FAWLEY GRID SUPPLY POINT: STRATEGIC DEVELOPMENT PLAN

Our network serving communities on the Isle of Wight and New Forest coast

(Draft for consultation)

09/09/2024

Scottish & Southern Electricity Networks

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EXECUTIVE SUMMARY

SSEN is taking a strategic approach in the development of its distribution networks. This will enable net zero at a local level to the homes, businesses, and communities we serve. Our Strategic Development Plans provide a blueprint of long-term electricity system needs that allow us to work with other stakeholders to design and build the local markets and networks they need to decarbonise their power needs.

Strategic Development Plans take the feedback we have received from stakeholders on their future energy needs through to 2050 and translate these requirements into strategic spatial plans of the future distribution network needs. Strategic spatial plans help us transparently present our future conceptual plans and facilitate discussion with Local Authorities and other stakeholders on how these could be translated into the local power systems of the future. To that end these are living plans reviewed as and when stakeholders tell us of changes to their future requirements.

Our intent is these plans will become blueprints for our future developments which are endorsed and supported by local stakeholders. On an annual basis, or as parties seek to connect or change their power use, we will use the Strategic Development Plans to guide our more detailed development works through the Distribution Network Options Assessment (DNOA)[1] process. Stakeholders require additional capacity to be delivered ahead of need and typically we would look at detailed development through the DNOA process up to seven years ahead of need. Through this approach we ensure that our projects and flexibility opportunities are developed as part of an overall strategic design of our networks.

To that end, this Strategic Development Plan carries a number of recommended interventions that we believe need to be progressed through the DNOA process imminently. These will be further developed in 2024 and the detailed project proposals published in a forthcoming DNOA outcomes report. This report also provides context on timescale for delivery of infrastructure works or use of flexibility services.

The overall strategic planning process is summarised below. We adopt a neutral facilitator role throughout our strategic planning process exploring flexibility options alongside network investment needs. Flexibility is a key component in the transition to Net Zero both assisting in earlier connection of customers as well as helping to optimise timing decisions around future investment needs.

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1 Earlier this year we published our first Distribution Network Options Assessment (DNOA) methodology describing how we are making transparent decisions over flexibility and network investment options. The DNOA methodology forms a key component of our Net Zero strategic planning process. https://www.ssen.co.uk/globalassets/about-us/dso/consultation-library/distribution-network-options-assessment-dnoa---making-decisions-on-the-future-use-of-flexibility.pdf

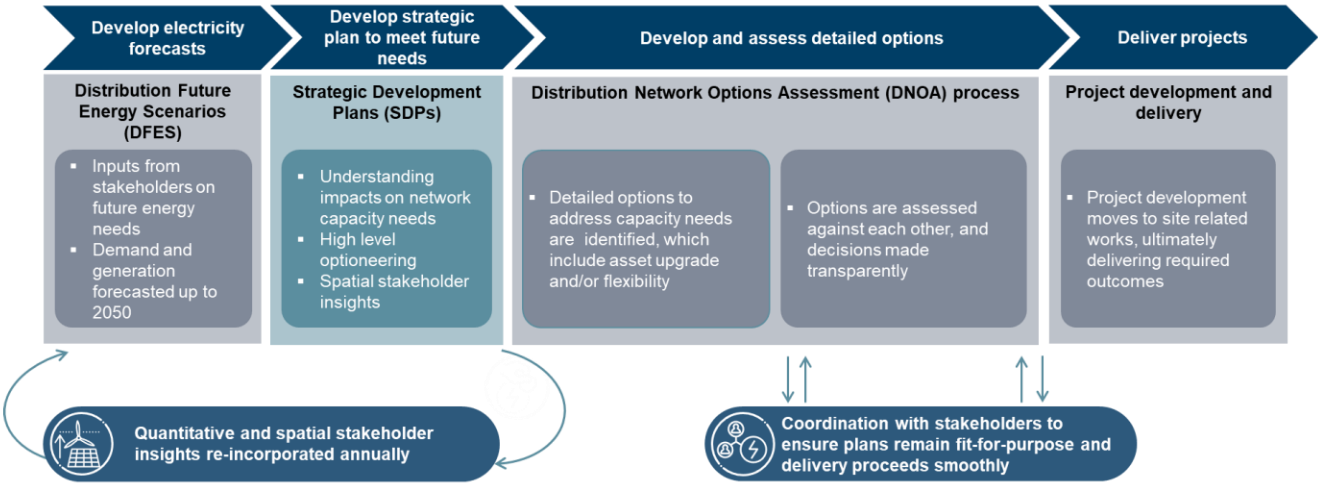

Figure 1 Overview of SSEN's Strategic Planning Process.

We operate our local networks across a range of differing voltage levels as power is transformed down to reach individual homes and businesses. This Strategic Development Plan considers networks at all these voltage levels and is tailored to the specific needs of each type recognising their different challenges.

This report focuses on the area fed from Fawley Grid Supply Point (GSP). The specific geographic area is shown in Figure 2 below. This area covers both the Isle of Wight, and also the south-east of the New Forest local authority area on the mainland including Fawley refinery and petrochemical complex. Fawley refinery and petrochemical complex is a single large customer and whilst we have not shown specific projections for the site, we have considered its operations. in this strategic development plan to understand network requirements, these will be reassessed as new information becomes available.

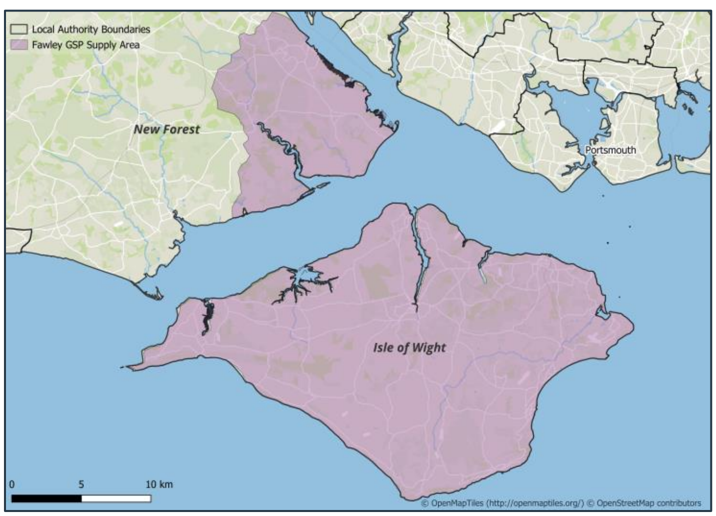

Figure 2 Geographic area covered by this report.

In the report we provide an overview of:

The future demand and generation requirements for the Fawley area and the Isle of Wight. Much of this information is drawn from our work with Regen to develop the 2023 DFES. However, we also consider additional information from connection request activities in the area and local stakeholder insights. This includes insights developed as part of the 2023 assessment carried out by Regen on the Isle of Wight.[2] The Local Energy Net Zero Accelerator (LENZA)[3] is currently being rolled out to local authorities within SSEN's licence areas to assist with Local Area Energy Planning (LAEP) to feedback stakeholder insights to SSEN. Isle of Wight Council, New Forest District Council, and Hampshire County Council have been onboarded to the platform and their insights will be used to inform future iterations of this Strategic Development Plan.

The impacts of these requirements on our electricity networks. In the paper we describe how future requirements affect both our higher voltage networks and also the lower voltage circuits feeding individual homes and businesses. From this we develop spatial plans of future network needs at key time intervals through to 2050.

In the case of Fawley there are dual drivers for both winter peak conditions when electricity demand is high and summer minimum demand where there is significant distributed generation active within the area. We undertake analysis under both these conditions and our SDP considers both aspects.

In particular the Isle of Wight is one of the optimum locations in GB for solar power which is why generation considerations are of such significance. The additional system needs identified for generation requirements are shown in Figure 3 below. This ultimately includes the potential need for a fourth 132kV cable connecting the Isle of Wight to the mainland. The initial driver for this need is generation export from the island, although our analysis indicates a longer term need to support future demand on the island, including for marine applications. Such developments are then developed further through our DNOA process which considers alternative solutions such as the use of flexibility.

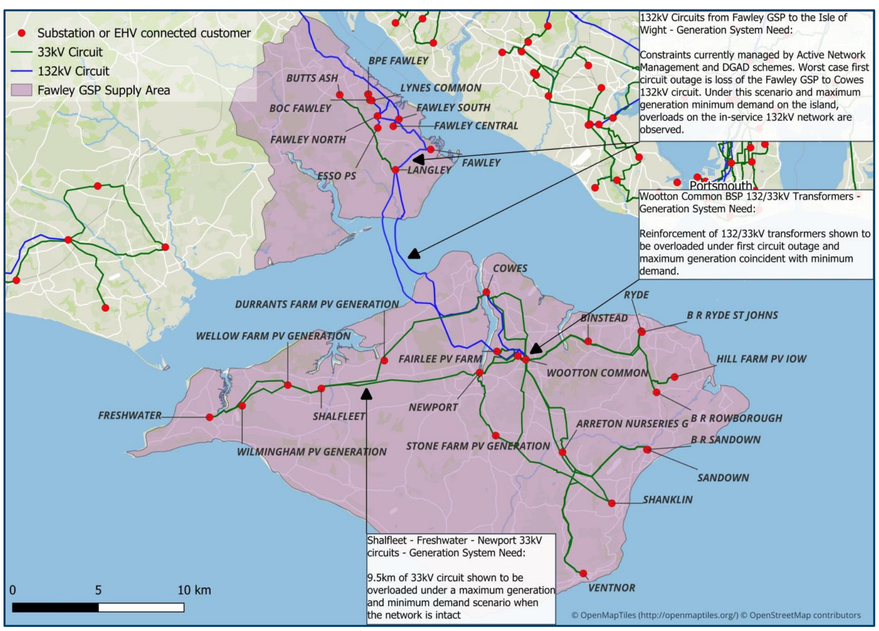

Figure 3 Generation system needs.

The 2050 spatial plan for our Extra-High Voltage (EHV) network based on demand requirements is shown in Figure 4. These show the projected headroom or shortfall in capacity at Primary Substations across the GSP. Areas such as Cowes and Ryde need capacity in the longer term, and we work with stakeholders to take a strategic view of these future needs also considering how they interact with the neighbouring needs in Newport and Sandown.

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2 Isle of Wight – Network Investment Study - Regen

3 https://www.ssen.co.uk/our-services/tools-and-maps/lenza/

The 2050 spatial plan for our High Voltage/Low Voltage (HV/LV) networks based on demand requirements is shown in Figure 5. This plan is driven by future demand requirements for low carbon technologies (such as EVs and electric heating) and clearly shows the specific needs of different local communities and a need to take a tailored approach to reinforcement of these networks and/or use of flexibility. However, there is a clear volume driver for this work to ensure we are building the capacity for our customers in Fawley GSP to decarbonise.

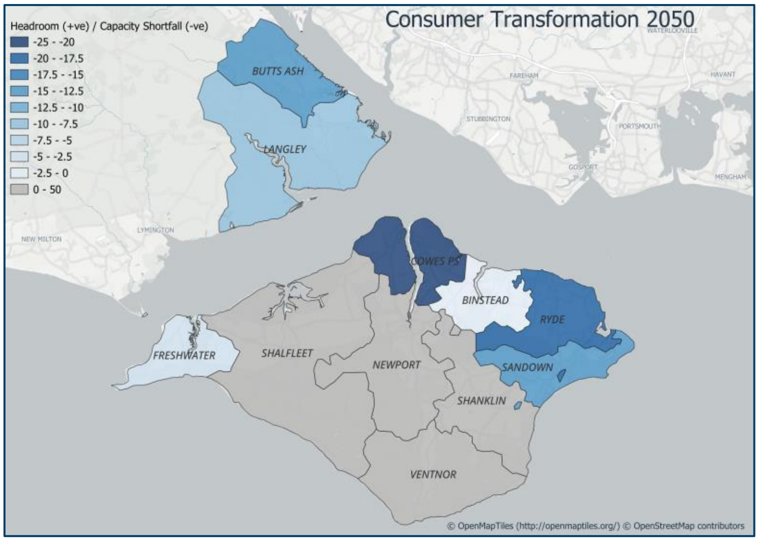

Figure 4 Fawley 2050 EHV/HV network spatial plan.

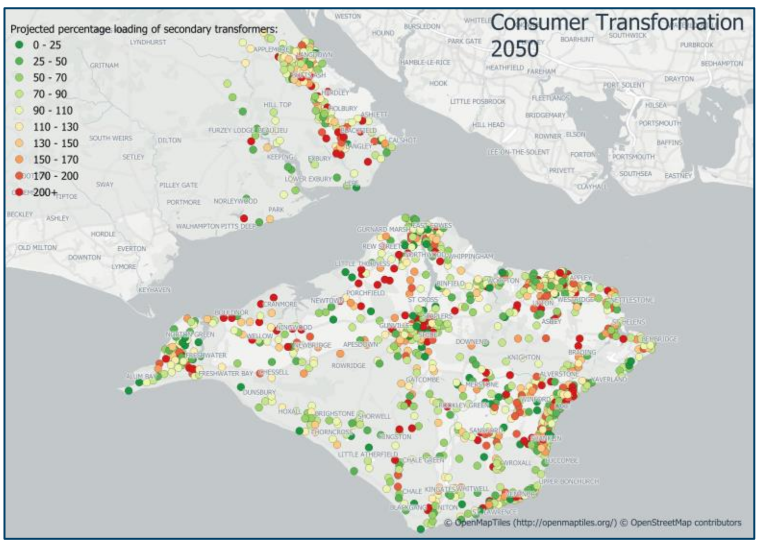

Figure 5 Fawley 2050 HV/LV network spatial plan.

Proposed activities to achieve the spatial plan. In the report we provide an overview of work that we recommend are developed further through the DNOA process. These are generally projects that we believe are needed within the next seven years, but also include required policy developments and areas where more investigative work is needed. We also provide outline thoughts on longer term needs to 2050 with a view to further discussions with key local stakeholders including Local Authorities. Across all timelines we will also consider the use of flexibility- as an alternative to traditional network investment.

The pathways to decarbonisation and Net Zero are not always clear and our use of four DFES backgrounds in the report recognises these future uncertainties. Whilst the Fawley Strategic Development Plan provides a best view of both our spatial needs and required activities, this is subject to change. This plan is therefore a living document that we will update annually reflecting changes from our updated DFES and any additional insights gathered from local stakeholders outside the DFES process.

This Strategic Development Plan is published as a draft report, and we welcome your feedback to shape both the form and content. We will use your feedback to inform both our final published Strategic Development Plan and also future publications.
Please submit any feedback to us through our inbox at: Whole.System.Distribution@sse.com

1. INTRODUCTION

1.1. This Strategic Development Plan summarises how local, regional, and national targets link with other stakeholder views in the area to provide a robust evidence base for load growth out to 2050 across the Ealing Grid Supply Point (GSP) area. A GSP is an interface point with the national transmission system where SSEN then take power to local homes and businesses within a geographic area. Context for the area this represents is shown above in Figure 2. To identify the future requirements of the electricity network, SSEN commission Regen to produce the annual Distribution Future Energy Scenarios (DFES). The DFES analysis is derived from the Electricity System Operator (ESO) Future Energy Scenarios (FES) while accounting for more granular stakeholder insights from stakeholders such as local authorities and new demand and generation connection applications. The DFES provides a forward-looking view of how demand and generation may evolve under four different scenarios as we move towards the national 2050 Net Zero target. These scenarios are summarised in Figure 6. SSEN use Consumer Transformation as the central case scenario following stakeholder feedback during the RIIO-ED2 development process. This position is reviewed annually.

1.2. Where recent demand and generation connection requests have not been captured in the DFES we have considered this to ensure that the projected load is representative of the current best view of future load.

1.3. Using the DFES, power system analysis has been carried out to identify the future system needs of the

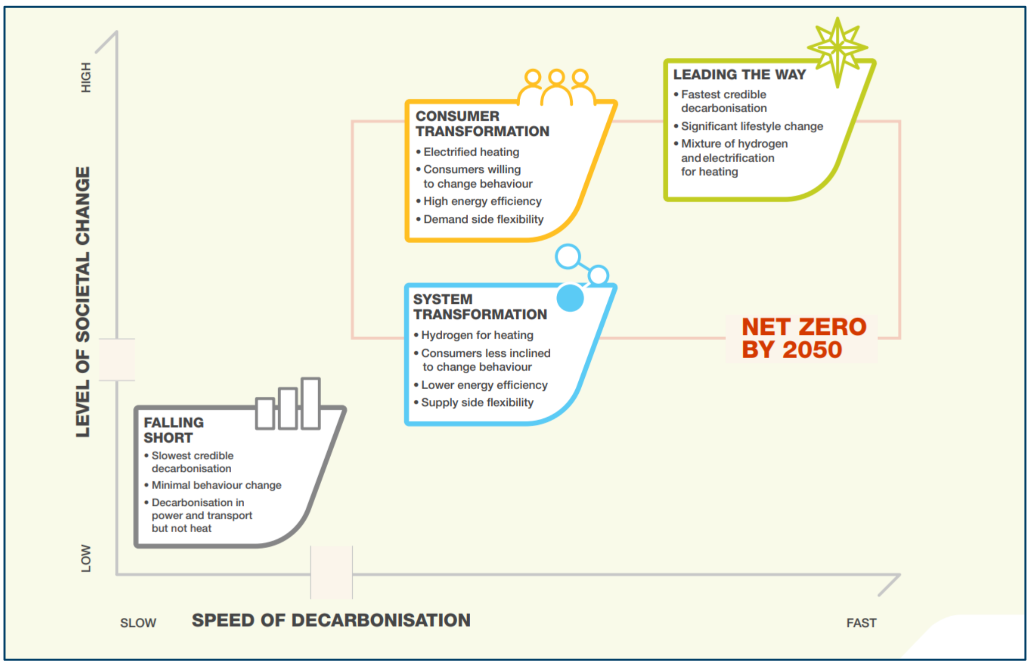

Figure 6 The 4 Future Energy Scenarios adopted for the DFES. Source: ESO FES

electricity network. These needs are summarized by highlighting the year the need is identified under each of the four scenarios, and the projected 2050 load. Here, system needs are identified through power system analysis using the Consumer Transformation scenario. We also model across the other three scenarios to understand when these needs arise and what demand projections should be planned for in the event each of these scenarios is realised.

1.4. The DNOA process will provide more detailed optioneering for each of these reinforcements, improving stakeholder visibility of the strategic planning process. Opportunities for procurement of flexibility will also be highlighted in the DNOA, to cultivate the flexibility markets, and to align with SSEN's flexibility first approach.

1.5. In the face of the increasing costs of fossil fuels, it has never been more important to ensure that everyone who wishes to adopt clean, electrified technologies can do so. SSEN is committed to supporting a just transition to Net Zero. To do this SSEN is working to identify consumers in vulnerable positions and forecast how those communities and their needs may change in the transition to Net Zero. Going forwards we will leverage our work on the VFES (Vulnerability Future Energy Scenarios) to better forecast impacts on vulnerable customers and how we can ensure they do not miss out on the ability to access low-carbon technologies.

2. STAKEHOLDER ENGAGEMENT AND WHOLE SYSTEMS CONSIDERATIONS

2.1. Local authorities and local area energy planning

2.1.1. Fawley GSP supplies three local authorities: the entirety of the Isle of Wight council area a small part of the New Forest District Council area and as such, an area of Hampshire County Council, as shown in Figure 7. The location of the GSP means it supplies both mainland and island communities and a range of different customer types: domestic, commercial, industrial, and agricultural.

2.1.2. Significant demand and generation arise from the Fawley refinery and petrochemical complex. This customer has multiple points of connection to SSEN's distribution network at both 132kV and 11kV. Also, on the mainland is Langley BSP that supplies the towns of Langley and Hythe and the surrounding areas. Recently, SSEN has received connection requests for large Battery Energy Storage Systems (BESS) connecting on the mainland to Fawley GSP.

Fawley GSP also supplies the Isle of Wight via three 132kV subsea cables.

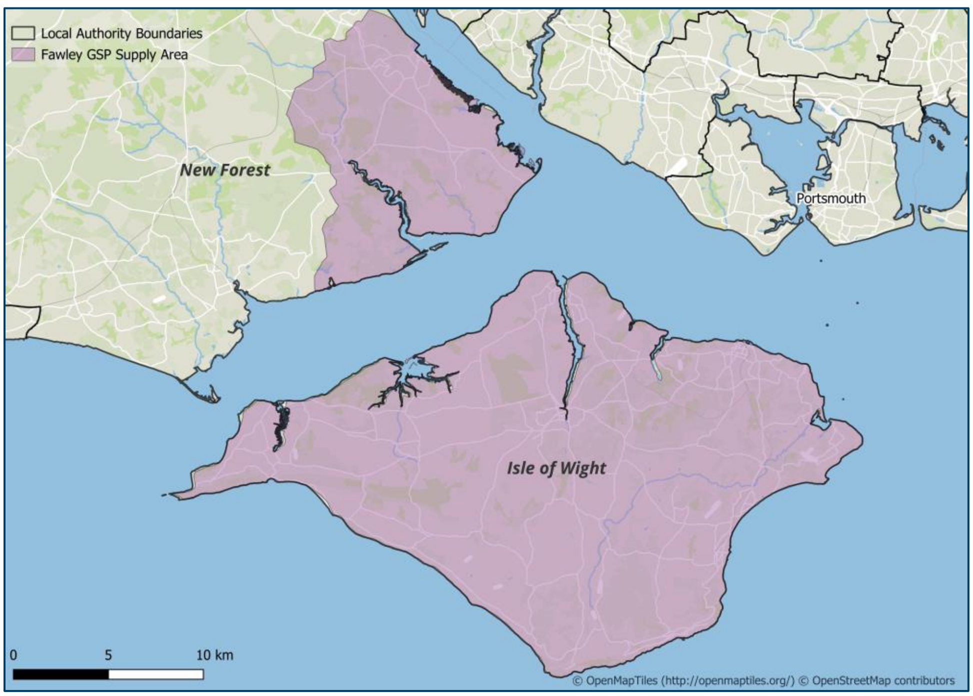

Figure 7: Fawley GSP Supply Area and Local Authority Boundaries.

2.2. Isle of Wight Council Local Energy Plans

2.2.1. Isle of Wight Council have committed to a 2040 target for the island to become net zero. In 2021, the council published *Mission Zero: Climate and Environment Strategy* which sets the direction of how they will achieve this.'[4] Part of the action plan outlined within this is to work directly with SSEN on grid reinforcements and smart grid solutions.

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4 Isle of Wight Council, September 2021, Mission Zero Climate and Environment Strategy 2021-2040.

2.2.2. Working with Regen and SSEN, an Isle of Wight Net Zero Network Investment study was published in April 2023.[5] The conclusions from the study highlighted that the DFES 2021 projections were much lower than the significant potential and market interest in renewable energy development on the island. It is conceivable that more energy development projects may come forward if greater network capacity were available. Industries that do not fall within one of the existing DFES building blocks, for example marine transport, were also shown to be potential sources of significant demand growth.

2.2.3. These findings have been reflected in the SSEN 2022 DFES (and other subsequent DFES publications). If we exclude Cowes power station, the DFES 2022 projects an additional 77MW of generation under the Consumer Transformation scenario. This is driven predominantly by increased projections for Solar PV and Marine generation.

2.3. New Forest District Council Local Energy Plans

2.3.1. In October 2021, New Forest District Council declared a Climate Change and Nature Emergency, pledging to be a carbon neutral district by 2030 including both production and consumption emissions.[6] Since then it has partnered with Community Energy South for a two-year initiative to deliver community-owned renewable energy and the council has increased the EV charging network within the local authority area. The Greener Housing Strategy lays out various means by which housing stock is decarbonised, focusing on electric vehicle charging points, photovoltaic panels and renewable energy heat sources including heat pumps, all of which will have an impact on the electricity distribution network.[7]

2.3.2. Within New Forest District Council's area is part of the Solent Freeport with the purpose of creating additional economic activity. Aims include pioneering approaches to climate change adaptation and decarbonisation and accelerating the transition to a Net Zero economy.

2.4. Hampshire County Council Local Energy Plans

2.4.1 Hampshire County Council has two targets: to be carbon neutral by 2050 and to build resilience to a two-degree rise in temperature. The Council has published a strategy[8], action plan[9] and strategic framework[10] for action to achieve its carbon neutral aims and details numerous steps it has planned to electrify various sectors of the local economy.

