.1 provide a connection at a later date with significant increased dependencies and risks;

6.84.2 provide for increased environmental concerns;

6.84.3 require additional Transmission infrastructure and provide unnecessary network over capacity;

6.84.4 fails to utilise existing capacity within the SP Manweb Distribution Network; or

6.84.5 are a more expensive solution with higher Transmission losses.

6.85 Welshpool Grid is considered to be the nearest available location in order to provide a connection to the existing SP Manweb Distribution Network for the Llandinam Repowering Wind Farm. These conclusions are borne out in section 6 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)) and in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A) and Mr Leavy (SPM/COMPANY/POE/LEAVY/002A).

6.86 When compared to the alternatives outlined in this proof, discussed further in the Alternatives paper Volume 5 of the Updated ES (CD/SPM/ES/01)) and in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A) and Mr Leavy (SPM/COMPANY/POE/LEAVY/002A), the Llandinam Scheme provides for:

6.86.1 the needs of the current and future network;

6.86.2 the maintenance of an efficient, co-ordinated and economical system of electricity distribution;

6.86.3 the utilisation of existing capacity within the SP Manweb Distribution Network; and

6.86.4 the most economic and earliest connection date for the customer.

6.87 As such, it is the connection solution which best meets SP Manweb's statutory duties.

7. THE LLANDINAM SCHEME

Introduction

7.1 Having confirmed that a connection from the Llandinam Repowering Wind Farm to the Welshpool Grid is the most suitable option, this section provides an overview of the main characteristics required for the Llandinam Scheme.

Characteristics of the proposed overhead line

7.2 The Llandinam Scheme is required to be connected from Llandinam Repowering Wind Farm to Welshpool Grid substation, as illustrated in Appendix 6, via the conventional 132kV network circuit breakers onto the respective 132kV busbars[23] within the substations. This is further explained in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A) and Mr Livingston (SPM/CONSTRUCTION/POE/LIVINGSTON/004A).

7.3 Accommodating the circuit at Llandinam Repowering Wind Farm is not considered to be an issue due to the establishment of new equipment at a new Llandinam Grid substation (Bryn Dadlau). This is explained further in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A) and Mr Livingston (SPM/CONSTRUCTION/POE/LIVINGSTON/004A).

7.4 Accommodating the circuit at Welshpool grid will require the installation of additional equipment and cabling connecting the existing incoming overhead line onto the new cable sealing ends at Welshpool. This is explained further in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A) and Mr Livingston (SPM/CONSTRUCTION/POE/LIVINGSTON/004A).

7.5 A single three-phase line is required to provide the necessary level of capacity, with the capability of supporting at least Poplar 200mm²

[23] a strip or bar of copper, brass or aluminium that conducts electricity within a switchboard, distribution board, substation, battery bank or other electrical apparatus

AAAC conductor with a rated temperature of 75°C. The rating for Poplar 200mm² conductor is illustrated in Table 9 – Poplar 200mm² overhead line rating (at 75 deg C).

MVA Rating	Winter	Summer
Intact	140	124
First Circuit Outage	155	137
Second Circuit Outage	167	147

Table 9 – Poplar 200mm² overhead line rating (at 75 deg C)

7.6 For generation connections, the minimum design conditions which the connection must provide for are typically during the summer when circuit ratings and system demands are at their lowest - with generation output at its maximum. The intact circuit rating therefore must not be exceeded.

7.7 To minimise the rise of earth potential risk[24] at Llandinam Repowering Wind Farm (due to high soil resistivity), it is considered necessary to incorporate an earthwire. This is explained further in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A).

7.8 The need for an earthwire necessitates a HDWP design. This provides for an under-slung OPGW25 earth wire and protection signalling and control capability. This is explained further in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A).

7.9 The Llandinam Scheme would be required as soon as the Llandinam Repowering Wind Farm has been built. 2017 is considered a feasible

[24] The rise of earth potential is as a result of large current flow, usually fault currents, flowing into the earth through an earthing grid impedance. This results in an electrical potential voltage difference.
[25] OPtical Ground Wire

connection date. This is explained further in the evidence of Mr Leavy ((SPM/COMPANY/POE/LEAVY/002A).