2.4.2 In its strategic framework, the Council lays out plans to develop and roll out an electric vehicle strategy across the county and development of an electric vehicle charge point strategy is underway, supported by the LEVI fund. In terms of its own estates, the Council aims to transition to fossil-fuel-free heating and install solar PV on depot buildings and a retrofit programme for privately owned residential properties has been identified and the Solar Together programme for group buying solar PV and battery storage has already taken place.

2.4.3 The Council intends to work with partners to balance renewable energy generation and demand, building self-sufficient communities throughout the county. A county-wide local area energy plan is to be developed and SSEN will be working closely with the Council and its partners during this process.

2.5. Whole system considerations

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5 Regen & SSEN, April 2023, Isle of Wight Net Zero Network Investment Study.

6 New Forest District Council, January 2023, Climate Change and Nature Emergency Report and Action Plan 2023.

7 New Forest District Council, July 2022, Greener Housing Strategy.

8 Hampshire County Council Climate Change Strategy 2020 - 2025

9 Hampshire County Council Carbon Mitigation Action Plan

10 Hampshire County Council Framework for Strategic Programmes

Transmission Interactions

2.4.1. The busbar at Fawley GSP is owned by National Grid Electricity Transmission so any additional circuit breakers and busbar extensions will involve modification applications and discussions with the ESO. For example, any new circuit breakers such as a new circuit breaker for a new subsea cable to the Isle of Wight will need a modification application.

Other utility considerations

2.4.2. Southern Water is the regional water and wastewater for the Fawley GSP area, and as such is a major electricity user. Southern Water's Sandown Sewage Treatment Works currently consumes 6.2GWh of electricity per year, changes to this will have significant capacity implications to this part of SSEN's licence area.

2.6. Flexibility considerations

Flexible connections

2.5.1. Flexible connections are those generation connections which have specific limitations within their contractual arrangements. There are three main forms of flexible connection within Fawley GSP:

- There is currently an Active Network Management (ANM) for constraints on the Isle of Wight this has currently reached its maximum capacity on the island.
- There is also the DGAD (Distribution Generation Automatic Disconnection Scheme) on the Isle of Wight which predates ANM. This will trip specific generators during defined 132kV network constraints.
- All generation connections 1MW and above within Fawley GSP are part of the SWAN South-West Active Network Management System that helps manage flows on the transmission network.[11]

Flexibility services

2.5.2. Flexibility services are procured from demand and/or generation customers to help SSEN manage constraints on their networks. We are not currently utilising flexibility services in this area, although this matter is being considered both through the UN:LOCK innovation project[12] with Regen and via the DNOA process.

11 SSEN, May 2017, SWANS – Southwest active network system.

12 SSEN Distribution secures funding for pioneering new innovation projects - SSEN

3. EXISTING NETWORK INFRASTRUCTURE

3.1. Fawley Grid Supply Point Context

3.1.1. The Fawley GSP Network is made up of 132kV, 33kV, 11kV, and LV circuits. It is an urban/rural network located to the Southeast of the New Forest local authority area and the Isle of Wight. Here the land use is primarily agricultural/residential with pockets of industrial/commercial land for example, Fawley refinery and petrochemical complex. In total the GSP supplies approximately 95, 980 customers with the breakdown for each substation shown in Table 1 (*excludes Fawley Petrochemical*).

Substation Name	Site Type	Number of Customers Served	2022/23 Substation Maximum MVA (Season)
Fawley	Grid Supply Point	95,980	380 (Autumn)
Cowes & Wootton Common BSP	Bulk Supply Point	79,190	99 (Winter)
Langley BSP	Bulk Supply Point	16,450	23 (Winter)
Binstead	Primary Substation	4,740	5 (Autumn)
Butts Ash	Primary Substation	11,070	14 (Winter)
Cowes	Primary Substation	13,300	18 (Winter)
Freshwater	Primary Substation	5,550	6 (Summer)
Langley	Primary Substation	5,700	11 (Summer)
Newport	Primary Substation	13,380	24 (Winter)
Ryde	Primary Substation	14,600	15 (Winter)
Sandown	Primary Substation	8,490	11 (Winter)
Shalfleet	Primary Substation	3,350	5 (Spring)
Shanklin	Primary Substation	9,070	10 (Winter)
Ventnor	Primary Substation	6,680	8 (Winter)

Table 1 Customer number breakdown and substation peak demand readings (2023)

3.2. Network Topology

3.2.1. The network at Fawley Grid Supply Point (GSP) is supplied from the 400kV transmission system, via supergrid transformers (SGT) which transform the voltage to 132kV. This Strategic Development Plan focuses on the network supplied from Fawley GSP.

3.2.2. Fawley GSP supplies substations both on the Isle of Wight (via three subsea cables) and an area on the mainland. Part of Fawley GSP demand can be transferred to the neighbouring Nursling GSP to manage certain outage conditions via a substation at Marchwood.

3.2.3. The local 132kV and 33kV SSEN networks are shown in geographic and schematic formats in Figures 8 and 9 respectively.

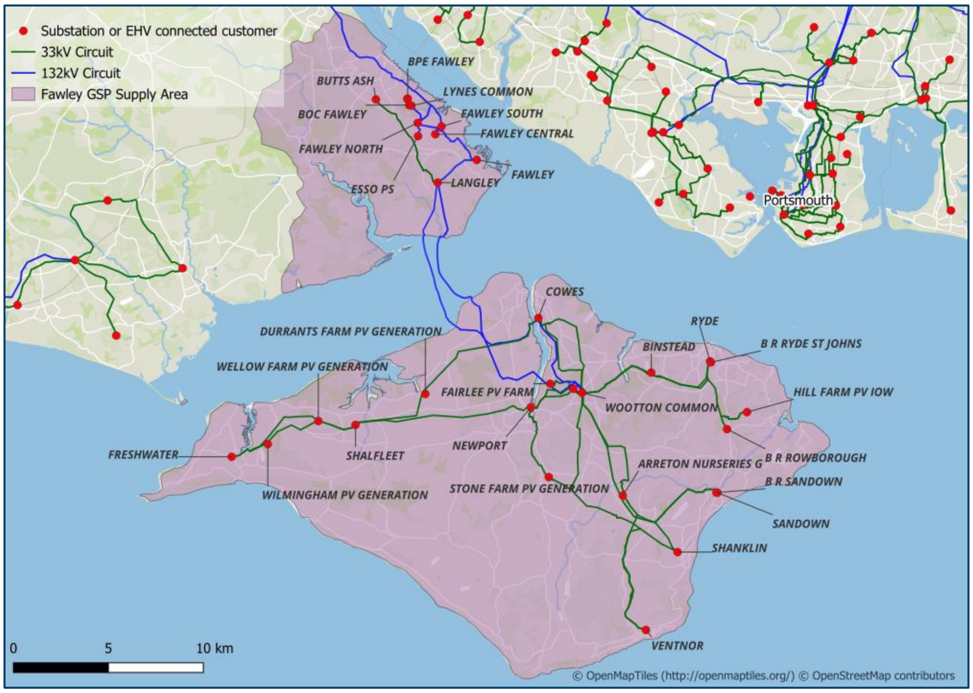

Figure 8: Fawley GSP geographical overview of 132kV network and 33kV network.

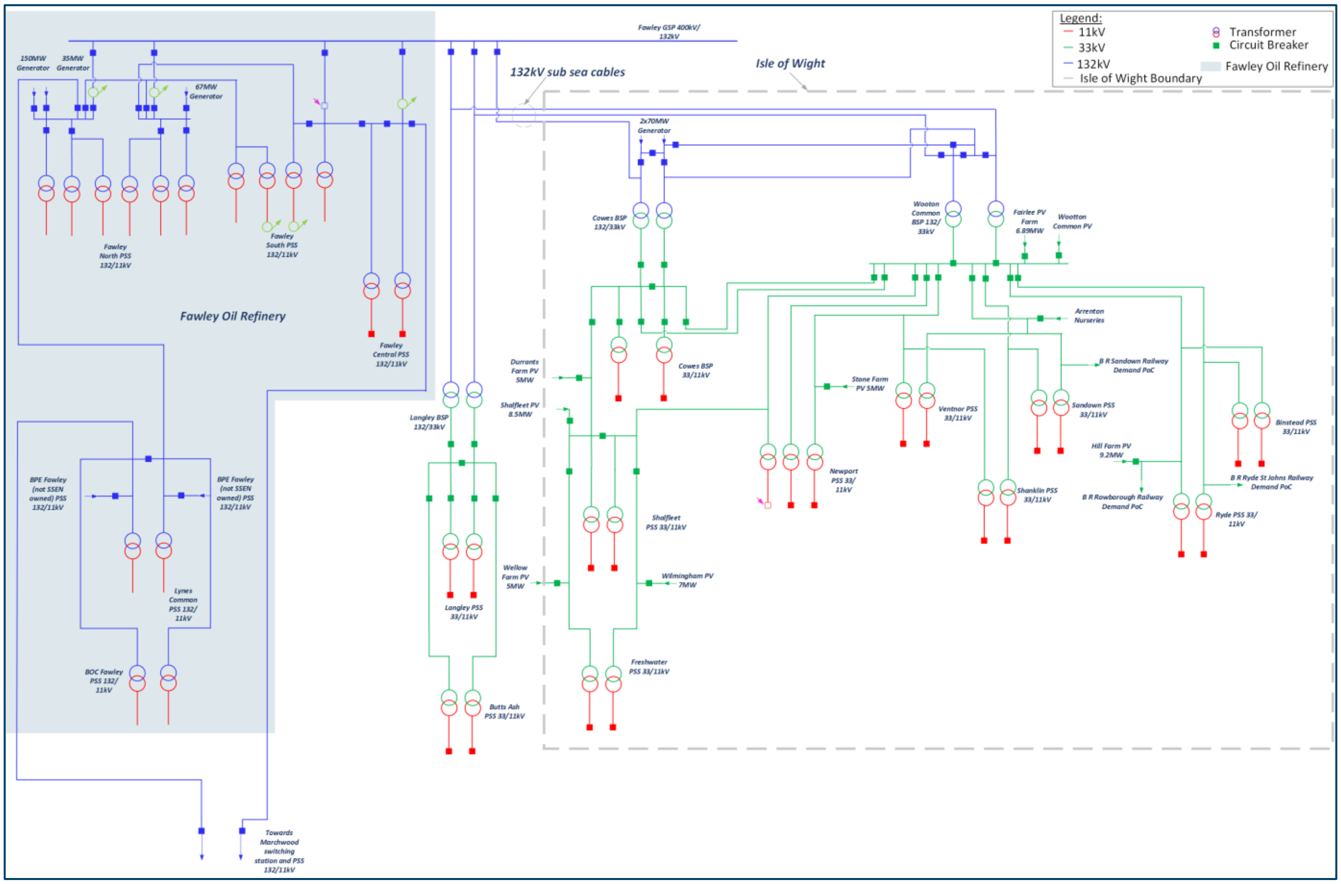

Figure 9: Electrical single line diagram of Fawley GSP

4. FUTURE ELECTRICITY DEMAND & GENERATION FORECASTS

4.0.1. The following section details load growth across the technologies projected for Fawley GSP. It is derived from the 2023 Distribution Future Energy Scenarios (DFES). Where megawatt (MW) values are presented in this section, they represent ***total installed capacity***. When conducting network studies these values are appropriately diversified to represent the coincident maximum demand of the entire system rather than the total sum of all demands. The projections presented here are the outputs from the most recent DFES 2023 analysis, it should be noted that values form the DFES 2022 were used as the basis for the power system analysis presented in later sections.[13]

4.0.2. Additionally, we will also consider the insights developed by Regen in their deep dive of future requirements for the Isle of Wight and any further information provided by stakeholders on their future plans.

4.1. Distributed Energy Resource

4.1.1. There is a significant amount of existing generation connected within Fawley GSP. This includes generation at Fawley refinery and petrochemical complex, the RWE operated Cowes Power Station, and a large number of solar PV farms across the Isle of Wight. Both Fawley refinery and Cowes Power Station are currently fossil fuel powered. This means we expect to see a changing generation mix under Fawley GSP as these sites either decarbonise or decommission. An increase in solar PV is also to be expected to take advantage of the high solar irradiance on the Isle of Wight.

DFES Projections

Generation

4.1.2. The 2023 DFES projections show a diverse mix of Distributed Energy Resource (DER) technologies connected under Fawley GSP. Under the Consumer Transformation scenario, we see growth in marine and solar PV. Forecasts also assume decommissioning of the large capacity of installed gas generation within the GSP under CT and LW scenarios however, there remains the possibility of repowering with green technologies. The net result is a current forecast for the CT scenario of a total of 364MW of installed generation projected by 2050. These trends and totals can be observed below in Figure 10.

13 This is due to overlapping timescales with publication of the new DFES with production of this document. Refreshed power system analysis will be produced as part of the annual update process.

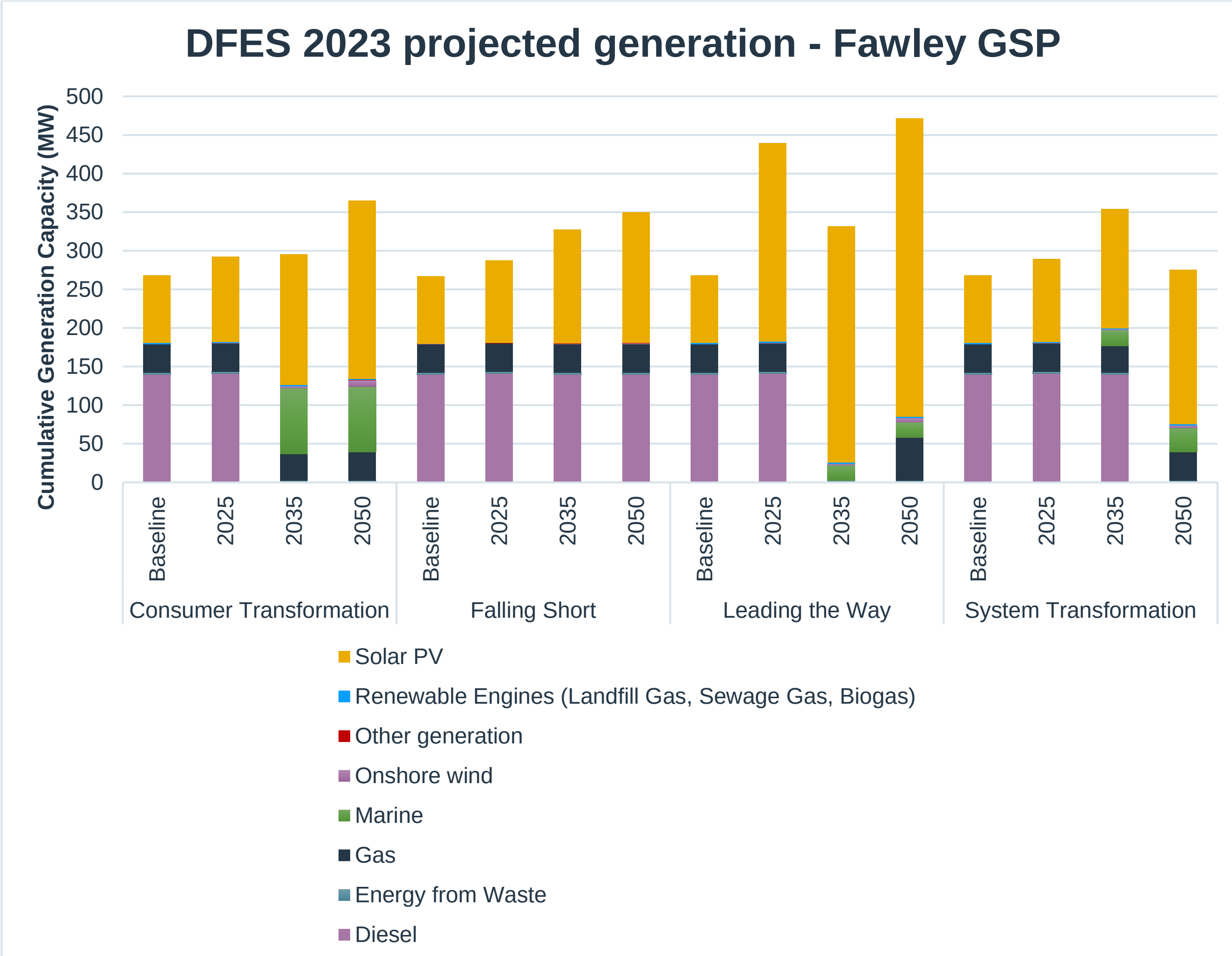

Figure 10: DFES 2023 generation projects under Fawley GSP

Storage

4.1.3. In a net zero world, significant energy storage technologies will be required to complement an increasing capacity of renewable and intermittent generation technologies. As detailed in the section above, there is potential for a significant increase in the capacity of solar generation on the Isle of Wight. To optimise the output of this, developers may aim to co-locate storage projects here.

4.1.4. The 2023 DFES projections show that, under the Consumer Transformation scenario, up to 22MW of generation co-location battery storage projects could be installed under Fawley GSP. This is complemented by multiple other battery storage projects for high energy users and those providing standalone grid services. This would sum to a total of approximately 29MW of energy storage under Fawley GSP by 2050 (excluding domestic storage).

4.2. Transport Electrification

4.2.1. The electrification of transport will be a key driver for electricity demand growth across Fawley GSP. Road, rail, and marine transport will all have an impact on the future load at Fawley GSP. The energy vector used for each of these transport types in the future will result in varied impacts on the distribution network. Using the four DFES scenarios allows us to compare and understand the implications of each of these scenarios on the network.

4.2.2. Only a single 8.5-mile railway exists on the east of the Isle of Wight with existing connection to the distribution network. This means we do not expect to see a significant electricity demand increase resulting from rail decarbonisation in this area.

4.2.3. Marine transport is particularly important for the Isle of Wight, on which it is almost entirely reliant on connections to the mainland. Commercial and public marine transport are good candidates for electrification with Ferries in particular having duty cycles well suited for battery solutions. The leisure marine sector is also starting to electrify, and we project significant demand increases at all the marinas on the isle of white in the study period.

DFES Projections

4.2.4. SSEN's 2023 DFES analysis shows that under the Consumer Transformation scenario, there could be over 105,000 Electric Vehicles (EVs) and Light Goods Vehicles (LGVs) across Fawley GSP supply area by 2050.

4.2.5. As the network operator, it is important for SSEN to understand the electrical demand of these EVs. To do provide an indication of this we have presented the projected EV charger capacity under the Consumer Transformation scenario in Figure 11.

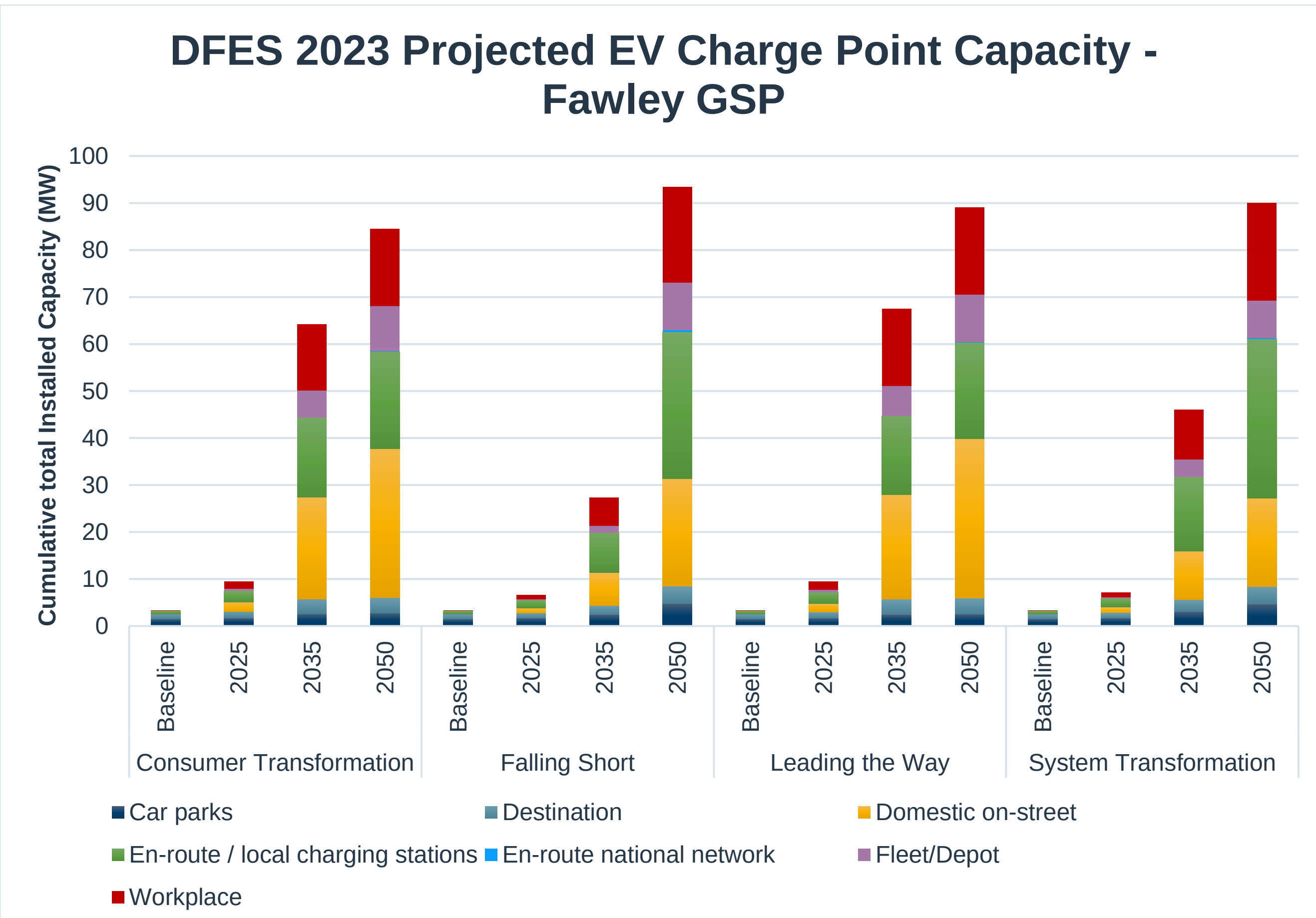

Figure 11: DFES 2023 Projected EV Charge Point Capacity

4.2.6. A sizeable proportion of projected EV chargers are en-route / local charging stations. The Isle of Wight sees significant seasonal tourism so en-route chargers will be important to satisfy charging demands of visitors to the Island throughout the summer months. The charging demands of tourists is investigated further in a report produced by element energy on behalf of SSEN.[14]

4.2.7. Domestic off-street charger numbers are also projected in the DFES analysis although not included in Figure 11. Under the Consumer Transformation scenario, projections show 58,407 Domestic off-street EV chargers supplied by Fawley GSP.

Marine transport

4.2.8. Three ferry companies currently operate 16 vessels across six routes between the north side of the island and the south coast of the mainland. Should these ferries move towards electric vessels as a route to rapid decarbonisation, an additional charging demand will be observed on SSEN's distribution network. Regen estimate that the shore power demand could be in the region of 20-30 MW. Battery electric may not be a feasible decarbonisation route for hovercraft operating between the mainland and the island due to the weight of batteries. Therefore, these may pursue alternative low carbon fuel sources. The ambition for decarbonisation of ferries to the Isle of Wight can be evidenced through Wightlink's future vision strategy.[15]

4.2.9. Outside of ferry operation, there may also be increased electrical demand from electrification of private vessels at marinas across the island. More in-depth information on the potential decarbonisation of marine transport please see the Isle of Wight – Network Investment Study conducted by Regen on behalf of SSEN.[16]

4.3. Electrification of heat

4.3.1. As the UK moves towards net zero, the electrification of heat has potential to result in a significant increase in electricity demand across the UK. The Isle of Wight is no exception to this. However, with uncertainty over the energy vector used for space heating we see a range in the projected number of heat pumps across the different DFES scenarios.

4.3.2. At a local level, the Isle of Wight Council's *Mission Zero* aims for an average of fifty heat pumps to be installed per week from April 2020 to December 2040 to achieve their accelerated net zero by 2040 target.[17]

DFES Projections

4.3.3. DFES 2023 forecasts a steep increase in the number of heat pumps installed across Fawley GSP, with 1,155 heat pumps accounted for in the baseline projected to increase to 91,962 by 2050 (Under the Consumer Transformation scenario). Figure 12 highlights the growth and decline of heating technologies shown in the DFES.

4.3.4. Notably, there is also an increase in Air Conditioning across Fawley GSP projected in the 2023 DFES. This is important to note as this technology will be used throughout the summer months where the thermal ratings of cables are lower.

14 Isle of Wight E-tourism: alternative solutions to network reinforcement, element energy, August 2022

15 Future Vision, Wightlink, (Our commitment to the environment - Wightlink Ferries)

16 Isle of Wight – Network Investment Study, Regen, April 2023 (Isle of Wight – Network Investment Study - Regen)

17 Mission Zero Climate and Environment Strategy 2021-2040, Isle of Wight Council, September 2021

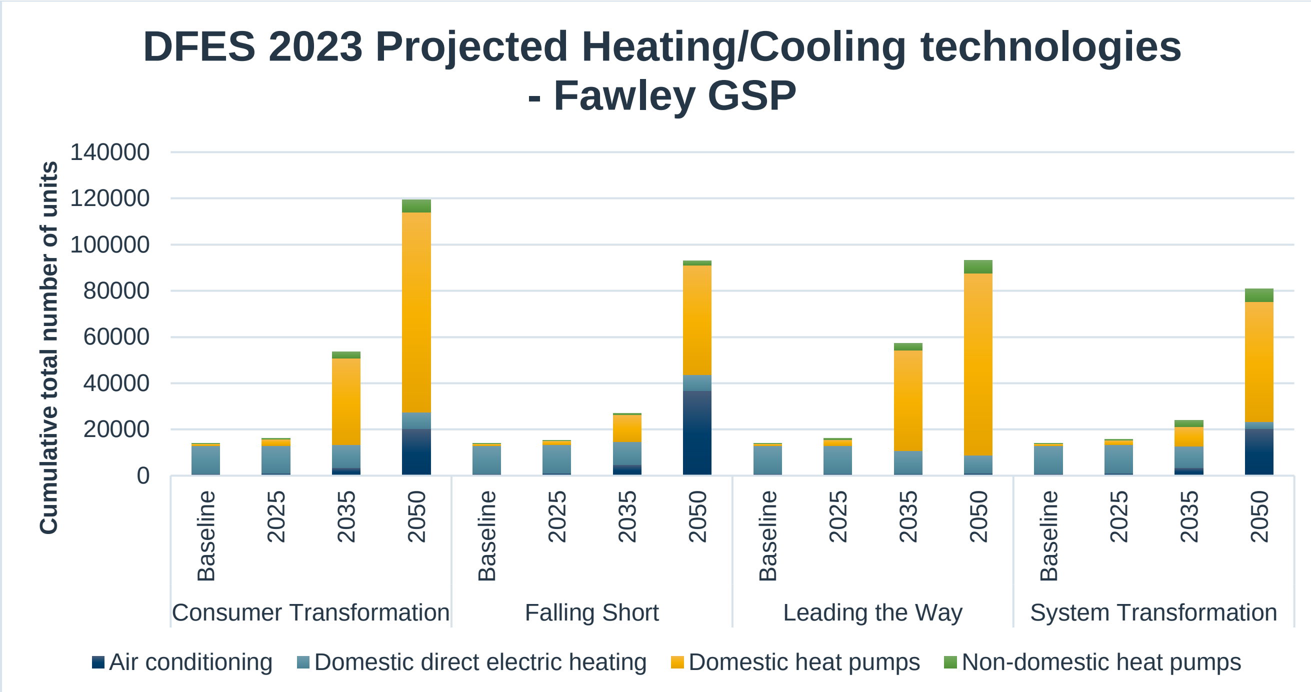

Figure 12: DFES 2023 Heating Demand under Fawley GSP group.

4.4. New building developments

4.4.1. To produce the SSEN DFES 2023, Regen undertook engagement with local authorities to understand local authority development plans across our licence areas. In the case of Fawley GSP, this will refer to the Isle of Wight Council and the New Forest District Council.

4.4.2. It should be noted that due to recent proposed policy updates that are currently being consulted on, there may be some discrepancies with local authorities' current best view on new development projections versus what is presented here. Through the DFES process we work closely with local authorities to update the new development projections. These updates will then be reflected in the next DFES publication and feed into the subsequent SDP as part of the annual update process.

DFES Projections

4.4.3. It is projected under the Consumer Transformation scenario for there to be 13,400 new homes by 2050 fed from Fawley GSP. Approximately 11,000 of these projected new homes are situated on the Isle of Wight with the remainder on the mainland.

4.4.4. Additionally, 75,615 m^2 of non-domestic floorspace is projected to be developed under Fawley GSP under the Consumer Transformation scenario. This is spread across a variety of building use-types with the largest contributors being factory and warehouse space, office space, and hospitals. The split is shown below in Figure 13.

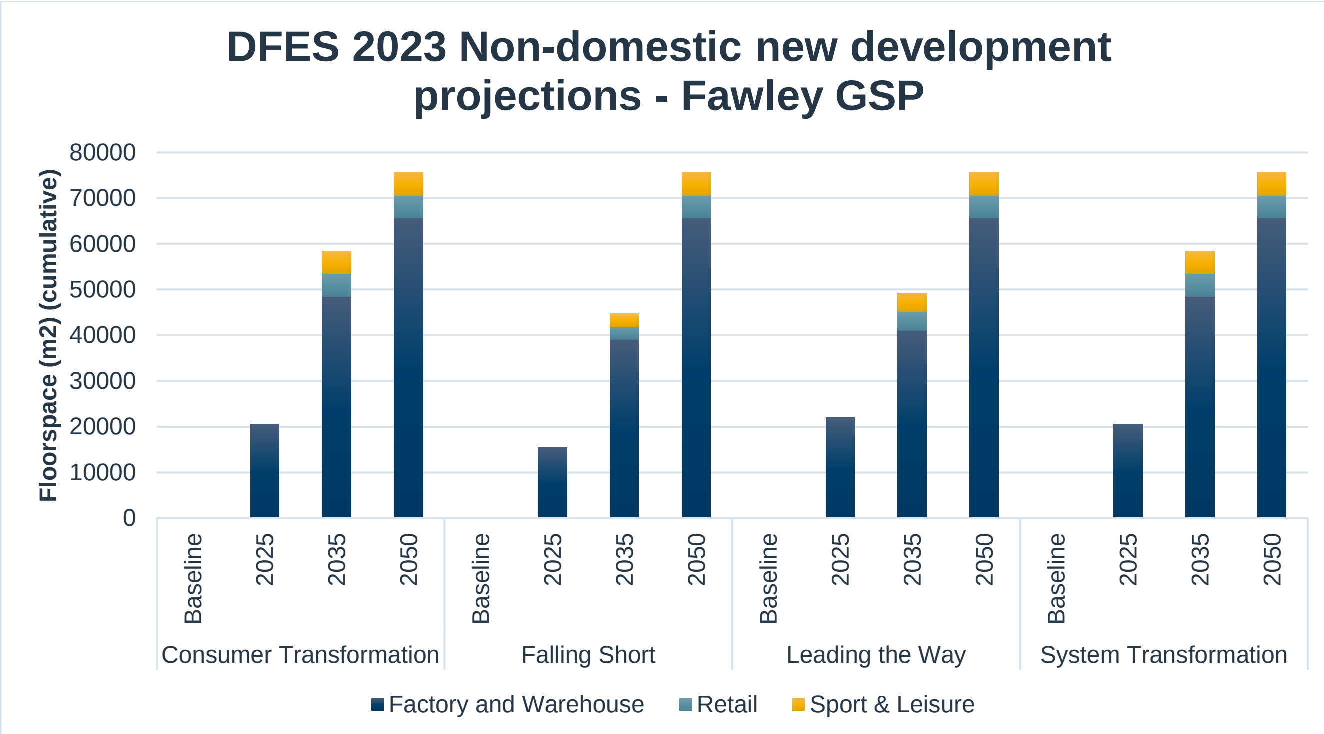

Figure 13 DFES 2023 Non-domestic new development under Fawley GSP group.

4.5. Commercial and industrial electrification

4.5.1. Outside of the SSEN 2023 DFES projections there are other industries that could electrify ahead of 2050. It is important for SSEN to remain informed on this so that the network has sufficient capacity for any increased demands arising from these industrial and commercial customers. For more information on each of these sectors the SSEN Isle of Wight Net Zero Network Investment Study produced by Regen should be referred to.[18]

4.5.2. Summary insights are provided below, and we are happy to meet further with stakeholders to discuss any additional plans to incorporate in this list.

4.5.3. Southern Water is the regional water and wastewater for the Fawley GSP area, and as such is a major electricity user. Southern Water's Sandown Sewage Treatment Works currently consumes 6.2GWh of electricity per year, changes to this will have significant capacity implications to this part of SSEN's licence area.

4.5.4. The Isle of Wight NHS trust operates multiple sites across the Isle of Wight. As part of the wider Greener NHS programme[19], there are specific objectives that the trust will aim to achieve. Targets for reduction of both directly controlled and influenced emissions will impact the electricity network in the area if electrification is the route to emission reduction.

4.5.5. GKN Aerospace are an international aerospace manufacturing and technology innovation company. GKN have a 105,00sqm facility at East Cowes on the north side of the Isle of Wight. While their overall net zero ambitions have been shared widely, it is important for SSEN to engage to understand plans at this specific site.[20]

18 Isle of Wight – Network Investment Study, Regen, April 2023 (Isle of Wight – Network Investment Study - Regen)

19 Greener NHS, NHS, October 2020, Greener NHS (england.nhs.uk)

20 GKN Aerospace Commits to Science-Based Net Zero targets for Decarbonisation Goals, GKN Aerospace, 2023, GKN Aerospace commits to science-based net zero targets for decarbonisation goals

5. WORKS IN PROGRESS

5.0.1. Network interventions can be caused by a variety of different drivers. Examples of common drivers are load-related growth, specific customer connections, and asset health. Across Fawley GSP these drivers have already triggered interventions on the network that have now progressed to detailed design and delivery. For this report, these works are assumed to be complete, with any resulting increase in capacity considered to be released.

5.0.2. The following changes have been triggered which relate to Fawley GSP (excluding works triggered through customer connections). These are also highlighted in the following schematic diagram.

Table 2 Triggered works across Fawley GSP.

Substation	Description	Driver	Forecast completion	Schematic Reference
Fawley North	Add in new circuit from Fawley South to Fawley North, new circuit breaker on Fawley North.	Primary Reinforcement	2024	N/A
Fawley North	Replacing one reactor and refurbish one reactor.	Asset Replacement	2025	N/A
Shalfleet PSS	2 x 33kV circuit breakers	Asset Replacement	2025	1
COWES BSP to WOOC BSP	400m of overhead line to be replaced with 425m underground cable.	Diversion	2024	2
Fawley North	11kV Switchgear replacement.	Asset Replacement	2026	N/A
Fawley South	Fawley South Reactor Replacement.	Asset Replacement	2024	N/A

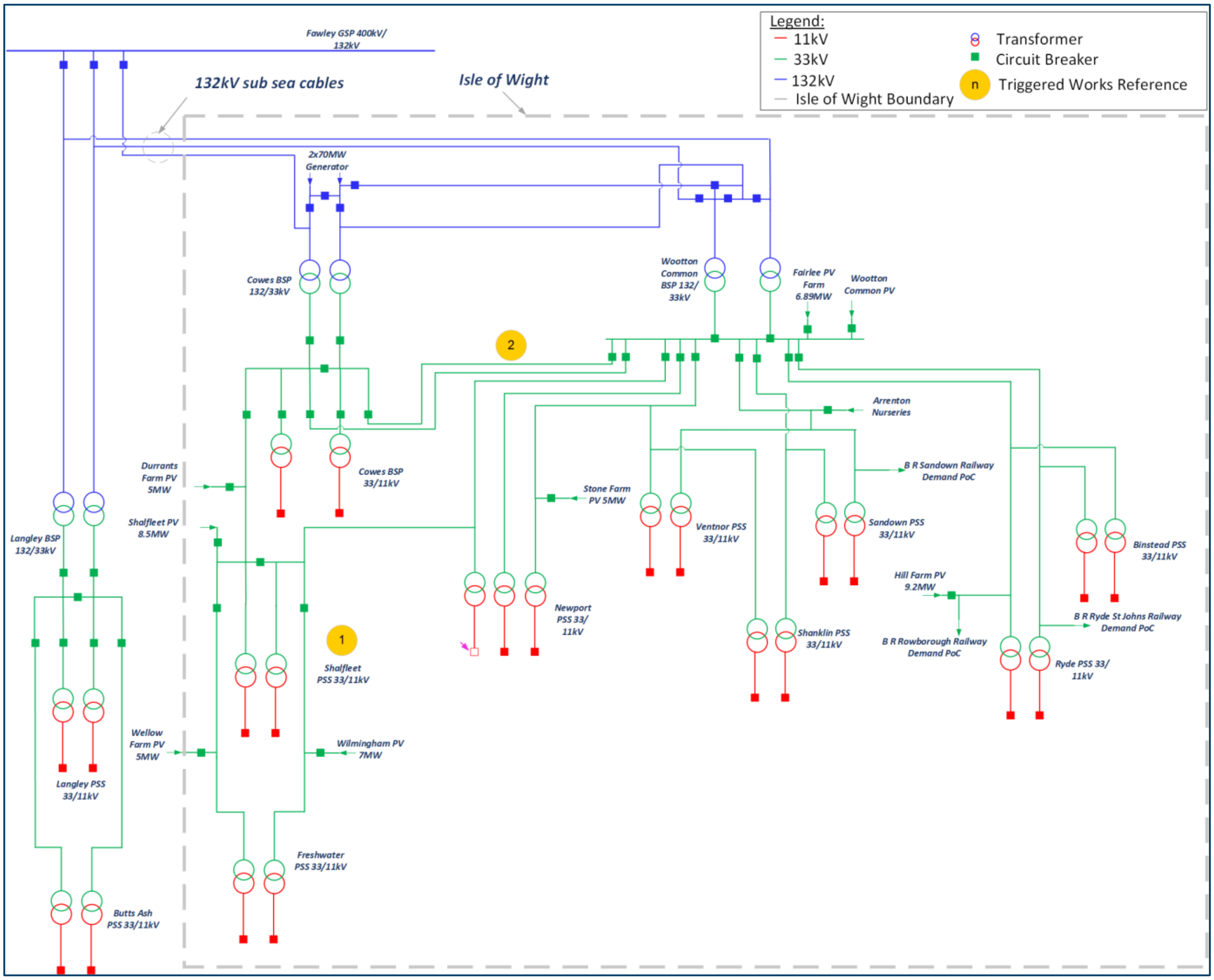

Figure 14 Network schematic with labelled triggered work.

6. SPATIAL PLAN OF FUTURE NEEDS

6.0.1. The previous section summarised Fawley's forecast future demand and generation requirements. We have used this information to understand what this means for the local networks in Fawley. Initially this is developed through the creation of a spatial plan of future system needs for peak demand periods within the GSP.

6.0.2. We have created spatial plans at a primary substation level (33/11kV) and secondary substation level (11kV/LV). Snapshots are provided for 2028, 2033, 2040, and 2050 enabling clear visualisation of future system needs beyond the network capacity following completion of triggered works. They are currently based on 2022 DFES Consumer Transformation forecasts.

6.1. Generation future system needs.

6.1.1. Needs driven by generation requirements during low demand periods are more readily identified and are brought out specifically in Figure 15 below. These relate to needs on the EHV networks and have all been identified as needing immediate development of options through the DNOA process. Further details are provided in section 8.3.

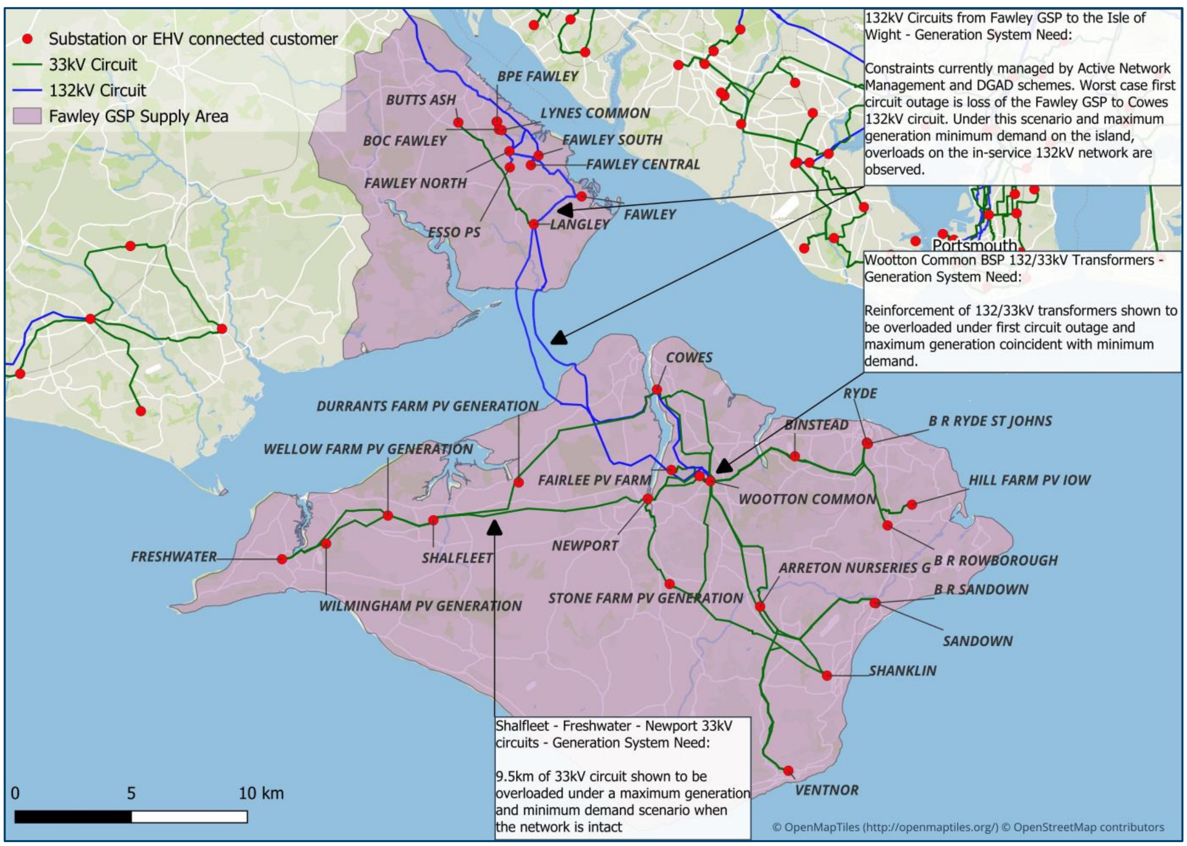

Figure 15 Generation future system needs on the Isle of Wight.

6.2. EHV/HV demand spatial plans.

6.2.1. These plans illustrate forecast electricity demand needs at a primary substation level (i.e. the level below the 132kV network). Whilst these are different to those driven by the future generation needs, there is interaction. For example, a significant increase in forecasted demand could help offset the need for export driven works. This is being further explored by the UN:LOCK project.

6.2.2. The following four figures show the projected headroom or capacity shortfall across the illustrative primary supply areas. This is calculated by comparing the firm capacity of the site with the projected demand at that site. Negative values represent a shortfall in capacity, positive values represent headroom.

6.2.3. Greyed out areas indicate that there is projected headroom in mega-Volt-amperes (MVA) at the site, while the shades of blue reflect the magnitude of the capacity shortfall. Darker blue indicates a larger capacity shortfall (more negative value). These are presented for each of the four DFES scenarios to understand how the projected availability of network capacity changes under each of these scenarios. It should be noted that the network scenario headroom report assumes no further works are carried out to increase the firm capacity of each primary substation. The purpose of these figures is to highlight the areas that SSEN need to deploy a solution to resolve the capacity need, and how these areas relate to one another geographically.

6.2.4. Section 7 builds on this through more in-depth modelling and high-level optioneering. In some cases, the system needs shown here are projected to arise slightly earlier when identified using power system analysis. Examples of this include Sandown and Ryde primary substations which are called out in more detail in Section 7.

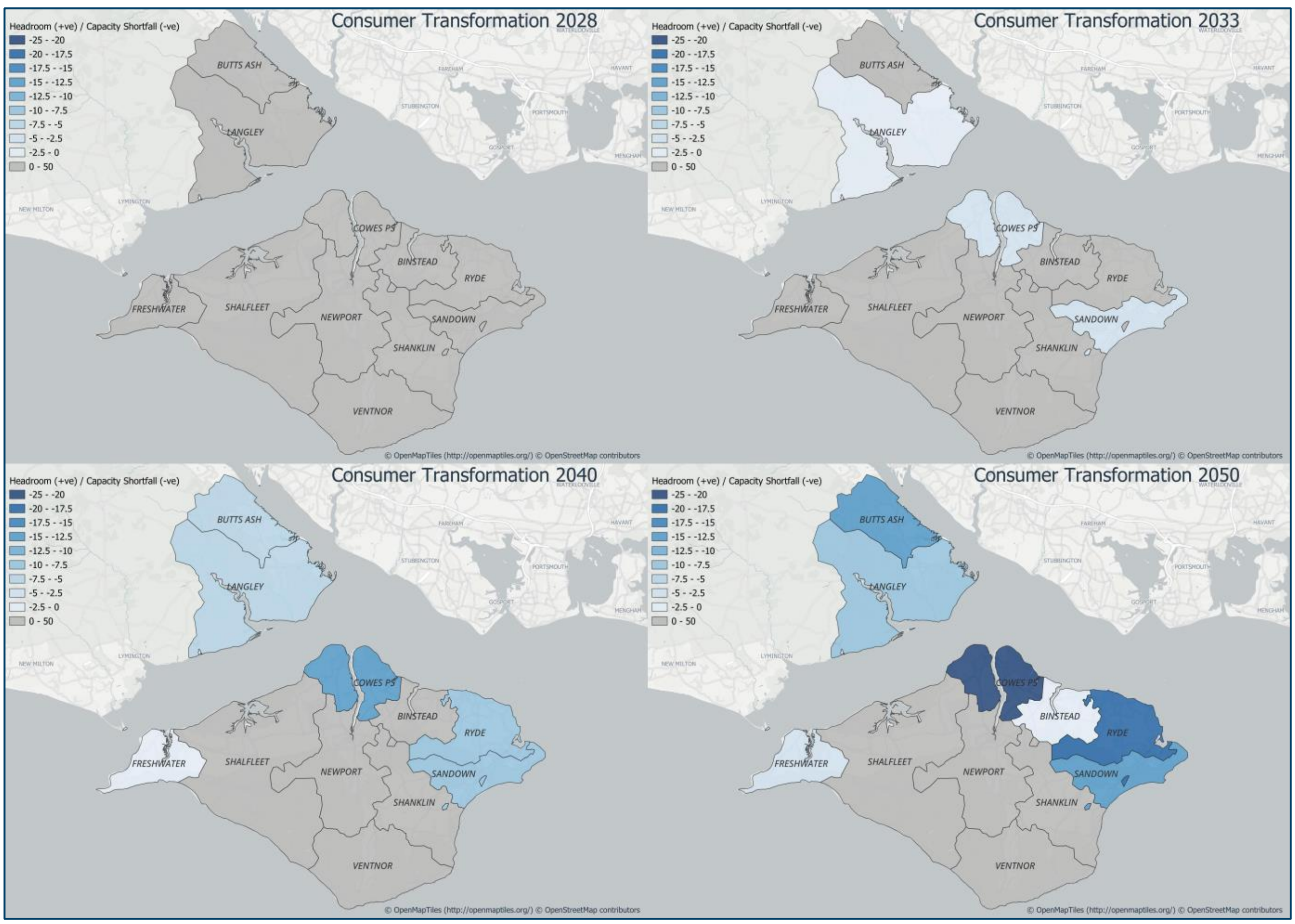

Figure 16 Fawley primary substation spatial plans under the Consumer Transformation scenario for 2028, 2033, 2040, and 2050 (Units: MVA).