Future Capacity

7.10 As discussed in table 4.1 of the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01)), the connection of the Llandinam Scheme would provide accommodation for up to 100MVA of generation on the existing SP Manweb Distribution Network without the requirement for additional network reinforcement.

7.11 Accommodating generation greater than 100MVA on the Llandinam Scheme is possible, but this would require significant additional upstream reinforcement and upgrade of the SP Manweb Distribution Network. The need to upgrade the network in this situation is recognised and acknowledged by Powys County Council (in PCC Statement of Case (OBJ-002-SOC-OHL), section 5.3). The upper limit for the Llandinam Scheme connection in this circumstance is considered to be 160MVA and this is outlined in Appendix 10.

Conclusions

7.12 The main characteristics of Llandinam Scheme, to meet the customer's identified needs, is a direct 132kV circuit connection between Llandinam Repowering Wind Farm and Welshpool Grid 132kV substation.

7.13 This connection needs to be achieved with a single three phase 132kV line with capability of supporting (at least) Poplar 200mm^2 AAAC conductor (at 75°C) to provide sufficient capacity for proposed contracted generation.

8. FINAL CONCLUSIONS

8.1 The evidence presented in this document outlines the need case for the Llandinam Scheme.

8.2 SP Manweb, as the holder of an Electricity Distribution Licence for the Cheshire, Merseyside, Shropshire, North and Mid Wales area, must comply with various statutory and licence duties and obligations.

8.3 Such duties require SP Manweb to develop, maintain and continue to provide an efficient, co-ordinated and economical system of electricity distribution, to facilitate competition in the supply and generation of electricity and to provide a connection to an owner or occupier of any premises on request.

The existing 132kV/33kV network

8.4 The existing SP Manweb network is depicted in Appendices 5 and 6.

8.5 The Legacy to Oswestry 132kV BK overhead line serves as the main arterial route in the supply of energy for the Legacy, Oswestry, Welshpool, Newtown and Whitchurch areas to some 85,000 customers. The Legacy / Oswestry group currently has a time limited[26] derogation from ER P2/6 (Appendix 3), granted by Ofgem on 7 March 2011, for non-compliance with Licence Condition 24 (Appendix 2).

8.6 Consent for the 3rd Legacy to Oswestry 132kV circuit was granted in 2013, following a con-joined Public Inquiry and necessary wayleave hearing in November 2012. Construction of the circuit is expected to be completed mid 2015 and will ensure the security of supply for the group, with local and widespread customers gaining an immediate benefit from the increased supply security it provides.

[26] 30th September 2015

8.7 In addition to the BK circuit, the remaining 132kV circuits south of Oswestry (EJ, BU and MB) are also of relevance as they connect the Llandinam and general area to the south west of Oswestry to the SP Manweb Distribution network.

8.8 The overall Distribution Network in the Legacy / Oswestry area has approximately 140MVA of wind generation connected (across both the 132kV and 33kV networks).

8.9 For the Llandinam area, there is some degree of 33kV interconnection via a 33kV 'ring' from Newtown Grid. The current Llandinam 34MVA wind farm is connected to this circuit at 33kV, the wind farms location being at the edge of the existing SP Manweb Distribution Network.

The need for the Llandinam Scheme

8.10 Llandinam wind farm has an unfirm connection to the existing 33kV SP Manweb Distribution Network, and exports up to an agreed 34MVA of connected generation capacity.

8.11 A request for a connection to the SP Manweb Distribution Network was received by SP Manweb from CeltPower Ltd to provide a new stand alone connection for the Llandinam Repowering Wind Farm for a capacity of up to 90MVA.

8.12 The connection of 90MVA of generation capacity is typically achieved at 132kV rather than 33kV. The connection of 90MVA at 33kV would require up to 5 x 33kV circuits and an equivalent number of circuit breakers at either end. This is less efficient and more expensive than a single 132kV circuit connection with additional upstream 132kV reinforcement also required, even if a local 33kV connection was achievable.

8.13 The nearest 132kV connection point to Llandinam Repowering Wind Farm is Carno or Newtown Grid. The combination of existing wind generation connected in this area (up to 88.8MVA), and the rating of

the 132kV circuits, is such that any additional generation cannot be accommodated on the Carno (MB) or Newtown (BU) circuits without reinforcement or their off-line rebuild.

8.14 The EJ circuit from Welshpool to Oswestry does not have any direct connected embedded generation. Power flows indicate that there would be sufficient capacity on the EJ circuit to accommodate up to 90MVA of direct connected generation without introducing thermal issues. The current 34MVA of generation at Llandinam would however have to be removed from the 33kV network to minimise upstream circuit thermal issues.

Final conclusions

8.15 A range of strategic options were considered in order to deliver a connection to the Llandinam Repowering Wind Farm. These ranged from a connection utilising the existing 33kV connection/network to 132kV and 400kV options.

8.16 The connection of an additional 56MVA of generation at Llandinam Repowering Wind Farm (90MVA total minus existing 34MVA), using the existing 33kV customer connection, will introduce severe 33kV circuit overloads and voltage issues. This would place existing customer supplies within the group at risk and would be considered, as discussed in 3.8, a breach of Licence Condition 21 (Appendix 2).

8.17 The introduction of additional 33kV circuits and the additional upstream 132kV reinforcement required to provide the necessary capacity is not considered a feasible solution which meets the needs of the current and future network. It does not demonstrate the maintenance of an efficient, co-ordinated and economical system of electricity distribution.

8.18 Alternative 132kV solutions are considered to either be not technically viable from a capacity perspective, have a greater environmental impact or are more expensive and less efficient than

the Llandinam Scheme. Such solutions do not, therefore, offer any material advantages over the Llandinam Scheme.

8.19 Alternative 400kV solutions are considered to either; provide a connection at a later date with increased dependencies and risks, provide for increased environmental concerns, require additional Transmission infrastructure and provide unnecessary network over-capacity, fail to utilise existing capacity within the SP Manweb Distribution Network, or provide a more expensive solution with higher Transmission losses.

8.20 As mentioned in 6.66 and 6.67, the integration of the Llandinam Repowering Wind Farm into the SP Mid Wales Connections Project would necessitate additional 132kV circuits between the GEP hub substation and SSA C27 to ensure that suitable circuit capacity is provided for the current contracted levels of generation.

8.21 Additional circuits between the GEP hub substation and SSA C would, depending upon the routeing corridor used (CC1 or CC2), result in either; increased environmental concerns than that of a single circuit (the current SP Mid Wales Connections Project), be a more expensive solution with higher Transmission losses, require additional infrastructure at Cefn Coch, provide for unnecessary over network capacity, provide a connection at a later date which the Llandinam Scheme can provide for or fail to utilise existing capacity within the SP Manweb Distribution Network.

8.22 Welshpool Grid is considered to be the nearest available location in order to provide a connection to the existing SP Manweb Distribution Network for the Llandinam Repowering Wind Farm.

8.23 When then compared to the alternatives outlined in this proof, discussed further in the Alternatives paper (Volume 5 of the Updated ES (CD/SPM/ES/01), in the evidence of Mr Paalman (SPM/ENGINEERING/POE/PAALMAN/003A), and evidence of Mr

[27] TAN 8 Strategic Search Area C (SSA C)

Leavy (SPM/COMPANY/POE/LEAVY/002A), the Llandinam Scheme provides for:

8.23.1 the needs of the current and future network;

8.23.2 the maintenance of an efficient, co-ordinated and economical system of electricity distribution;

8.23.3 the utilisation of existing capacity within the SP Manweb Distribution Network; and

8.23.4 the most economic and earliest connection date for the customer.

8.24 As such, it is the connection solution which best meets SP Manweb's statutory duties.

8.25 From a need and network design perspective, the Llandinam Scheme is the preferred option to deliver the need for a connection from the Llandinam Repowering Wind Farm.