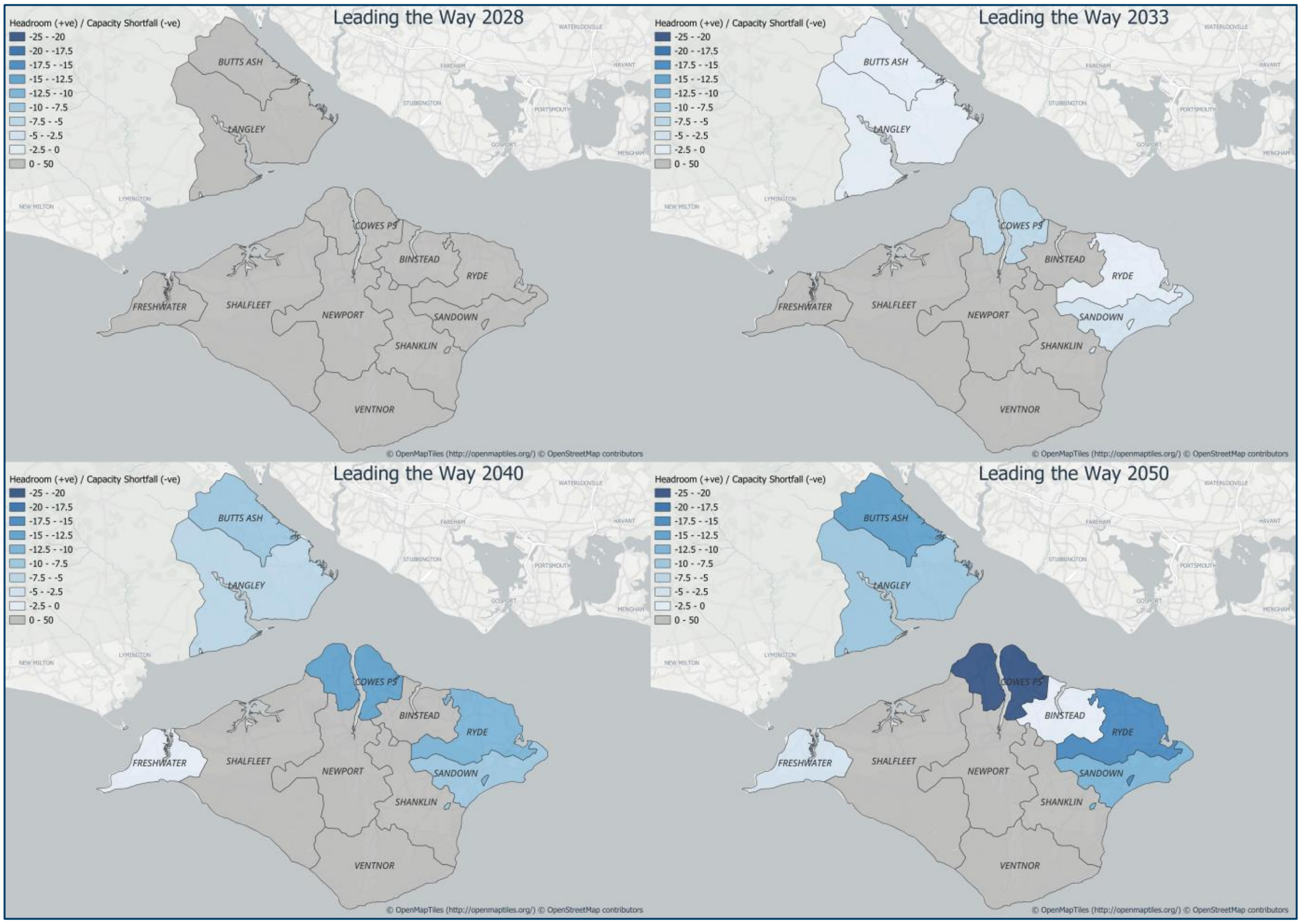

Figure 17 Fawley primary substation spatial plans under the Leading the Way scenario for 2028, 2033, 2040, and 2050 (Units: MVA).

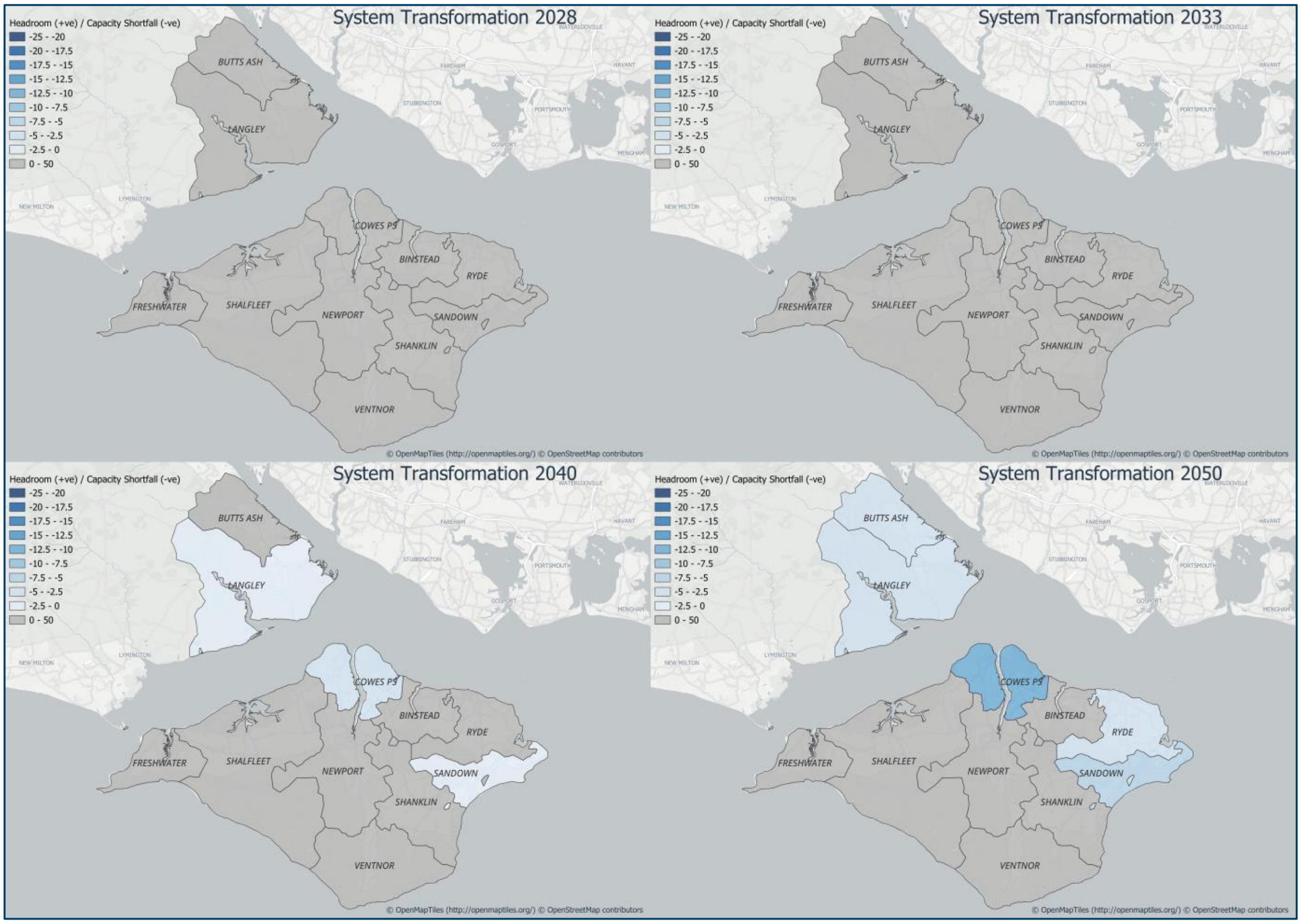

Figure 18 Fawley primary substation spatial plans under the System Transformation scenario for 2028, 2033, 2040, and 2050 (Units: MVA).

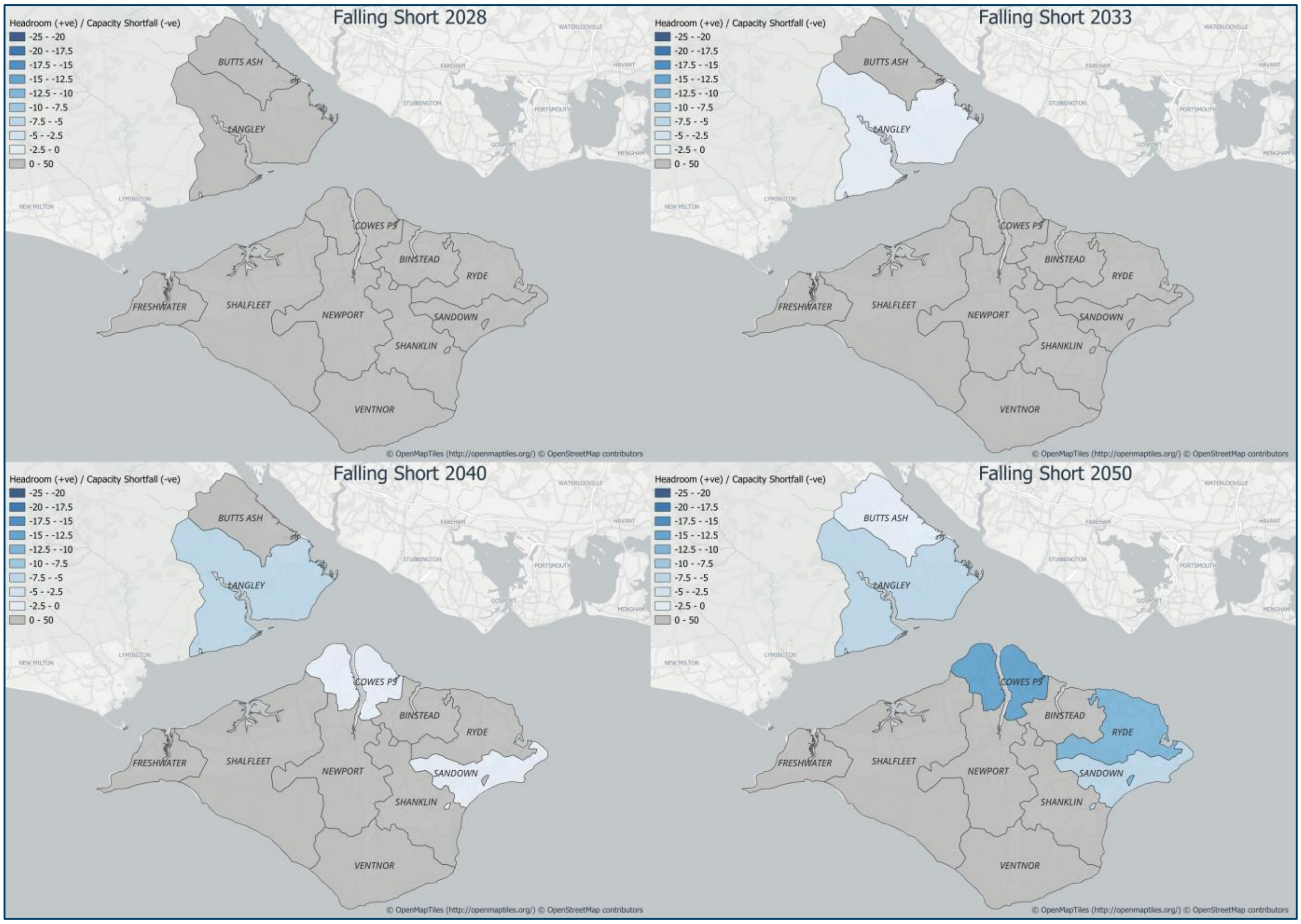

Figure 19 Fawley primary substation spatial plans under the Falling Short scenario for 2028, 2033, 2040, and 2050 (Units: MVA).

6.3. HV/LV demand spatial plans

6.3.1. The following four sets of figures present the percentage loading of secondary transformers in 2028, 2033, 2040, and 2050 across each of the four DFES scenarios. This information has been derived from the SSEN load model.[21]

6.3.2. The points are coloured based on their percentage loading with green being low percentage loading and darker reds being higher percentage loading. There is no clear trend for the location of demand increases or specific areas of load growth. Local demand trends and underlying demographic factors contribute to load growth at secondary transformers across the GSP.

6.3.3. Figure 20 presents the percentage loading of secondary transformers in 2028, 2033, 2040, and 2050 under the CT scenario. As expected, the majority of secondary transformers are centred around existing population centres. There is also a general trend for increased loading of secondary transformers as we move towards 2050. This gives us a good indication of demand centres across the GSP group, this may contrast to the location of large-scale generation on the Isle of Wight for example solar PV that is located in more rural areas, as shown in Figure 8.

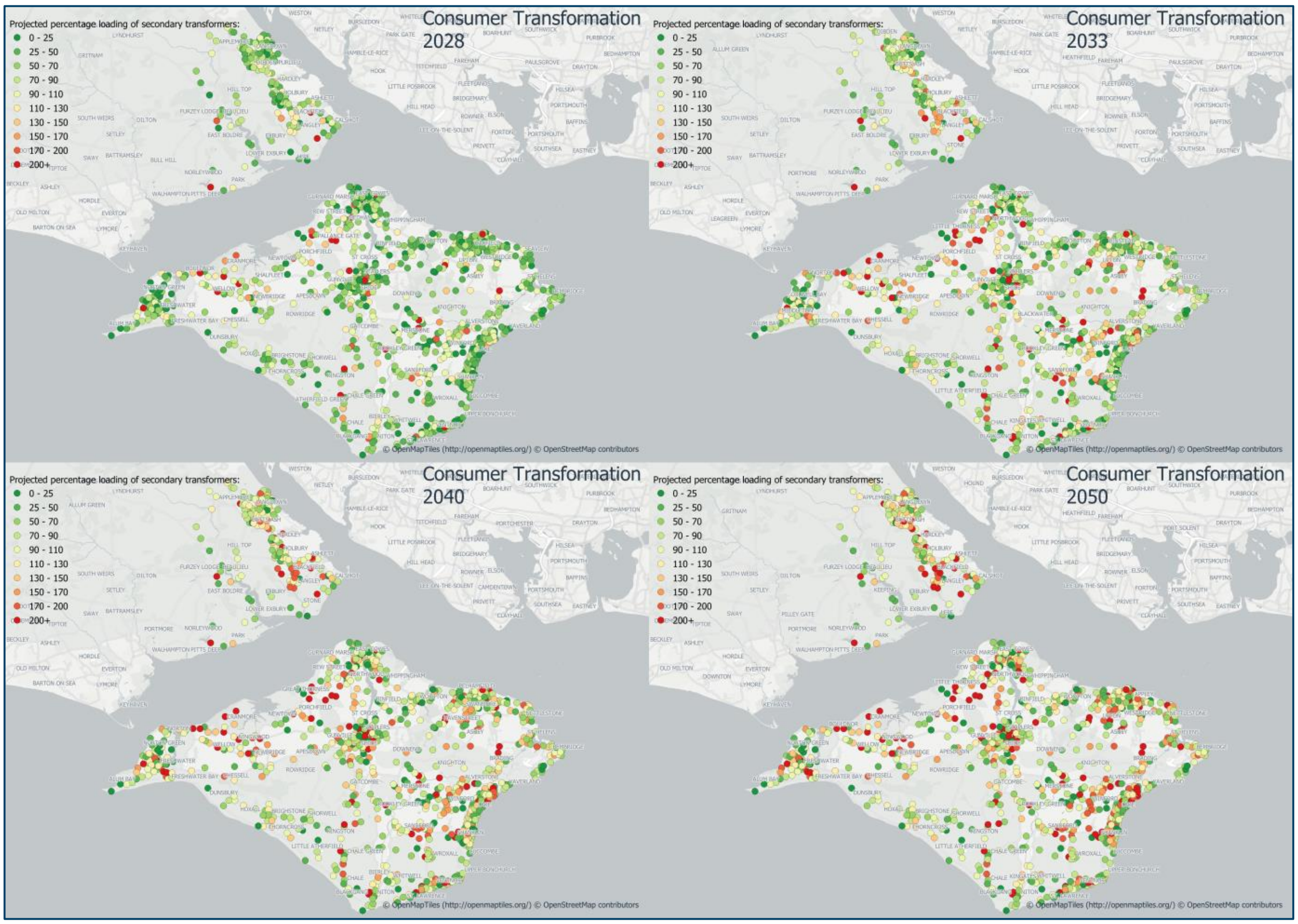

Figure 20 Fawley HV/LV spatial plans under the Consumer Transformation scenario for 2028, 2033, 2040, and 2050.

21 SSEN Secondary Transformer - Asset Capacity and Low Carbon Technology Growth - Data Asset - SSEN Distribution Data Portal

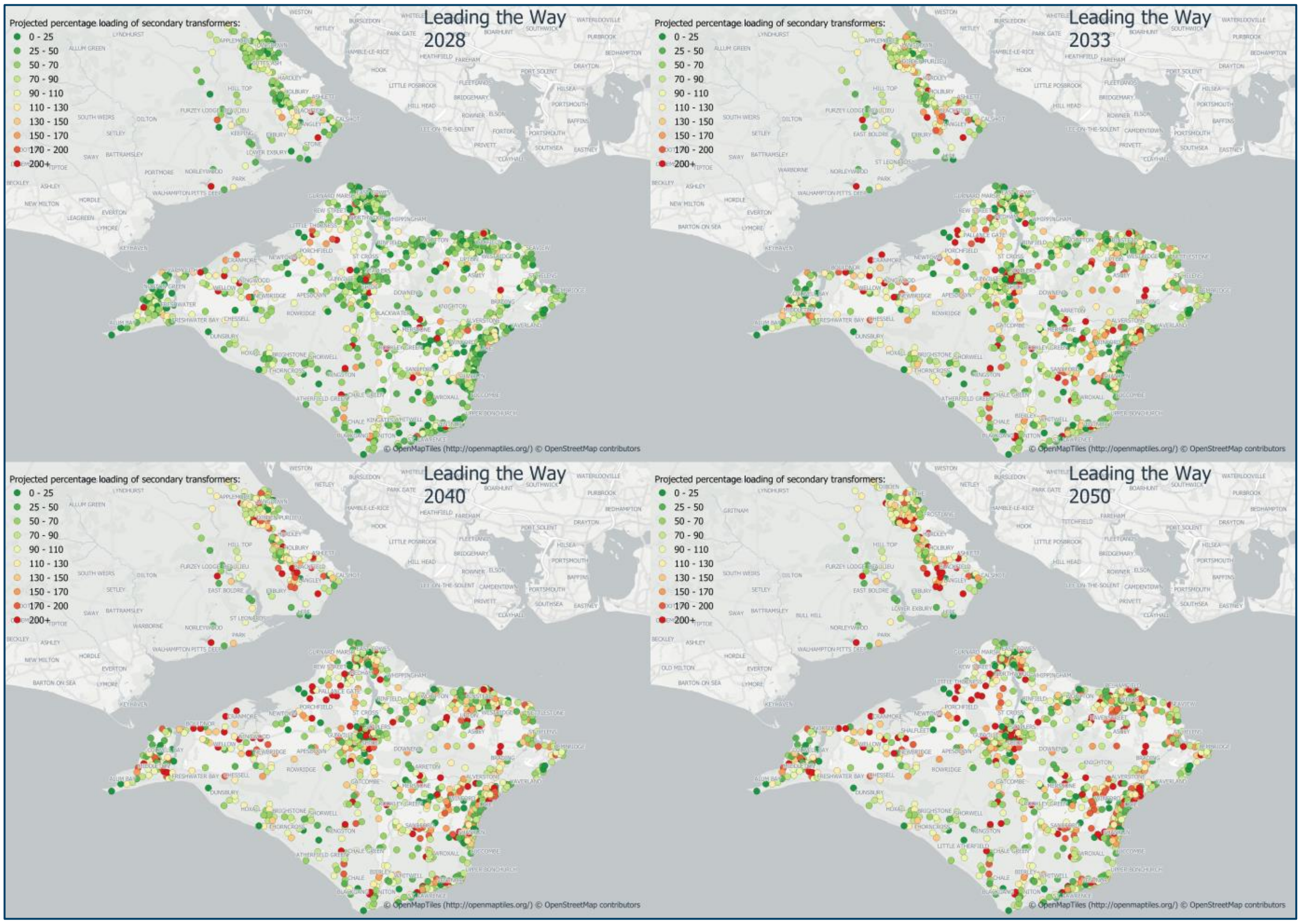

Figure 21 Fawley HV/LV spatial plans under the Leading the Way scenario for 2028, 2033, 2040, and 2050.

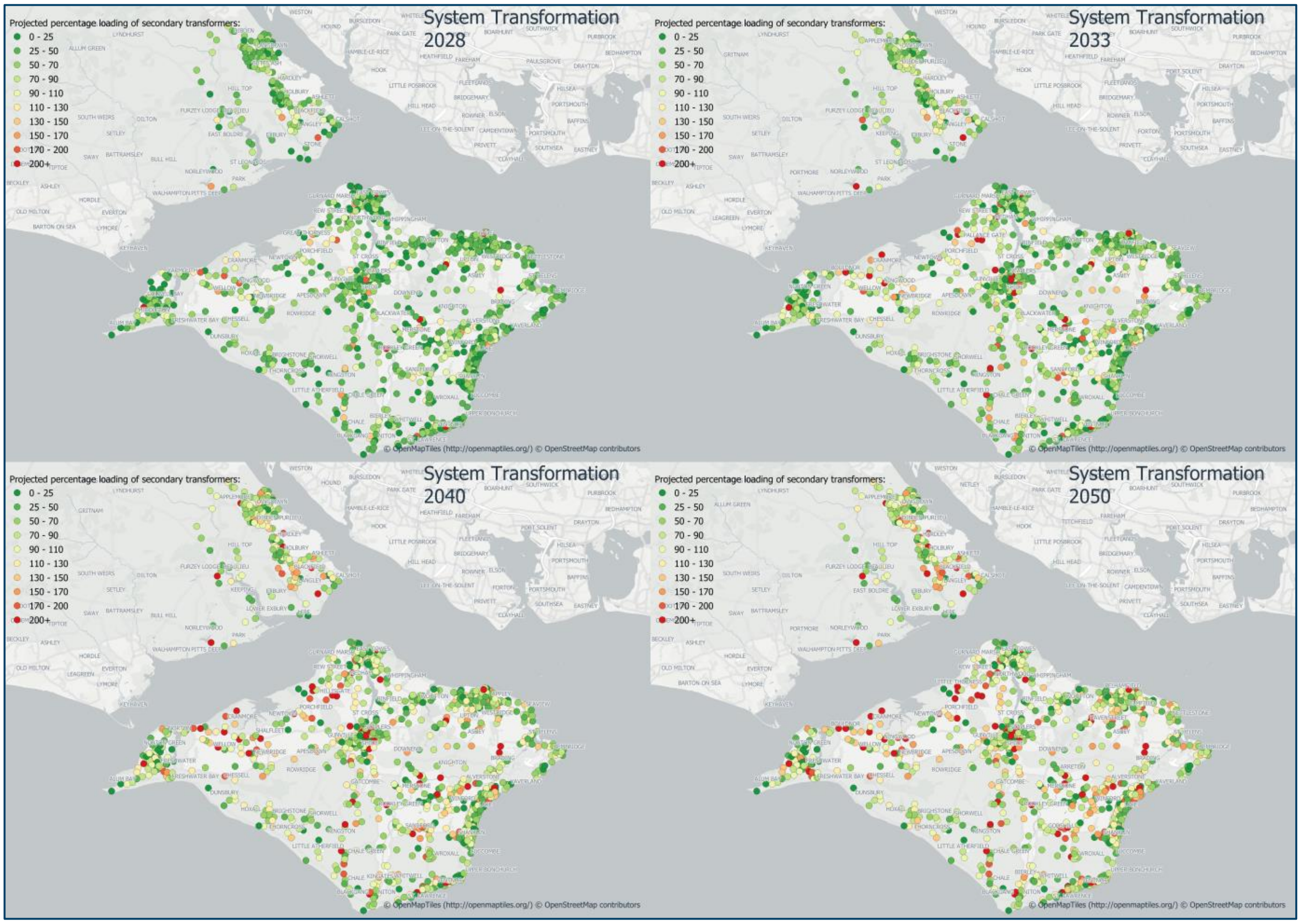

Figure 22 Fawley HV/LV spatial plans under the System Transformation scenario for 2028, 2033, 2040, and 2050.

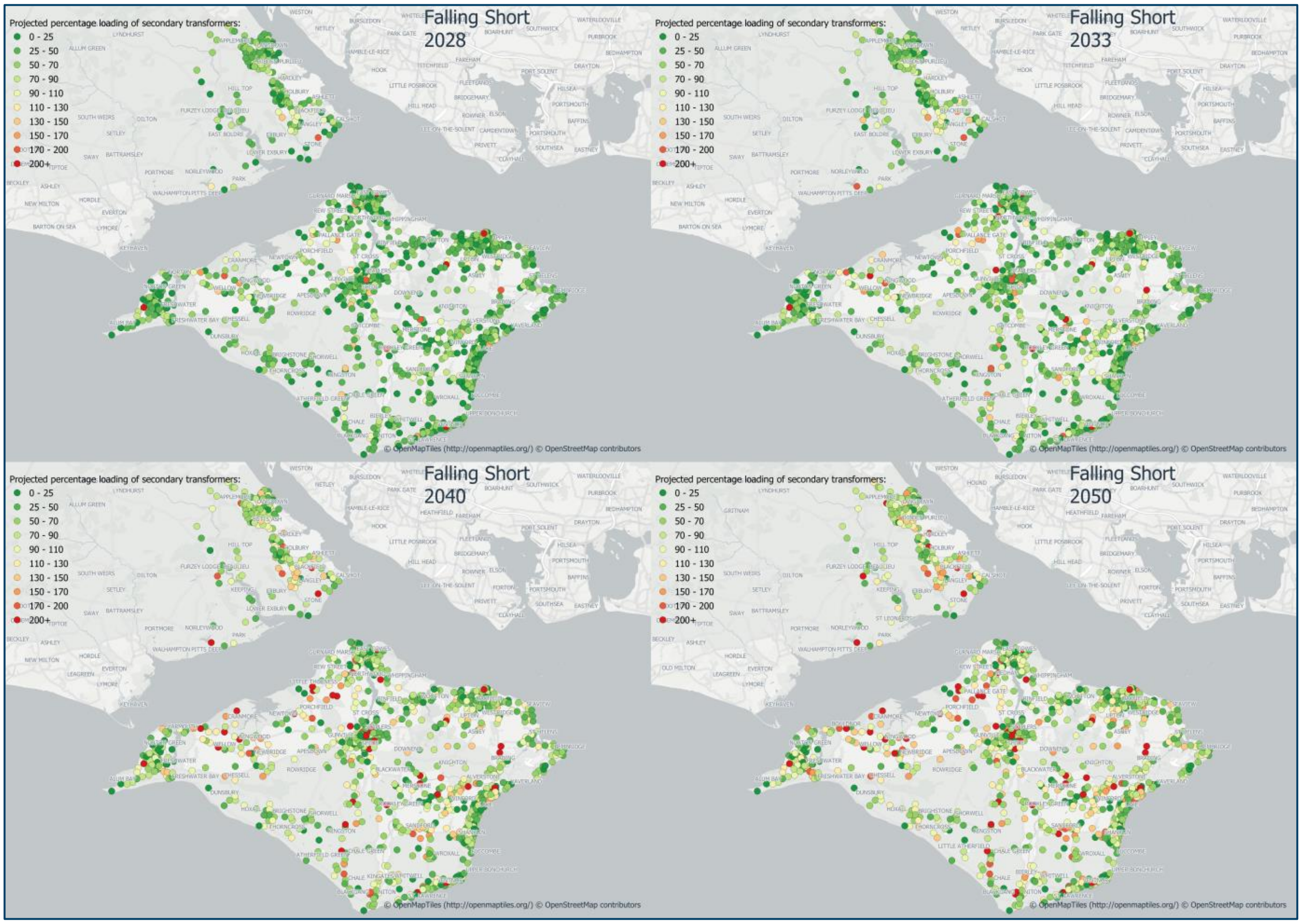

Figure 23 Fawley HV/LV spatial plans under the Falling Short scenario for 2028, 2033, 2040, and 2050.

7. SPECIFIC SYSTEM NEEDS AND OPTIONS TO RESOLVE

7.0.1. In this section we summarise the more specific needs arising from our future spatial plans. We also propose initial options to resolve. These will be further developed through the DNOA process, where they will be considered alongside the potential for flexibility.

7.0.2. The section is split into six parts:

- Generation future system needs – works required in the ED2 period to resolve generation led EHV constraints. Both non-network and network options to resolve this are currently being considered and will be detailed in the following section. There are no longer term additional generation driven EHV constraints identified at this time.

- Future System Need: Import and export capacity options to the Isle of Wight – works specifically required to optimise and increase both import and export capacity to the Isle of Wight. We have specifically separated this section recognising the unique challenges of this need and the range of network and non-network options that could be employed.

- Future demand EHV system needs from 2024 to 2028 – works required in the ED2 period that are currently undergoing detailed assessment or have been identified that this is required.

- Future demand EHV system needs from 2029 to 2033 – needs that are currently projected to arise in the ED3 period. These will need to be resolved in the medium term and early potential solutions are proposed, details of these schemes may change when detailed assessments are conducted.

- Future demand EHV system needs from 2034 to 2040 and from 2041 to 2050 – these needs have a higher degree of uncertainty than the previous sections. Where possible, high-level solutions are proposed with the caveat that system requirements are dynamic and will have changed ahead of delivery of reinforcement or flexibility. Annual reassessment will allow us to signpost to these needs and update potential solutions.

- Future HV/LV system needs – the future needs of the HV and LV networks are locationally specific but can be considered as an aggregated volume. In this section we provide information on our future forecasts for local HV and LV network needs.

7.0.3. In all cases we have proposed options that would meet local requirements out to 2050, i.e. proposals are futureproofed for future forecast changes to demand and generation. For more in-depth analysis of each of the system needs identified, please see the appendices.

Overarching dependencies, risks, and mitigations

7.0.4. We have identified one overarching dependency for Fawley GSP. This relates the ANM future needs and policy development. We will work with stakeholders to develop proposals in this area.

7.0.5. Dependency: Future requirements for Active Network Management on the Isle of Wight.

7.0.6. Risks: ANM has been helpful in facilitating generation connections quickly but is currently at capacity. We recommend that policy development is needed to understand the future need and extent of ANM systems on the Isle of Wight to facilitate further flexible generation connections.

7.0.7. Mitigation: Assessment for the requirement of ANM should be carried out alongside studies into built network solutions. This is being considered through the UN:LOCK innovation project. We will also look to understand synergies with ANM development on Orkney.

7.1. Generation Future System Needs

7.1.1. The renewable generation potential of the Isle of Wight is widely documented. This is due to the area benefiting from the high solar irradiance levels of the south coast making it a suitable area for solar PV and the potential for tidal generation schemes.

7.1.2. The existing and projected generation mix on the Isle of Wight has been described in the future electricity demand and generation forecasts section of this report.

7.1.3. Previous efforts to release capacity on the Island have been successful with Active Network Management and the Distributed Generation Automatic Disconnection (DGAD) schemes having enabled more generation to connect to the distribution network. However, the ANM scheme is also now at capacity. As a result, further network and non-network options will be required to relieve generation constraints on the Isle of Wight. There are three key potential development areas that could facilitate further generation capacity on the island. These are shown in Figure 24 below.[22]

7.1.4. The most significant of these is the need for additional 132kV capacity between the Isle of Wight and the mainland by the early 2030s.[23] This could potentially be delivered through a fourth subsea cable; however other options allow this to be deferred or even avoided. We recommend that further work is done to understand generator behaviour (historical and forecast) to further establish credible scenarios. Outcome of these to be further developed through the DNOA process as required. Outcomes of these assessments would then be published later this year in the SSEN Distribution Network Options Assessment (DNOA) outcome reports.

22 Please note 2 subsea cables to the Isle of Wight share similar cable routes and are indistinguishable in the figure but there are in fact 3 separate cables.

23 This is an earlier timescale that than cited for demand driven needs on the Isle of Wight which do not suggest a system need until 2038 (see Table 5).

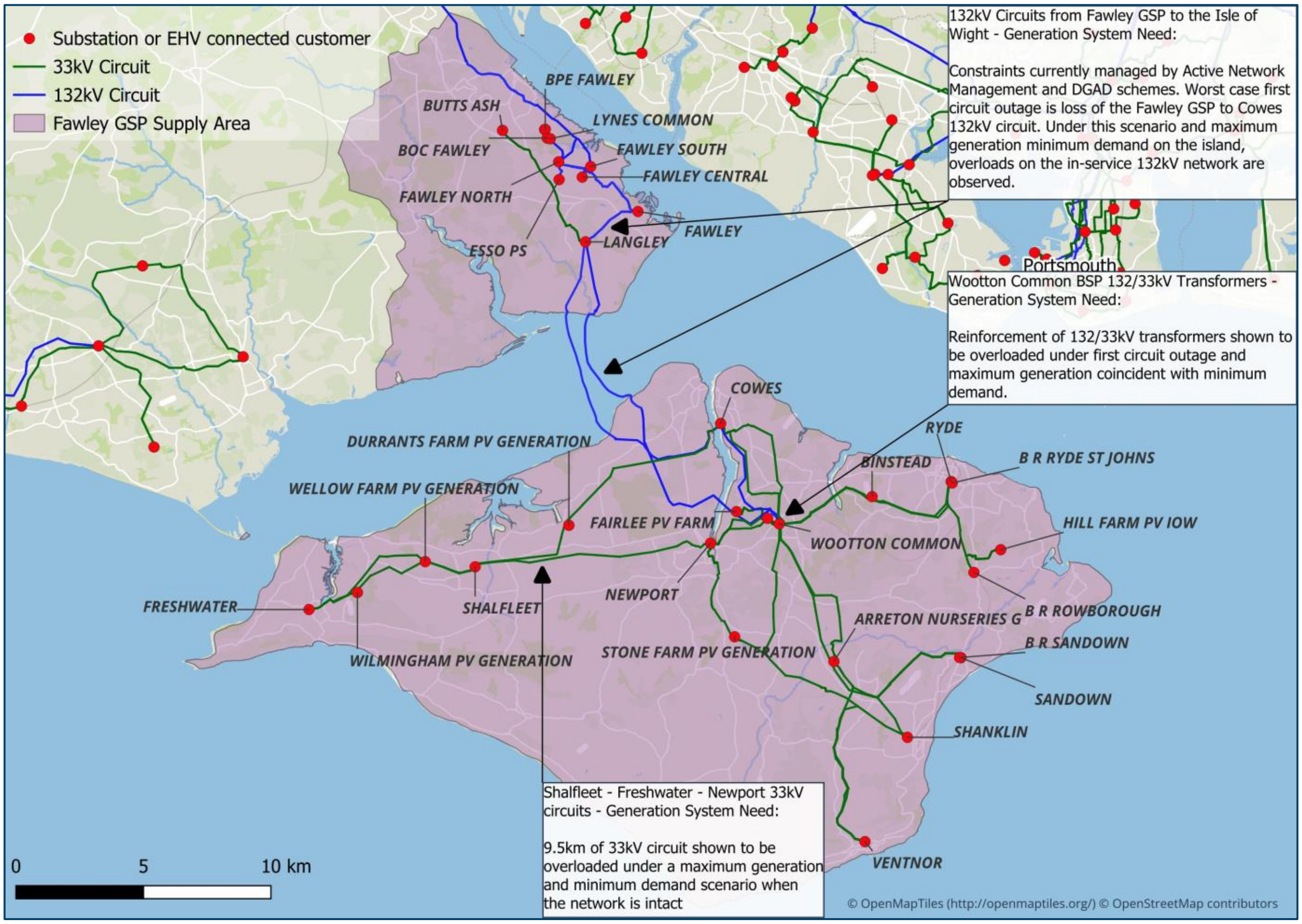

Figure 24 Generation System Needs

7.1.5. Alongside the network options shown above, a variety of non-network solutions are being developed to release capacity ahead of and/or compliment any network solutions deployed. One of these initiatives is the UN:LOCK project. The purpose of this project is to accelerate the ways in which the connection of new generation can be accelerated, within existing network capacity limits. Opportunities to reliably increase on-island demand at the appropriate times to reduce net export of power from the island will be explored. This will allow additional connection of generation alongside the planning, consenting, and construction requirements of any investment requirements. SSEN has recently been awarded funding through Ofgem's Strategic Innovation Fund to move forward with this pioneering innovation project.

7.2. Future System Need: Import and export capacity options to the Isle of Wight

7.2.1. Fawley GSP is unique in SSEN's south licence area (SEPD). This is because alongside the mainland electricity network, there are also three existing 132kV subsea cables from the mainland to the Isle of Wight (See labelled in Figure 24, two of the three cables share a very similar route so are indistinguishable in the figure). This brings challenges to network planning in the area due to the high costs associated with reinforcement of existing assets, or addition of new assets.

7.2.2. As highlighted in the previous section, existing generation and demand growth projected in our latest Distribution Future Energy Scenarios results in this network being constrained due to demand by the late 2030s under the Consumer Transformation scenario. Generation is projected to result in a constraint on this network from the early 2030s under the Consumer Transformation scenario.

7.2.3. Historically such a constraint would have meant a need for traditional network intervention in the short term through the installation of a fourth cable. However, in the advent of new technologies including smart grid solutions and flexibility markets there are now a much wider range of options we can consider.

7.2.4. In 2023 we commissioned Regen to investigate the future energy needs of the Isle of Wight and relevant options to meet its future needs.[24] Regen made a number of recommendations which we have further enhanced through Project Unlock and internal discussions. Some of the report recommendations, such as the development of flexibility services (recommendation 7B), are now normal practice for SSEN and these will be considered in the DNOA process. However, we have identified five potential options that could be used to mitigate both demand and generation constraints. This SDP recommends that work is progressed on all these options through the DNOA process given the length of time to deliver some of the options and the criticality of the requirement. This will allow comparison of the costs and benefits of each option. A hybrid solution utilising a combination of options may also be possible. We note that further options may be identified through the UN:LOCK innovation project with Regen and these also need to be fed into the DNOA process.

7.2.5. The five identified options that could potentially resolve constraints on the 132kV subsea cables are as follows:

- **Current limiting reactor:** One reason for the projected overload under a first circuit outage is uneven load balancing. This is caused by lower impedance of the Cowes to Fawley subsea circuit section than the in-service Wootton Common to Langley subsea circuit section. To resolve this issue, it is proposed that a current limiting reactor is introduced to the Cowes to Fawley circuit. This will enable better load sharing between cables and therefore utilisation of the existing network capacity.
- **Better utilisation of existing capacity:** An existing large generator on the Isle of Wight has a firm agreement with SSEN resulting in a large amount of capacity being reserved for this generator but in practice this capacity is not regularly utilised. To resolve this a close working relationship with NESO could allow a better understanding of when this generator will be called on for service provision to the ESO. An intelligent scheme would then allow for this capacity to be optimised and potentially utilised by alternative generators outside of likely service windows. This aligns with Recommendations 2 and 3C in the 2023 Regen report.
- **Enhancement of existing Active Network Management (ANM) scheme:** The ANM scheme has existed for a number of years facilitating the connection of many embedded generators. Enhancements to the scheme could allow for further optimisation which in turn could allow for more generators connecting on the Isle of Wight ahead of or in lieu of reinforcing or adding new 132kV assets. This aligns with Recommendation 3A in the 2023 Regen report.

24 Isle of Wight Net Zero Network Investment Study (regen.co.uk)

- **Reinforcement of existing assets:** Additional capacity provided by reinforcing the existing 132kV network both on-land and subsea circuit sections. This will offer increased capacity without the need for surveying and wayleaves required for an additional circuit.
- **Addition of fourth cable:** An additional circuit from the mainland to the Isle of Wight would offer a significant uplift of capacity for both generation and demand. The significant capital cost associated with this project and potential uncertainty over the future generation mix on the island means that the other more economic options should be exhausted before progressing this option, but sufficient preliminary work should be done on to allow it to be advanced quickly should it be needed earlier.

7.3. Future Demand System Needs: 2024 – 2028

Tabulated Summary

Table 3 Summary of system needs 2024-2028.

Asset	CT Year of need	ST Year of need	LW Year of need	FS Year of need	Potential Solution	Schematic Reference
Sandown Primary Substation 33/11kV 7.5/15MVA CER transformer	2028	2033	2027	2033	Initially, potential for deferral or mitigation of asset solution through flexibility. Ultimately, reinforcement of transformers to provide a firm capacity at the primary of 30MVA.	1

Network Schematic

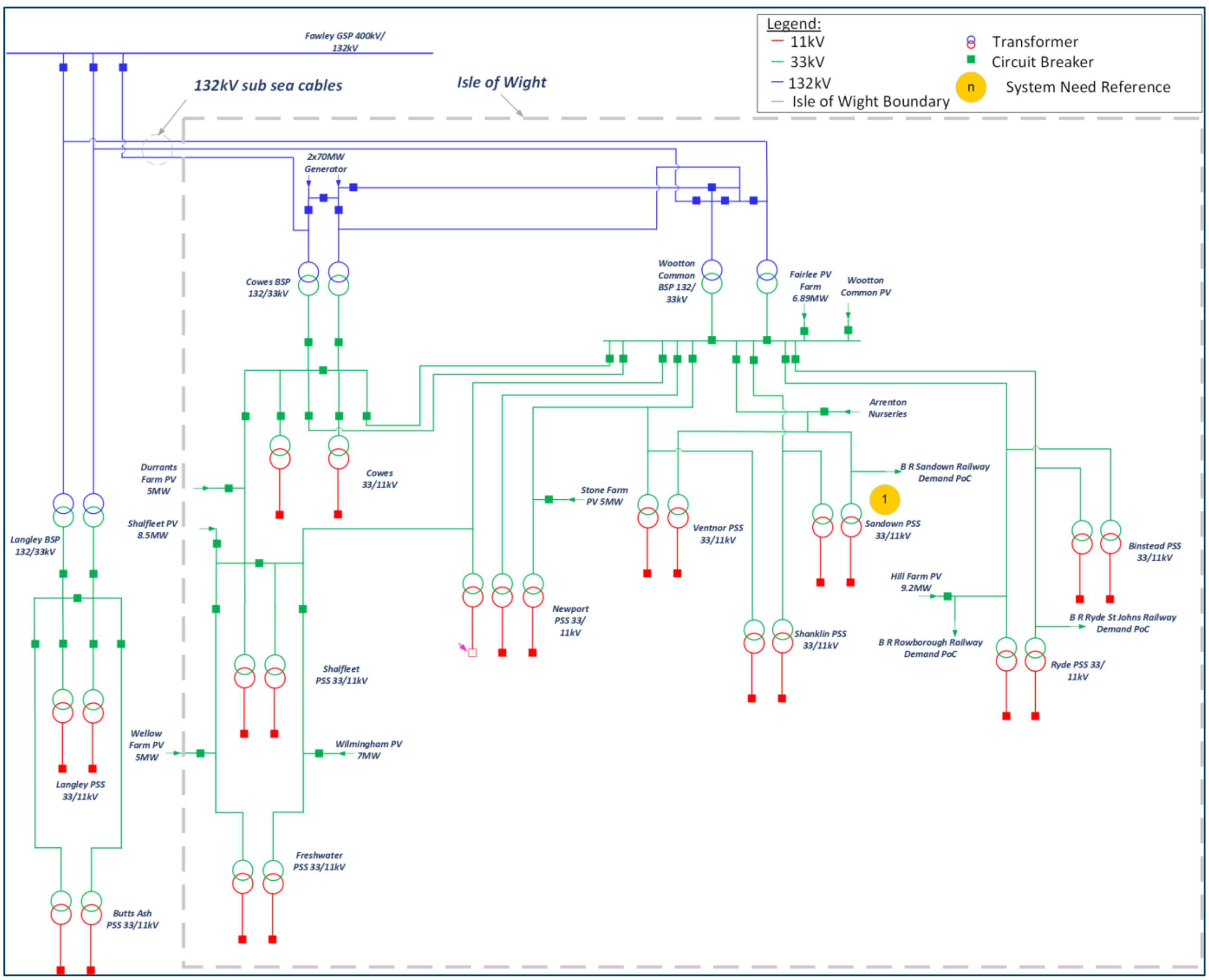

Figure 25 Network schematic with system needs 2024-2028.

7.4. Future Demand System Needs: 2029 – 2033

Tabulated Summary

Table 4 Summary of system needs 2029-2033.

Asset	CT Year of need	ST Year of need	LW Year of need	FS Year of need	Potential Solution	Schematic Reference
Cowes 33/11kV 30MVA CER transformers	2031	2034	2029	2036	Reinforcement of existing assets to resolve issue in medium term. Continue to monitor and explore the potential to use flexible services to mitigate further system needs in the mid – to – late 2040s.	2
Ryde 33/11kV 30MVA CER transformers	2032	2039	2031	2039	Addition of a third asset may not be viable due to increased fault level. Load transfers to Binstead in the short-term may defer the system need. Binstead and Ryde primaries supply the demand centre that is the town of Ryde. Reinforcement of both Ryde and Binstead with load transfer from Ryde to Binstead may be a viable solution in the long-term.	3
Binstead-Ryde 33kV shared circuits	2033	2040	2032	2040	Reinforcement of 4.3km of 33kV circuit ahead of 2033 with a further 4.41km required ahead of 2040.	4

Network Schematic

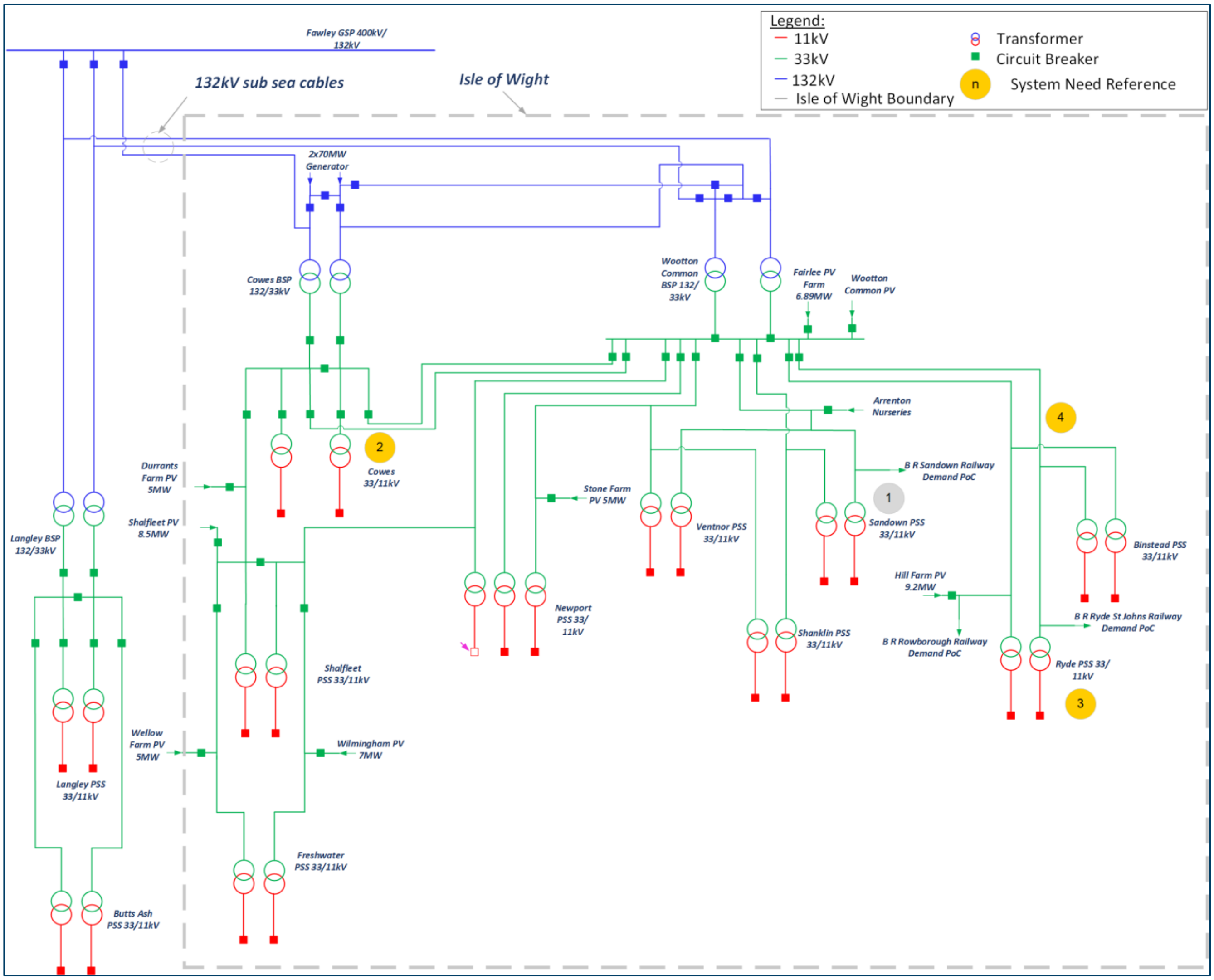

Figure 26 Network schematic with system needs 2029-2033.

7.5. Future Demand System Needs: 2034 – 2040

Tabulated Summary

Table 5 Summary of system needs 2034-2040.

Asset	CT Year of need	ST Year of need	LW Year of need	FS Year of need	Potential Solution	Schematic Reference
Ventnor – Shanklin – Newport 33kV shared circuits	2034	2046	2033	2045	Possibility for reinforcement deferral or mitigation through use of flexible services. Reinforcement of 5.2km of 33kV circuit.	5
Shanklin-Sandown 33kV shared circuits	2034	2046	2033	2044	Possibility for reinforcement deferral or mitigation through use of flexible services. Reinforcement of 8.4km of 33kV circuit.	6
Langley BSP 132/33kV 45MVA transformers	2036	2049	2035	2049	Possibility for reinforcement deferral or mitigation through use of flexible services. Reinforcement of 132/33kV transformers to a minimum rating of 60MVA.	7
Langley Primary 33/11kV 7.5/15MVA CER transformers	2034	2042	2034	2042	Butts Ash primary substation shows a system need at a similar time. Propose reinforcement of assets of Langley primary due to worse asset health. A proportion of the demand projected at Butts Ash primary can be load-transferred through the HV network to defer or mitigate the system need at both primaries.	8
Butts Ash 33kV feeding circuits and 33/11kV 30MVA transformers	2036	2046	2033	2048	*See above.*	9
Freshwater Primary Substation 33/11kV 15MVA CER transformers	2038	-	2037	-	2050 Overload is 124% of nameplate rating. Peak is projected for winter and load curve is cyclic, so risk of outage is less likely. Approximately 3.65MVA of flexible solutions should be procured to mitigate the risk.	10
Fawley to Isle of Wight 132kV network (One of the Langley to Wootton Common subsea circuits out of service) – Fawley to Cowes 132kV circuit critically loaded.	2039	-	2038	-	Fourth subsea cable from the mainland to the Isle of Wight as a long-term solution. Potential through mitigation through the initiatives being investigated through the UN:LOCK project (demand turn down/generation turn up).	11

Newport Primary Substation 33/11kV 30MVA transformers	2040	-	2040	2049	New 33kV circuit from Newport to Wootton Common BSP following same route as existing 33kV direct cable route from Newport to Wootton Common to address uneven transformer loading. Dependent on availability of space at the Wootton Common BSP for a new 33kV circuit breaker.	12
Ventnor-Sandown 33kV shared circuits	2040	-	2040	-	*Constraint due to voltage drop, re-assessment should be conducted following the finalised solution to Langley and Isle of Wight 132kV circuits system need.*	13

Network Schematic

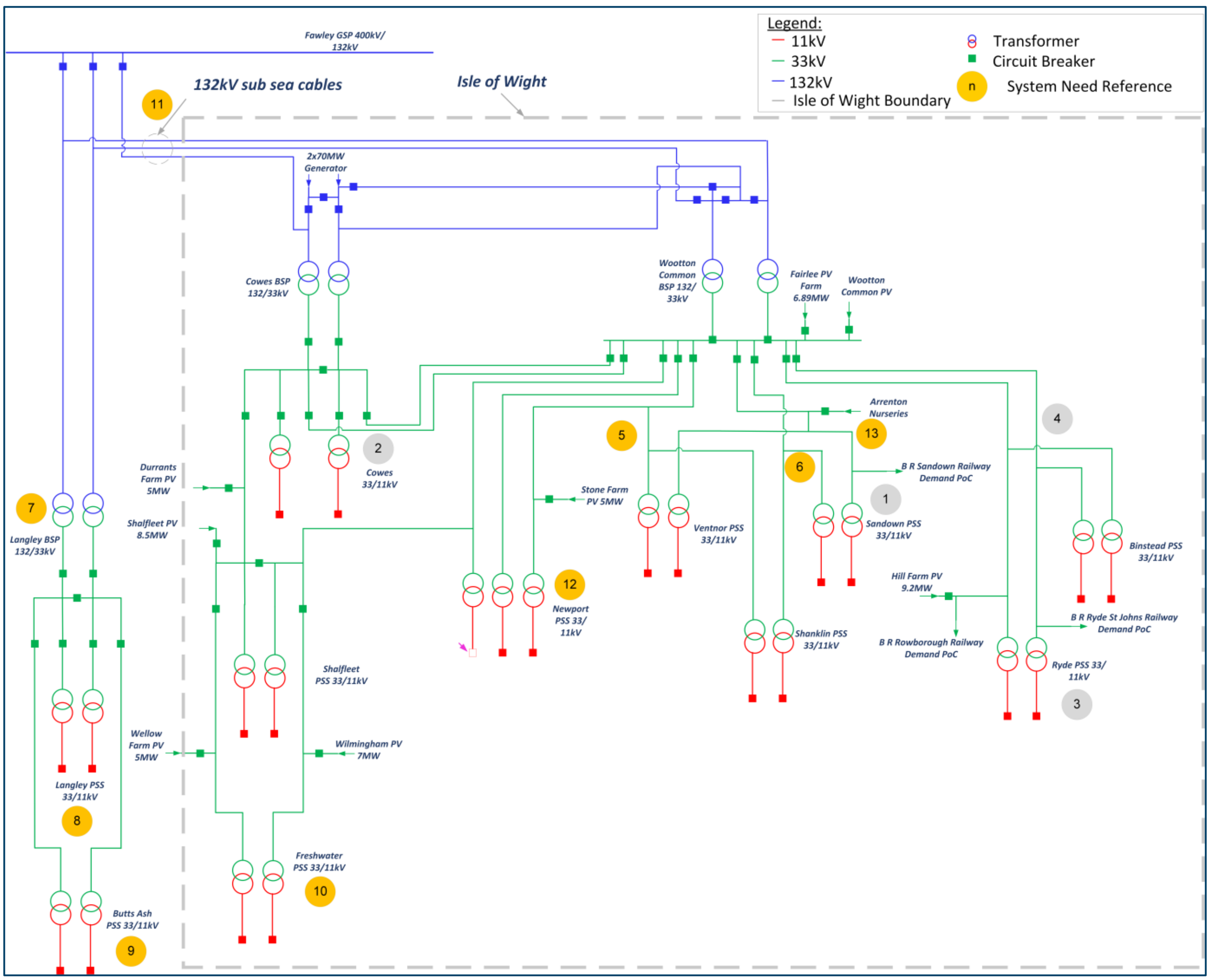

Figure 27 Network schematic with system needs 2034-2040.

7.6. Future Demand System Needs: 2041 – 2050

Tabulated Summary

Table 6 Summary of system needs 2041-2050.

Asset	CT Year of need	ST Year of need	LW Year of need	FS Year of need	Potential Solution	Schematic Reference
Ventnor Primary Substation 33/11kV 15/30MVA CER transformers	2041	-	2041	-	*Constraint due to voltage drop, re-assessment should be carried out following the finalised solution to Langley and Isle of Wight 132kV circuits system need.*	14
Binstead Primary Substation 33/11kV 15MVA CER transformers	2042	-	2043	-	Firm capacity is only exceeded by ~2MVA in 2050. Potential to contract demand-side response or generation turn up as a flexible service to manage this need.	15
Shanklin Primary Substation 33/11kV 30MVA CER transformers	2042	-	2044	2050	*Constraint due to voltage drop, re-assessment should be conducted following the finalised solution to Langley and Isle of Wight 132kV circuits system need.*	16

Network Schematic

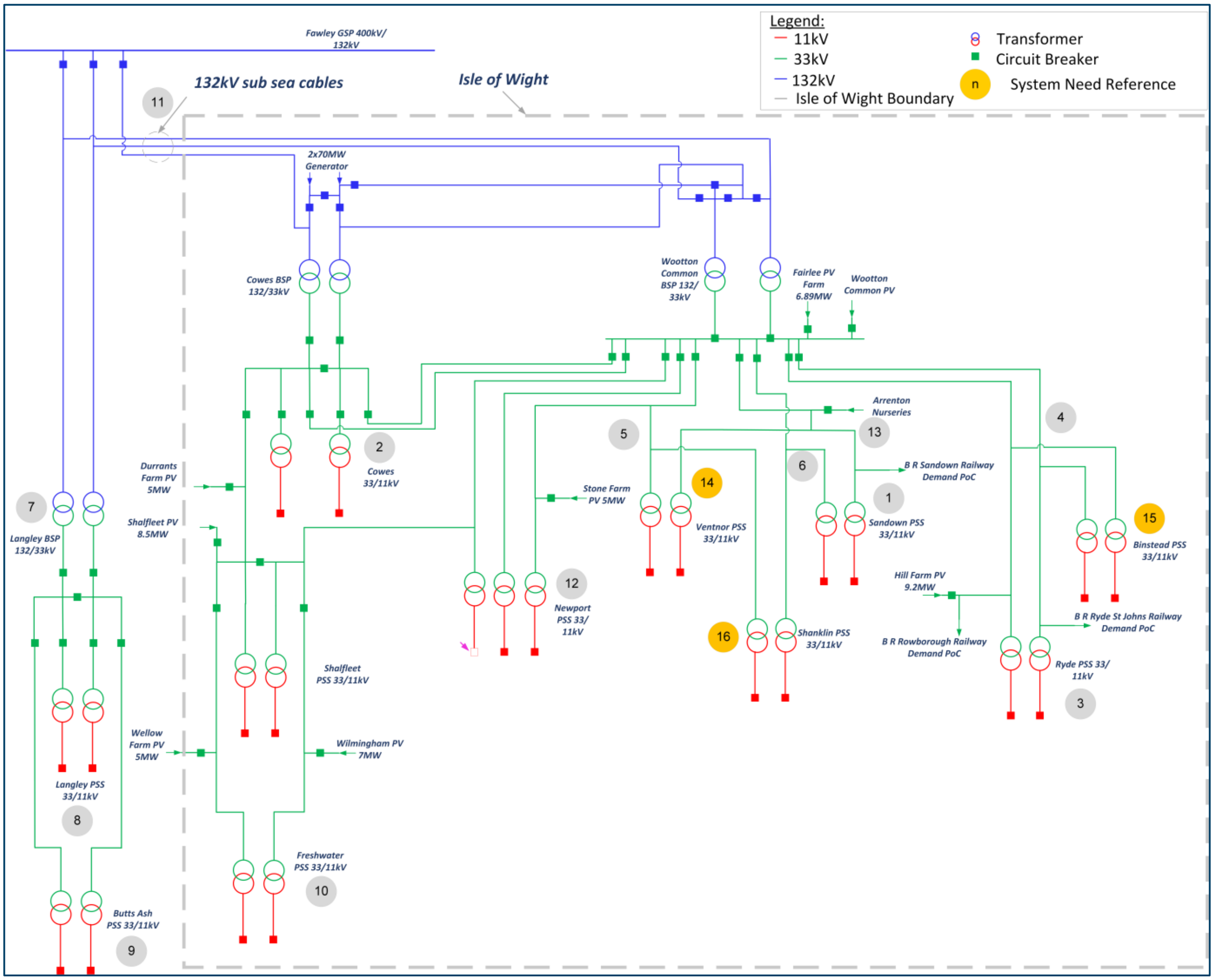

Figure 28 Network schematic with system needs 2041-2050.

7.7. Future Requirements of the High Voltage and Low Voltage Networks

7.7.1. High Voltage

7.7.1.1. As well as the EHV system needs identified in the previous section, increased penetration of low carbon technologies (LCTs) connecting to the distribution network will result in system needs on the High Voltage (HV) and Low Voltage (LV) networks. To provide a view on the impact of these technologies on the distribution network here we have used the SSEN load model.[25]

7.7.1.2. The load model is a machine learning product which estimates a half-hourly annual demand profile for each household based on a series of demographic, geographic and heating type factors. This enables us to estimate capacity on the electricity network while protecting individual customers data privacy by using modelled data. These views are then aggregated up the network hierarchy based on the combinations of customers associated with each asset. This view is supplemented with the DFES to highlight the projected impact of LCTs on the network.

7.7.1.3. For the 11 primary substations supplied by Fawley GSP, the percentage of secondary substations where projected peak loading exceeds the nameplate rating of the secondary transformer was taken from the load model data. Figure 29 shows how this percentage changes under each scenario from now to 2050.

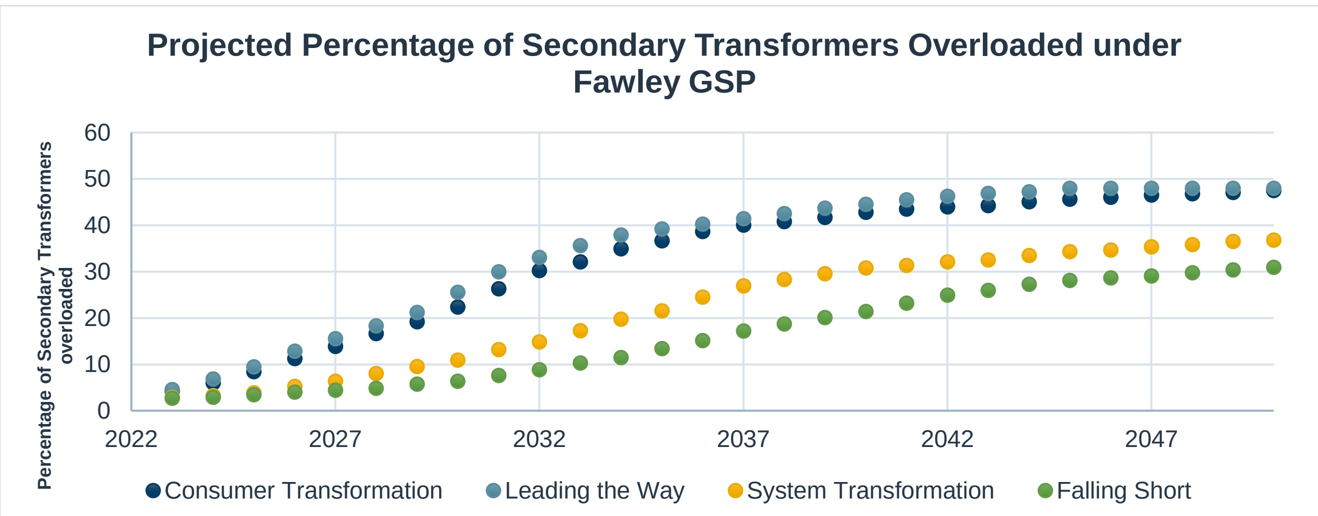

Figure 29 Projected Secondary Transformer Loading. *Source: SSEN Load Model*

7.7.1.4. To satisfy these requirements a variety of solutions will need to be investigated. It is likely that a combination of flexibility and asset replacement will be employed to resolve the projected HV system needs. It is important to note that for HV needs, flexibility is likely to be provided through Distributed Energy Resources (DER), Consumer Energy Resources (CER), and domestic/commercial Demand Side Response (DSR). One of the challenges associated with procuring flexibility to High Voltage and Low Voltage system needs is that only a small number of customers can provide a flexible service due to the requirement to be supplied by a specific secondary transformer. As the role of aggregators develops, we may see a shift in the potential for flexibility in an area. Where the magnitude of an overload is too large for flexibility to be feasible, addition of new assets or asset replacement will be necessary.

7.7.2. Low Voltage

25 SSEN Open Data Portal, 2023, SSEN Secondary Transformer – Asset Capacity and Low Carbon technology Growth.

7.7.2.1. Drivers for interventions in low voltage networks may be either capacity related or be driven by voltage requirements. We are progressing options to resolve both of these drivers. From a network perspective the solution typically involves upgrading the number of LV feeders to split/ balance the load and improve voltage or to install another substation at the remote end of the LV network to balance load and improve voltage. In both instances, flexibility at a local level, especially voltage management products linked to battery export and embedded generation such as solar is likely to be required alongside traditional reinforcement.

7.7.2.2. We are leveraging recent innovation work through Project LEO (Local Energy Oxfordshire) and My Electric Avenue to inform this strategy. Enhanced network visibility through Smart meter data analytics and low-cost substation feeder monitoring is also necessary to enable appropriate dispatch of services and network reconfiguration.

7.7.2.3. Capacity driven needs – Thermal constraints tend to materialise in the sections of cable leading to the substation (transformer) where multiple customer loads join together. We are modelling requirements out to 2050 leveraging low voltage monitoring and metering equipment combined with analytical techniques. This will demonstrate how the magnitude of the requirements of the LV network across Fawley differs across scenarios and years out to 2050.

7.7.2.4. Voltage driven needs – Generally, connection of Low Carbon Technology and large loads such as heat pumps is limited by voltage constraints before thermal constraints when located more than around 150m from the local secondary transformer. Increased loading on our low voltage networks can reduce the voltages to consumer premises. This is a non-liner relationship and as such requires more complex analysis. We are currently undertaking analysis to better understand the extent of this future need.

7.7.2.5. Initial analysis indicates that 5.97% of low voltage feeders may need intervention by 2035 and 13.52% by 2050 as shown in Figure 30. The need is unlikely to be triggered until 2028 onwards. However, due to the timeline to grow workforce, with jointing skills taking typically four years to be fully competent, it is necessary to start recruitment and initiate programmes in the current DNO price control period ahead of critical need, in order to develop the execution capacity to be able to deliver the required volumes from 2028 onwards.

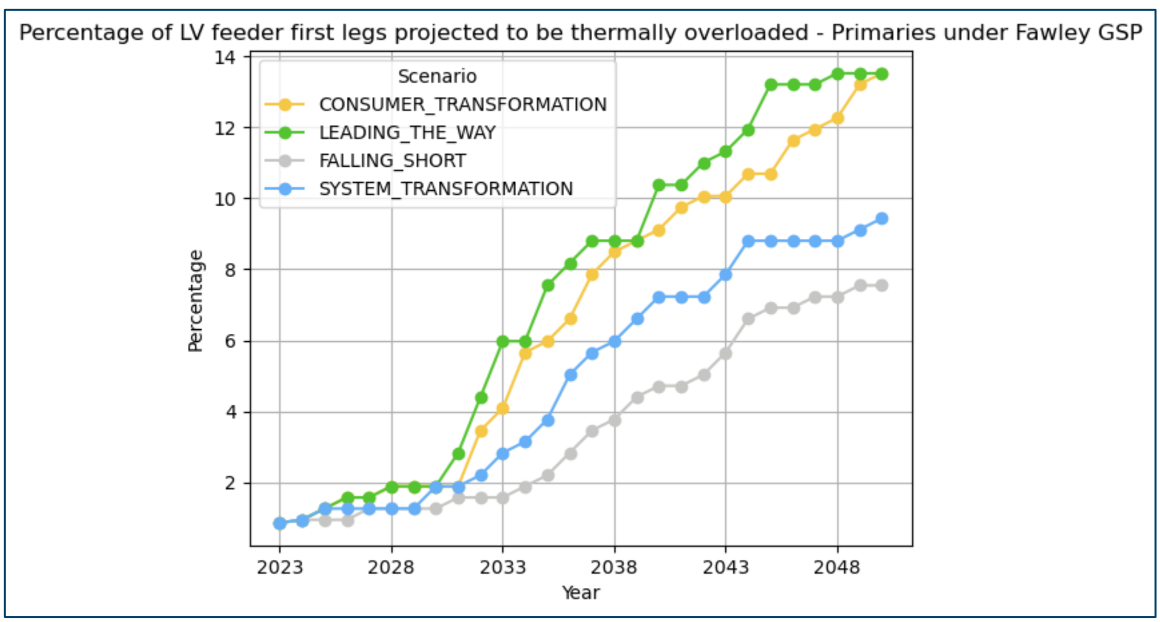

Figure 30 Projected LV feeder thermal overloading under Fawley GSP.

8. RECOMMENDATIONS

8.1. The findings from this SDP have provided evidence for five key recommendations:

- Deeper consideration needs to be given to historical and future scenarios for generation export from the Isle of Wight. This to inform future system needs with a view to further development of options through the DNOA process. This will include consideration of a potential fourth cable between the Isle of Wight and the mainland.
- The four-demand system needs that have been identified to arise in the ED2 and ED3 price control periods (2024-2028 and 2028-2033) should be progressed through the SSEN DNOA process. This includes:
    - Sandown Primary Substation 33/11kV 7.5/15MVA CER transformers.
    - Cowes Primary Substation 33/11kV 30MVA CER transformers.
    - Ryde Primary Substation 33/11kV 30MVA CER transformers.
    - Binstead-Ryde 33kV shared circuits.
- Policy considerations for ANM usage and upgrades need to be progressed in parallel to inform asset proposals.
- Alongside generation increases, adoption of LCTs across the Isle of Wight are projected to increase the demand for electricity across the Isle of Wight. Spatial mapping suggests that this is expected to arise around centres of population, the necessary build requirements should be considered alongside any opportunities for demand peak shifting identified through the UN:LOCK project.
- SSEN should continue proactive engagement with key stakeholders to ensure that works are scoped correctly both in the near term and long term. This could take the form of a Local Area Energy Plan (LAEP), that would consider local insights and improve the SSEN DFES.

Appendix A Generation Future System Needs

a. Isle of Wight and Langley 132kV circuits - future system needs: Generation 2024

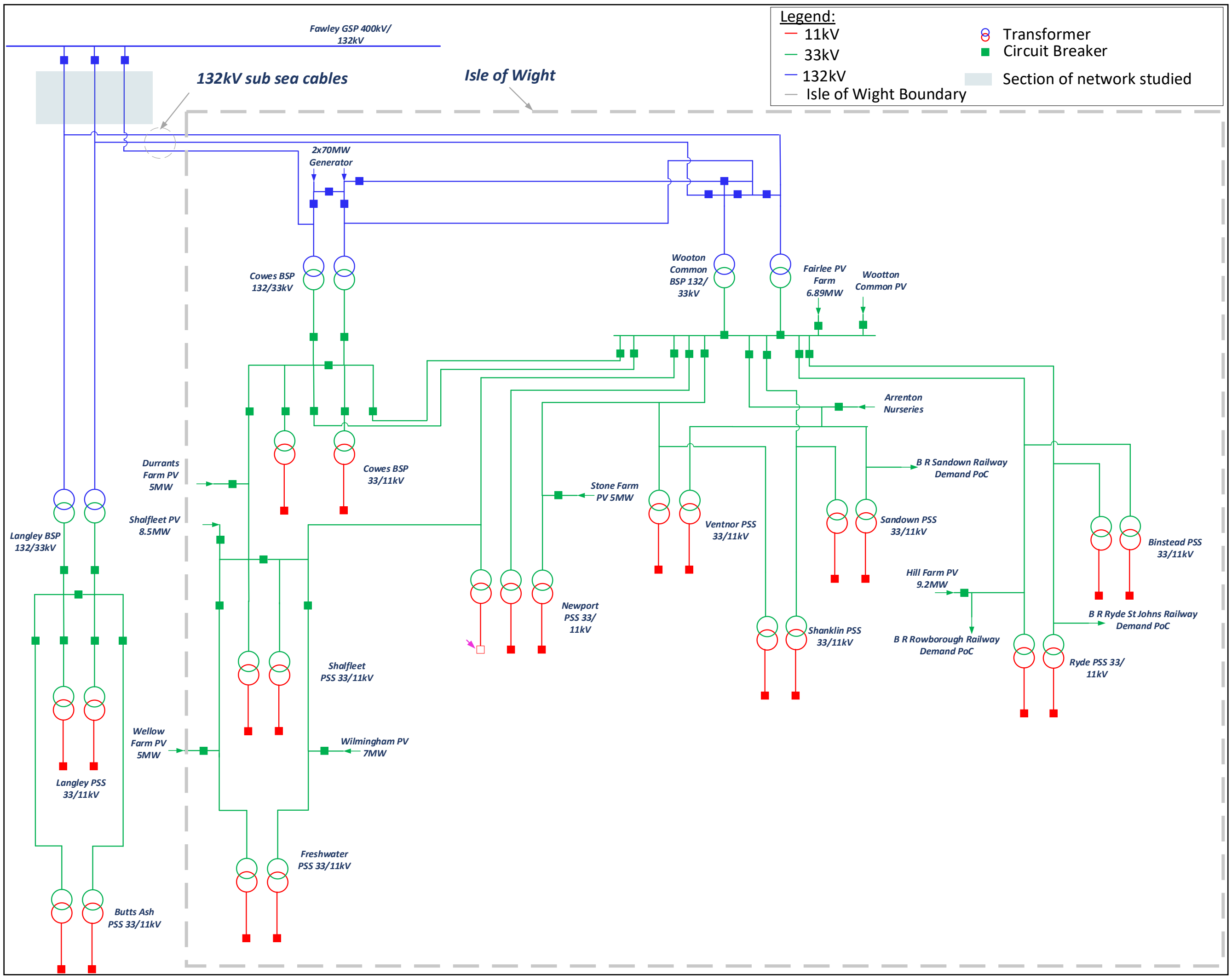

Figure 31 Network schematic with system need highlighted.

System Need Description

The Isle of Wight network and Langley BSP share two 132kV circuits from Fawley GSP highlighted above in Figure 31. The third subsea cable to the Isle of Wight is directly from Fawley GSP to Cowes BSP. Considering the subsea cables, the worst case first circuit outage is loss of the Fawley GSP to Cowes BSP 132kV circuit (minimum rating of 120MVA). Using the 2022 DFES, we can see that without curtailment or active network management, under a worst case first circuit outage the in-service 132kV circuits will be overloaded.

Currently, the ANM and DGAD schemes on the Isle of Wight manage these constraints. Under the specific constraint events, generation will be curtailed or tripped under the existing schemes. These schemes have enabled a number of new generation projects on the Isle of Wight to connect to the network. However, even with the additional generation headroom provided by these schemes, recent contracted offers mean that there is currently no available generation headroom on the island. Significant reinforcement costs and long timescales would likely be incurred should a generation developer apply for a connection today.

As such, to release generation capacity on the Isle of Wight investment is required.

System Need Timeline

Active Network Management is full, system need from 2024 onwards.

Proposed outline solution and potential next steps

Due to the near-term nature of this constraint, SSEN will need to deploy a solution if generation capacity is to be released on the Isle of Wight. Modelling and development of a strategic solution to resolve this system need is currently underway. Works will be summarised in a later publication of DNOA outcome reports.

b. Cowes and Wootton Common BSPs – future system needs: Generation 2024

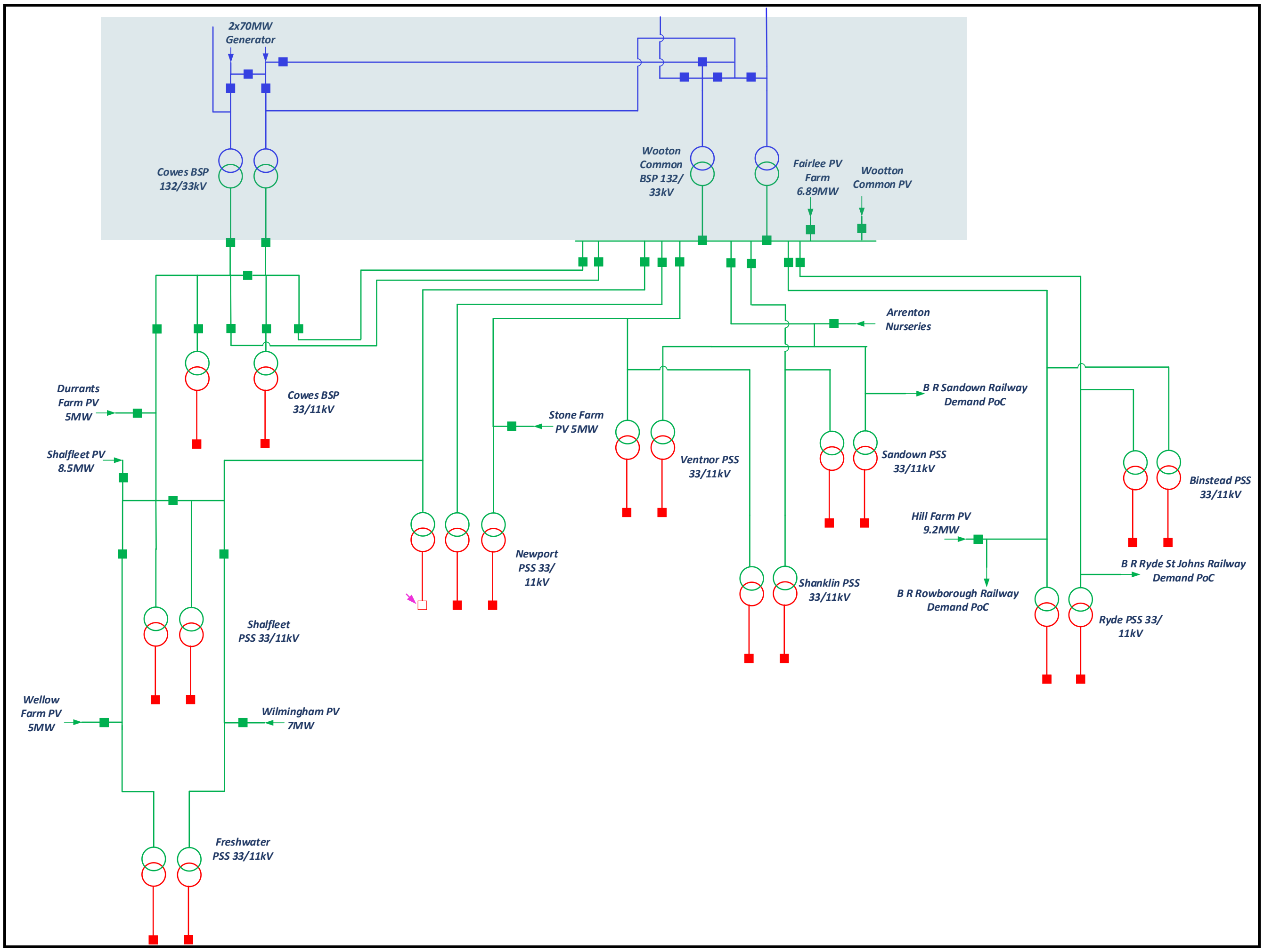

Figure 32 Network schematic with system need highlighted.

System Need Description

Cowes and Wootton Common are the two BSPs on the Isle of Wight. These substations are interconnected at both 132kV and 33kV. The 33kV interconnections are directly through 33kV circuits from Cowes to Wootton Common, but also through several meshed circuits.
Power System Analysis using the 2022 DFES shows a system need at Cowes and Wootton Common from 2024 onwards. The system need was identified under an outage of any one of the four 132/33kV transformers across Cowes and Wootton Common.

System Need Timeline

The system need is identified for 2024 and based off existing demand rather than projected future load, therefore system need in 2024 is consistent across the four DFES scenarios.

Proposed outline solution and potential next steps

Due to the near-term nature of this constraint, SSEN will need to develop a solution. Modelling and development of a strategic solution to resolve this system need is currently underway. Works will be a later publication of DNOA outcome reports.

c. Shalfleet-Freshwater-Newport 33kV circuits – future system needs: Generation 2024

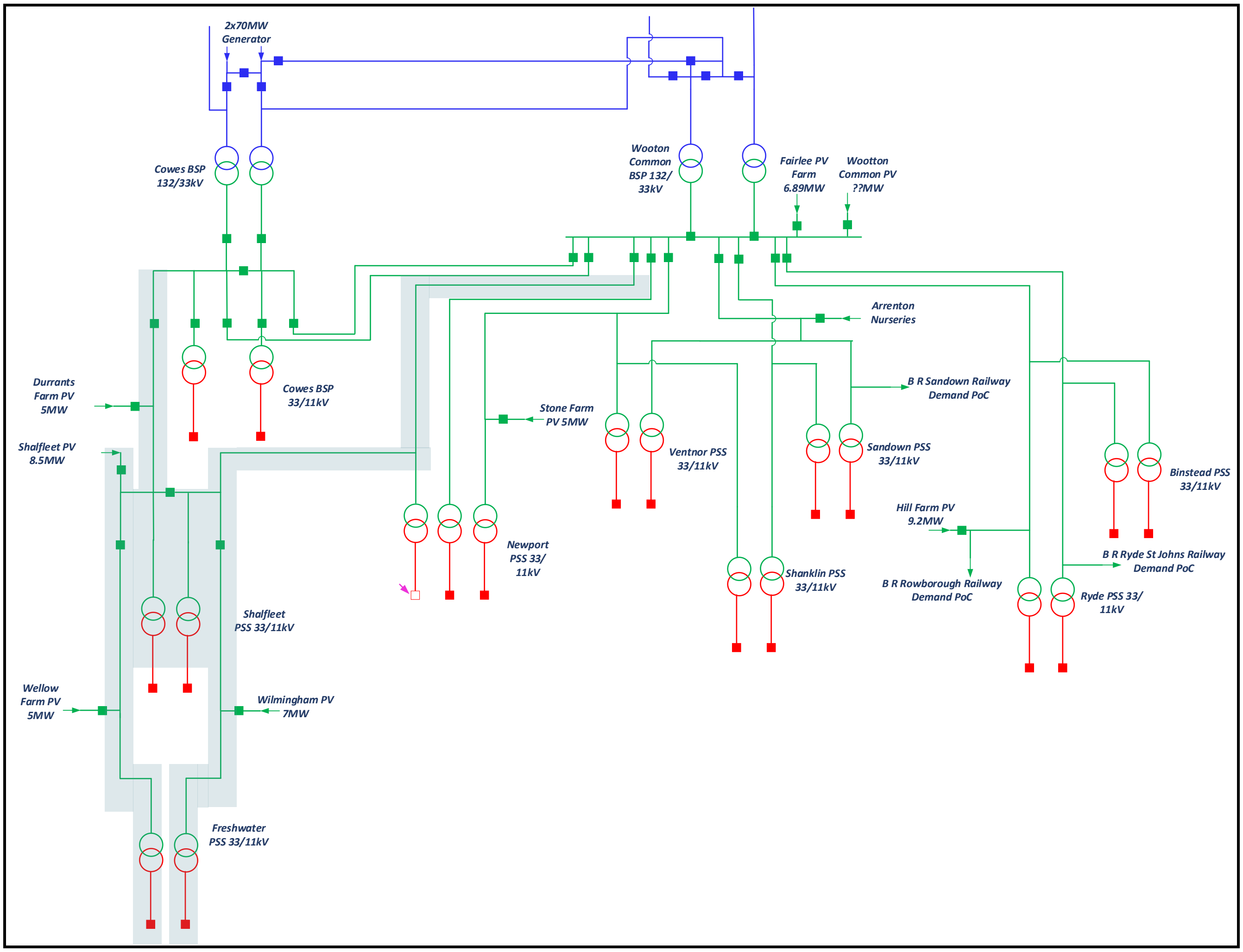

Figure 33 Network schematic with system need highlighted.

System Need Description

The Shalfleet-Freshwater-Newport ring feeds Shalfleet and Freshwater primaries from Cowes BSP and Wootton Common BSP, as shown in the schematic above. Four solar PV farms are also connected to the circuit: Durrants Farm PV, Shalfleet PV, Wellow Farm PV, and Wilmingham PV. Additionally, Withybed PV farm also holds an accepted connection offer.

As described earlier, there are generation constraints on the Isle of Wight that are caused by the 132kV circuits form the mainland to the Island. Even if these are addressed, this system need on the 33kV network will need to be addressed.

System Need Timeline

The system need is identified for 2024 and based off existing demand rather than projected future load, therefore system need in 2024 is consistent across the four DFES scenarios.

2050 Peak generation across the 33kV ring

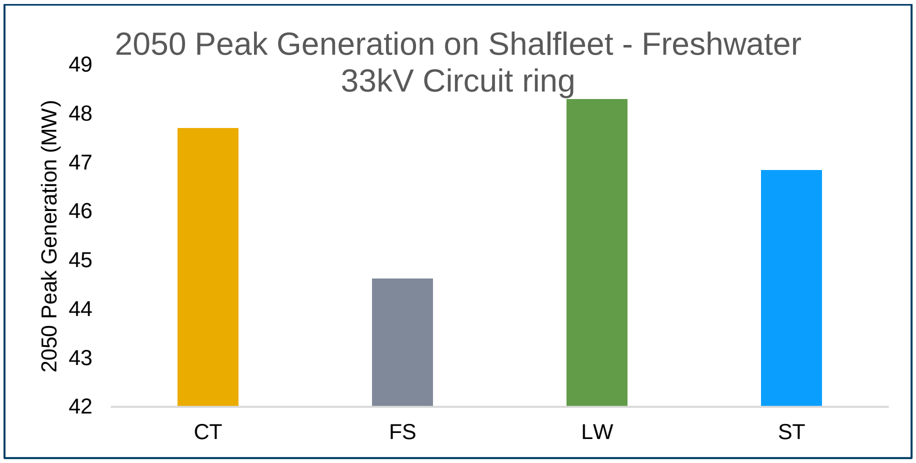

Figure 34 Shalfleet - Freshwater 33kV circuit 2050 peak demands.

**Sums existing 33kV connected generation and generation projected to connect at 11kV from the DFES. Does not account for 33kV connected DFES generation as this is modelled at the BSP 33kV busbar.*

Proposed outline solution and potential next steps

The current capacity limiting factor is 9.5km of 33kV circuit. Due to the near-term nature of this constraint, SSEN will need to develop a solution. Modelling and development of a strategic solution to resolve this system need is currently underway. Works will be summarised in a later publication of DNOA outcome reports.

Appendix B Future Demand System Needs 2024-2028

a. Sandown Primary Substation – future system needs: Demand 2028

System Need Description

Sandown primary substation is fed from Wootton Common by two 33kV circuits. One circuit is shared with Shanklin primary substation, and one circuit is shared with Ventnor primary substation. On the 33kV side the transformers share a 33kV busbar that is split by a normally open point. There are two 33/11kV transformers at the substation, one has a CMR rating on 15MVA and the other is a 7.5/15MVA CER transformer. For N-1 studies each transformer is assumed to have a rating of 15MVA.
Under an N-1 condition, a system need is projected for 2028 (CT scenario). The feeding circuit was also identified to be overloaded later in 2044, this will also need to be addressed.

System Need Timeline

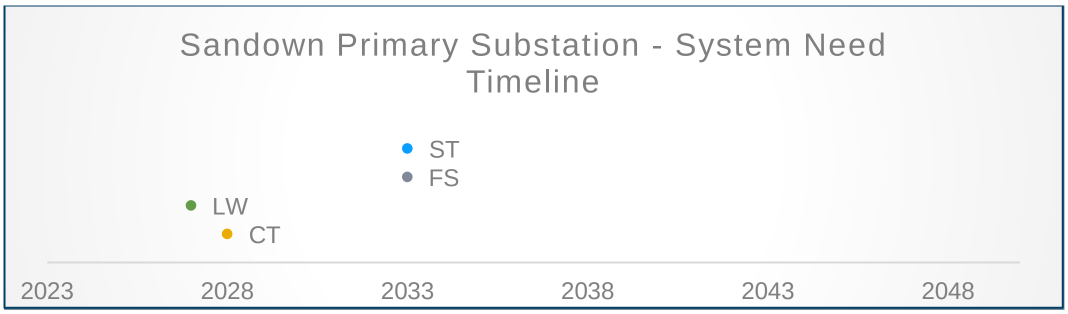

Figure 35 Sandown Timeline

2050 Peak demands at Sandown Primary Substation

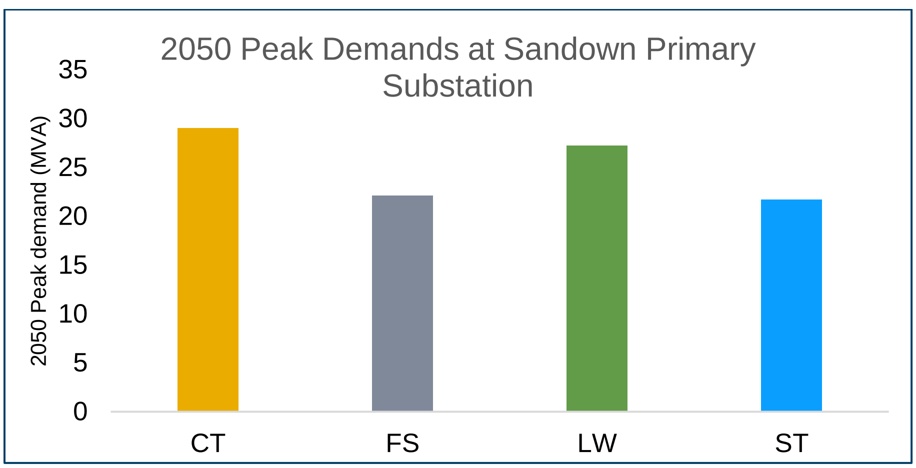

Figure 36 Sandown 2050 projected peak demands.

Proposed outline solution and potential next steps

To resolve this system need through to 2050, the substation will be required to have a firm capacity of 30MVA (under the CT scenario). An asset solution would be to either add an additional 15MVA transformer or replace the existing assets with 33/11kV 15/30MVA CER transformers. It is likely that there will be an opportunity to defer this reinforcement through procurement of flexibility solutions. However, due to the projected 2050 demands, it is unlikely that flexibility alone will be an enduring solution.

Appendix C Future Demand System Needs 2029-2033

a. Cowes Primary Substation – future system needs: Demand 2031

System Need Description

Cowes PSS 33/11kV 30MVA CER transformers are projected to be overloaded under an N-1 condition in 2031 (Winter) based on the Consumer Transformation scenario.

System Need Timeline

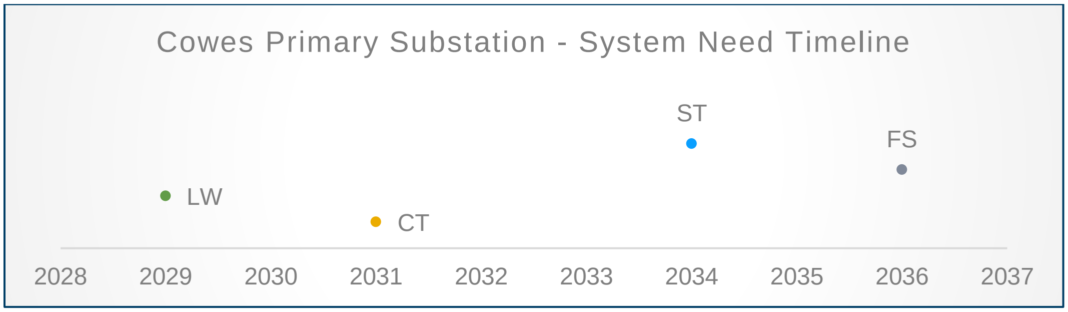

Figure 37 Cowes primary substation timeline.

2050 Peak demands at Cowes Primary Substation

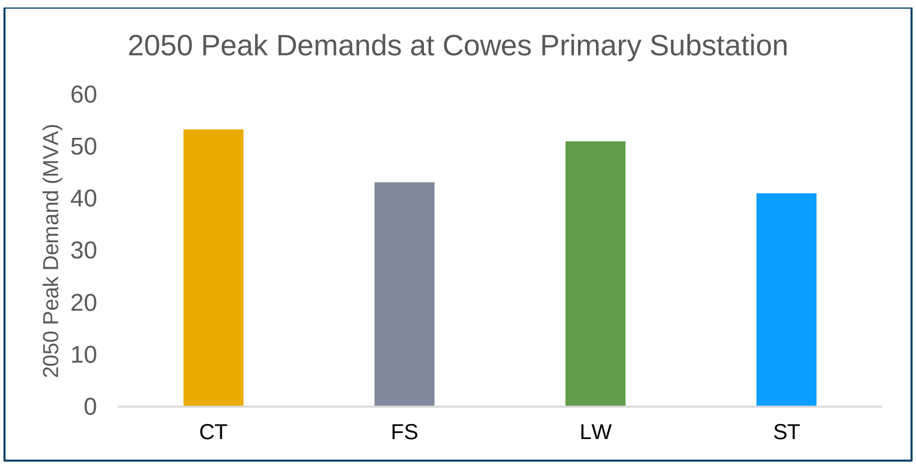

Figure 38 Cowes primary substation 2050 projected peak demands.

Proposed outline solution and potential next steps.

Any increased capacity here will be dependent on the headroom available at Cowes BSP. If there is sufficient capacity at the BSP, the assets should be replaced with higher rated transformers. The health indices of HI4 for both primary transformers suggest load related reinforcement may tie in with potential replacement due to asset The feeding circuits for these assets should also be checked to confirm they are of sufficient rating for 2050 peak demands. If these are found to be of insufficient capacity, then they should also be reinforced (~200m of 33kV circuit) to an equal rating as the newly installed transformers.

Projected 2050 peak demands should be closely monitored with the potential for flexible solutions to mitigate a network overload in the late 2040s where the firm capacity may be exceeded without some further intervention.

b. Ryde Primary Substation – future system needs: Demand 2033

System Need Description

Analysis suggests there is a system need at Ryde PSS from 2032 (Winter) onwards based on the Consumer Transformation scenario. This system need relates to projected overloads on the 33/11kV 30MVA CER in-service transformer under an N-1 scenario, the circuit breaker on the 11kV side of the transformer will also need replacement due to the thermal rating being exceeded.

System Need Timeline

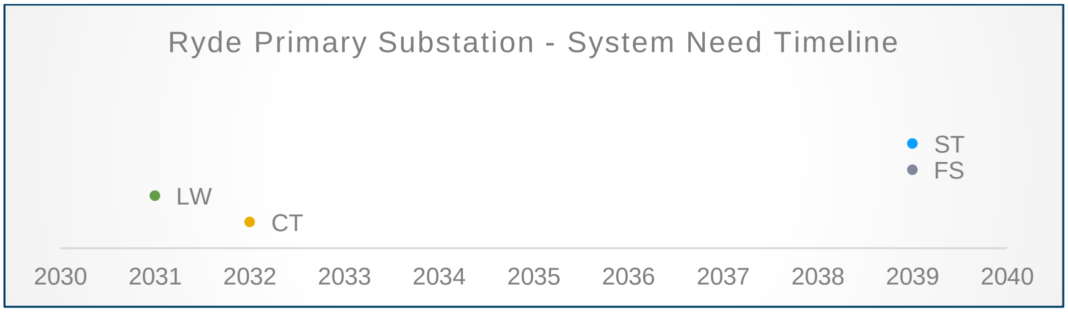

Figure 39 Ryde Timeline

2050 Peak demands at Ryde Primary Substation

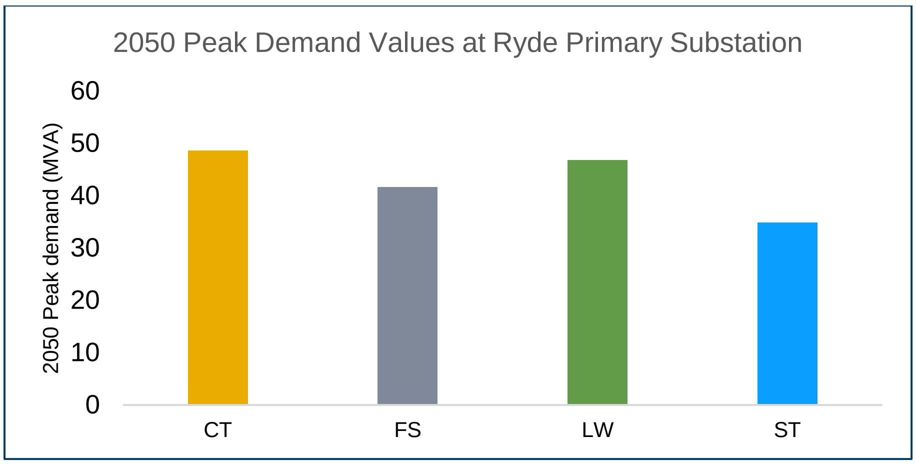

Figure 40 Ryde 2050 projected peak demands.

Proposed outline solution and potential next steps.

An intervention will be required to ensure there is sufficient capacity at Ryde PSS to supply the significant demand growth projected for the area. While flexible services may be procured to defer investment, it is unlikely that ~15MVA of flexible services will be available to cover the shortfall in firm capacity in 2050.

The maximum rated 33/11kV transformers that SSEN currently have on their distribution network are 20/40MVA CER. It is clear from the peak demands shown in Figure 40 that 20/40MVA CER transformers will not be sufficient in this case.

To resolve these issues, it may be possible to install an additional primary substation looped in/looped out of the existing 33kV ring and upgrade the 33kV circuit and 33kV breakers at Wootton Common. By doing this, existing assets at Binstead and Ryde will not need to be uprated. Binstead and Ryde have a combined projected 2050 capacity of 66.02MVA and currently a combined firm capacity of 45MVA. Installation of a third primary substation in the 33kV ring with 2 x 15/30MVA CER transformers will provide sufficient capacity for CT 2050 projections and thus future proofing this part of the 33kV network.

Alternatively, SSEN could install maximum rated assets at existing primary sites and conduct HV load transfers to balance capacity between the two primary substations.

c. Binstead-Ryde 33kV shared circuits – future system needs: Demand 2033

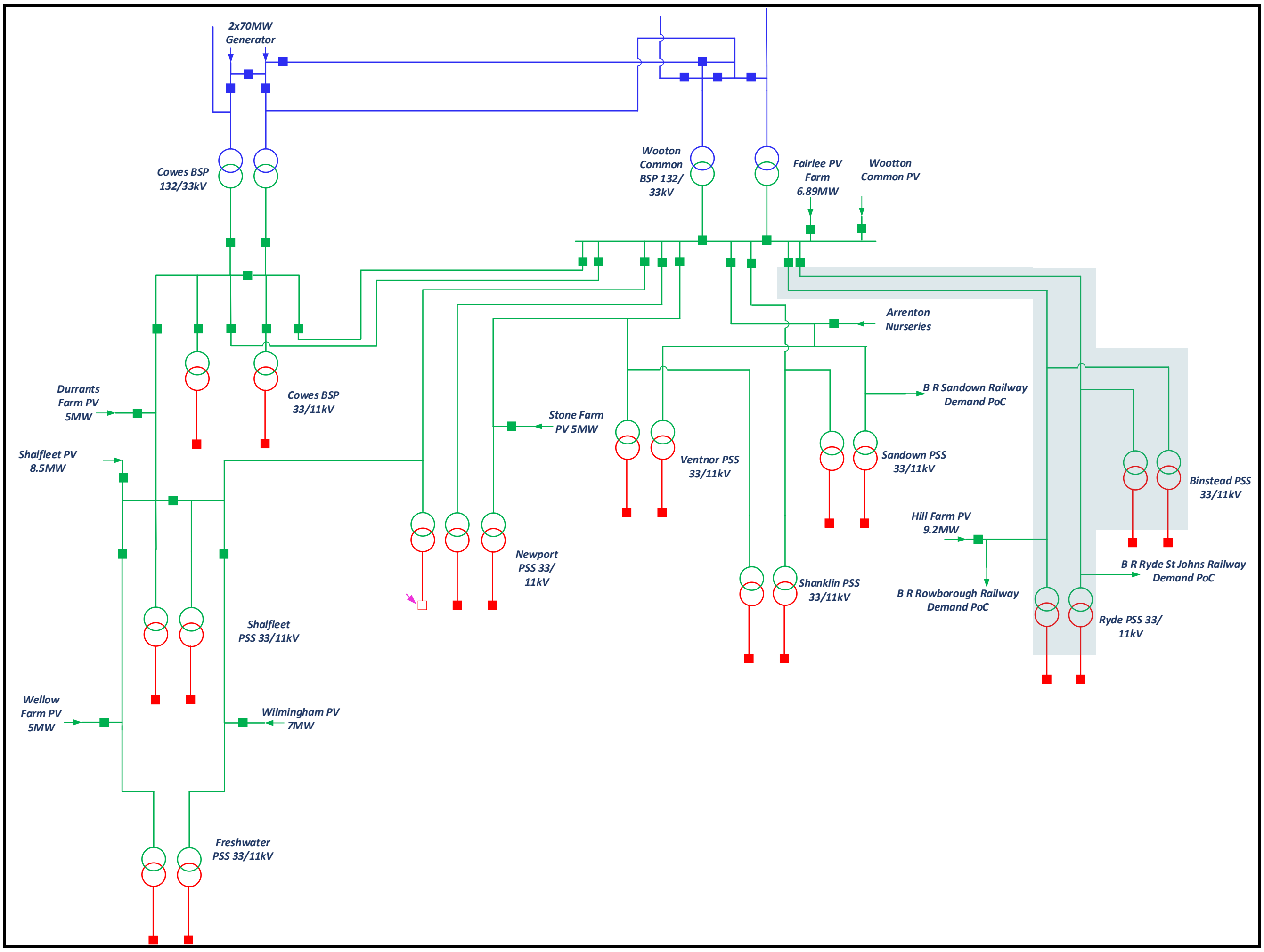

Figure 41 Network schematic with system need highlighted.

System Need Description

Under a worst-case N-1 scenario, the circuit from WOOC C14L5 to the Binstead tee will be out of service. Power system analysis using the DFES projections has identified a system need for winter peak demand in 2033 on the in-service circuit from Wootton Common C10L5 to the Binstead PSS tee. The current winter rating of the asset is 44MVA. Under N-1 conditions, the circuit supplies both Binstead PSS and Ryde PSS. It is important to note that any required intervention here will be interactive with those deployed at Binstead and Ryde primary substations. Although the initial system need impacts the first leg (4.3km) of the circuit (from Wootton Common C10L5 to Binstead Tee), in later years (ahead of 2040) we see the 33kV circuit from Wootton Common C10L5 to Ryde primary substation. The relevant circuits are highlighted above in Figure 41.

System Need Timeline

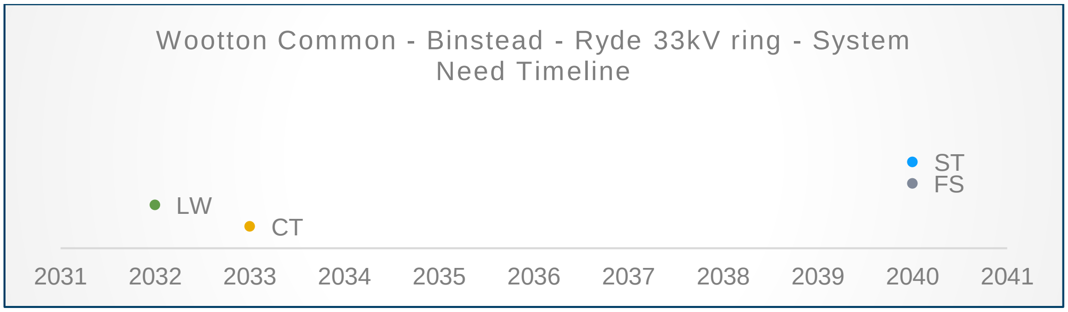

Figure 42 Wootton Common - Binstead - Ryde 33kV circuit timeline.

2050 Peak demands on the first leg under N-1 conditions

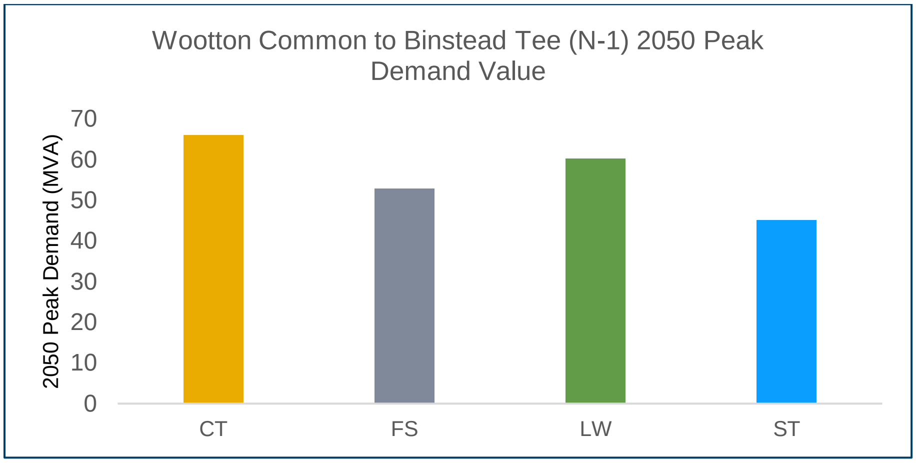

Figure 43 Wootton Common to Binstead Tee 33kV circuit 2050 projected peak demands.

Proposed outline solution and potential next steps.

To account for the projected demand on the circuit reinforcement of approximately 8.71km of 33kV circuit will be required, 4.3km ahead of 2033 with an additional 4.41km required by 2040.

Appendix D Future Demand System Needs 2034-2040

a. Ventnor-Shanklin-Newport 33kV shared circuits – future system needs: Demand 2034

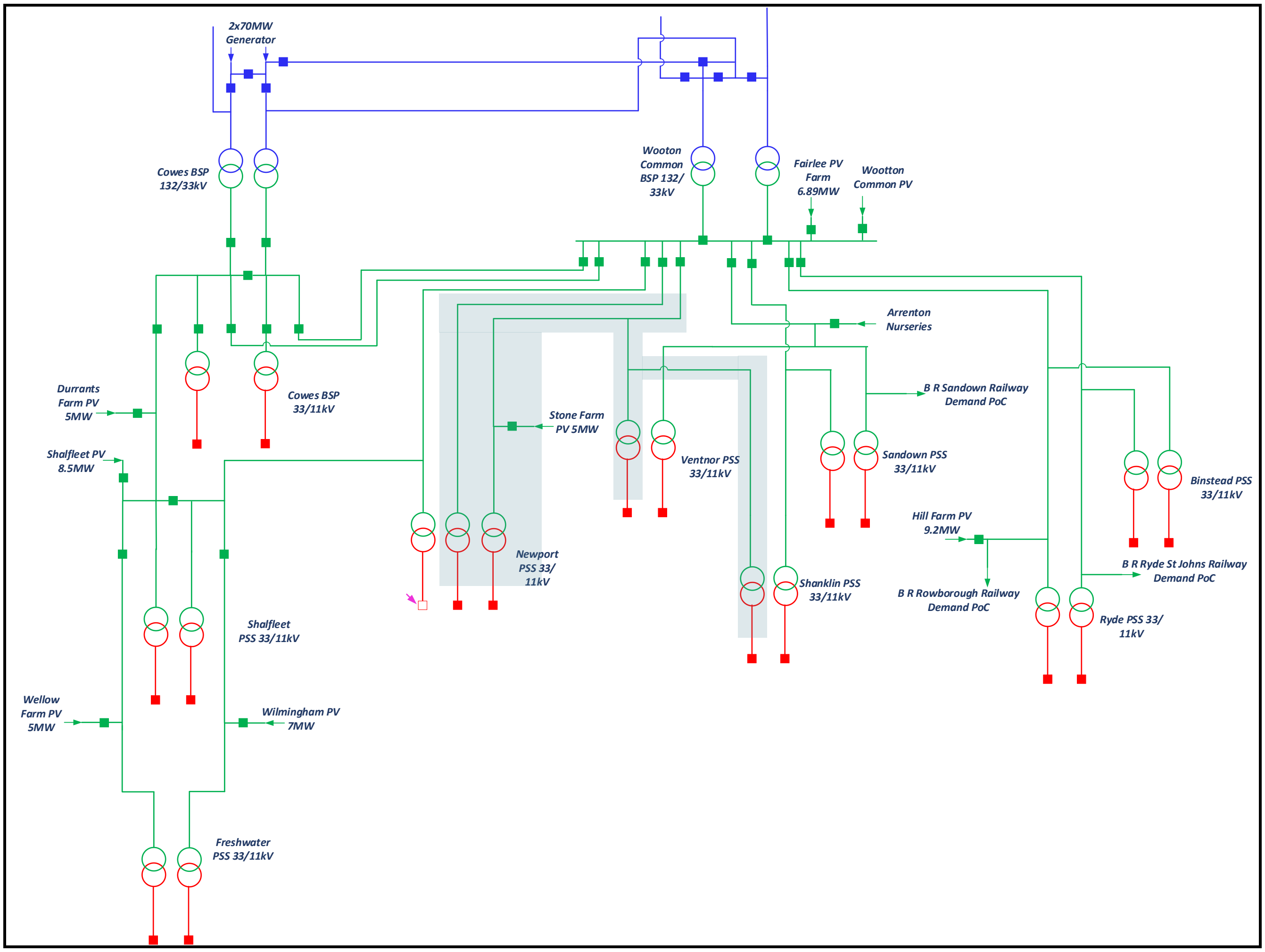

Figure 44 Network schematic with system need highlighted.

System Need Description

Ventnor-Shanklin-Newport 33kV ring is supplied from Wootton common BSP. The circuits feed one of the transformers at Ventnor, one at Shanklin, two at Newport and Stone Farm PV. If either of the Newport transformers are de-energised, then the 3rd transformer is switched in automatically and links Newport to the Shalfleet-Freshwater-Newport ring. In normal running Newport is entirely fed by Wootton common.

The network was modelled for thermal issues using the DFES for generation and demand, no generation issues were found for small generation and no larger generation sites are predicted to connect to this ring.

The Consumer Transformation scenario shows that under a N-1 condition there is a risk of the network overloading. This risk applies when the following circuits sections are out of service:

- From Wootton common towards the Ventnor-Sandown 33kV shared circuit.
- From Wootton common towards the Shanklin-Sandown 33kV shared circuit.

During modelling of the aforementioned outages, a section of the circuit from Wootton Common towards the teed section which splits off one way towards Ventnor PSS and the other towards Stone Farm PV could become overloaded in 2034.
Without intervention before this new demand connections will be delayed. Due to upstream constraints, there will be generation connection delays on any generation connection above 199kW connecting on this part of the network.

System Need Timeline

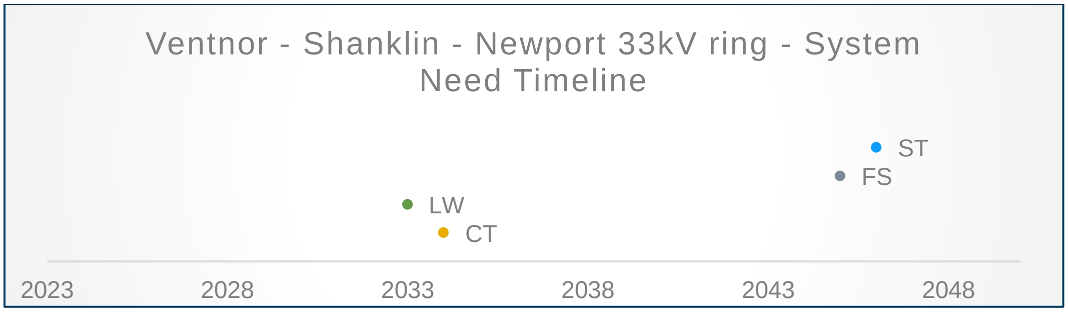

Figure 45 Ventnor - Shanklin - Newport 33kV circuit timeline.

2050 Peak Demands on the 33kV circuit ring

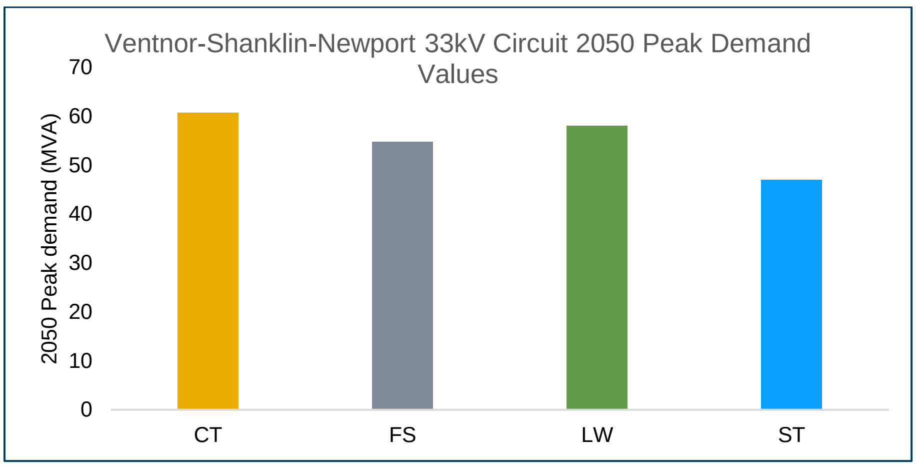

Figure 46 Ventnor - Shanklin - Newport 33kV circuit 2050 projected peak demands.

Proposed outline solution and potential next steps

Viability of a non-network solution i.e. flexibility should be carried out to understand if the system need can be mitigated without traditional reinforcement. The cost of this versus the cost of reinforcement should then be assessed through the DNOA process. In the event flexibility solutions are not viable, reinforcement of 5.2km of 33kV circuit will be required to a minimum rating of 60MVA, the 2050 shortfall in capacity would then equate to <1MVA and this could likely be managed through flexibility.

b. Shanklin-Sandown 33kV shared circuits – future system needs: Demand 2034

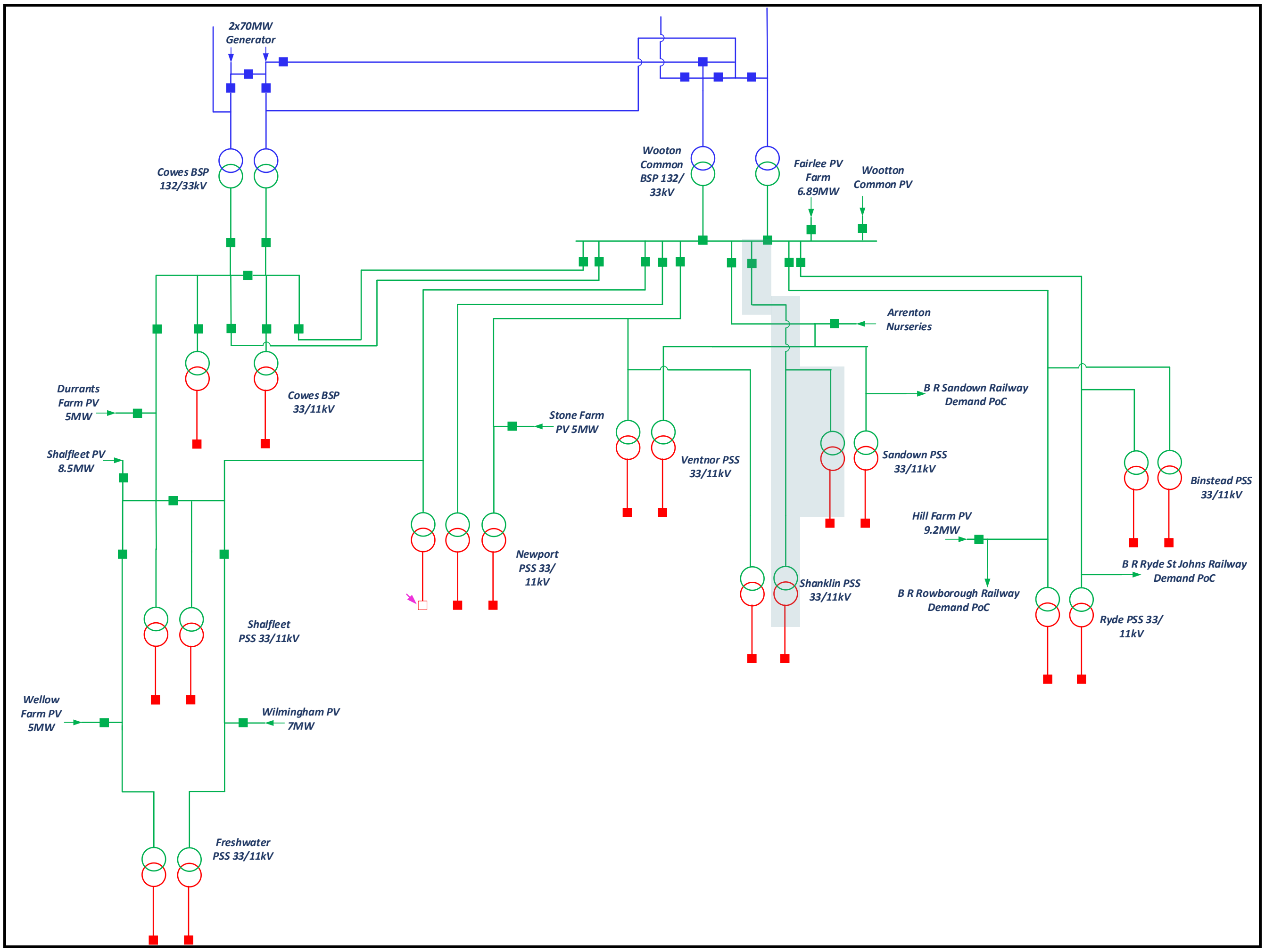

Figure 47 Network schematic with system need highlighted.

System Need Description

The Shanklin-Sandown 33kV shared circuits feed one of Sandown Primary's transformers and one of Ventnor Primary's transformers.

The Consumer Transformation scenario shows that under a N-1 condition there is a risk of the network overloading. This risk applies when the following circuits section(s) are out of service:

- Wootton Common to Arreton Nurseries tee point.

Analysis shows that the circuit section between Wootton Common to the splitting point to Sandown primary and Shanklin primary substations will be overloaded in 2034.

System Need Timeline

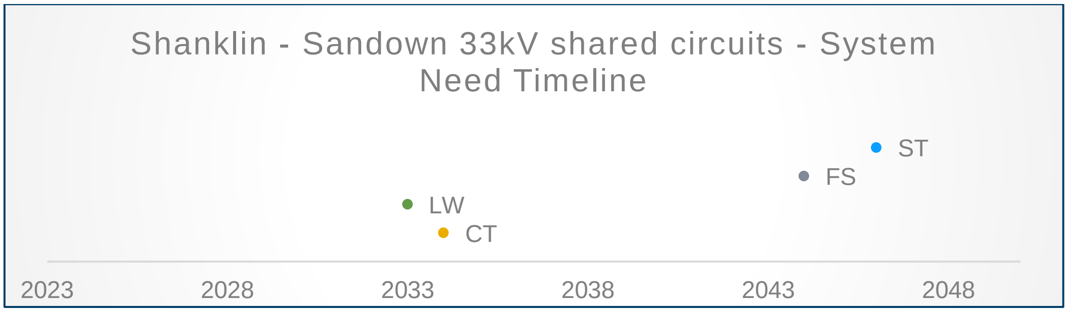

Figure 48 Shanklin - Sandown 33kV circuit timeline.

2050 Peak Demands on the 33kV circuit (under the outage condition)

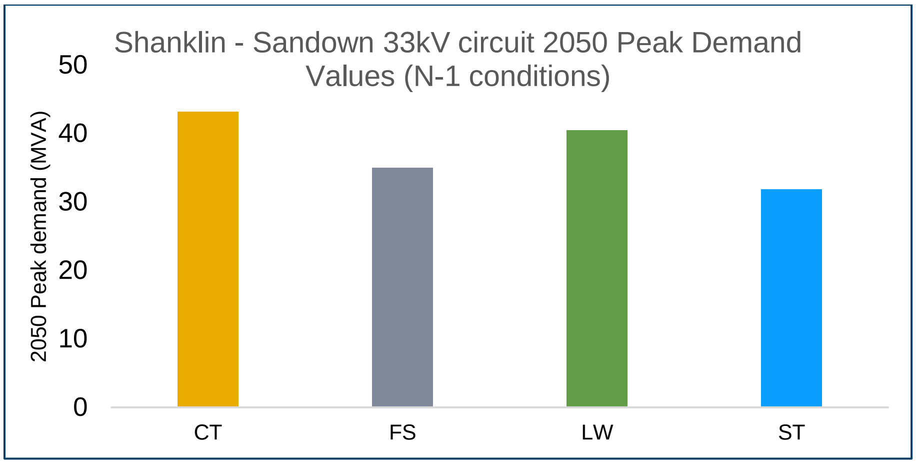

Figure 49 Shanklin - Sandown 33kV circuit 2050 projected peak demands.

Proposed outline solution and potential next steps

The overloaded circuit section is 8.4km long and it is only this section that is projected to be overloaded ahead of 2050. In the near-term, this constraint could be deferred through utilisation of a flexible solution. However, when considering the 2050 peak demand that is projected for the N-1 condition, it is unlikely flexibility will be a viable option. Approximately, 10MVA of flexibility would need to be procured in 2050 and with the current absence of 33kV connected dispatchable generation on this circuit, it would be highly uncertain enough flexibility through demand side response alone across Shanklin and Sandown would be available.

As such, following potential deferral through flexibility, reinforcement of the 8.4km 33kV circuit should be carried out to a Winter rating of 40MVA.

c. Langley Bulk Supply Point - future system need: Demand 2036

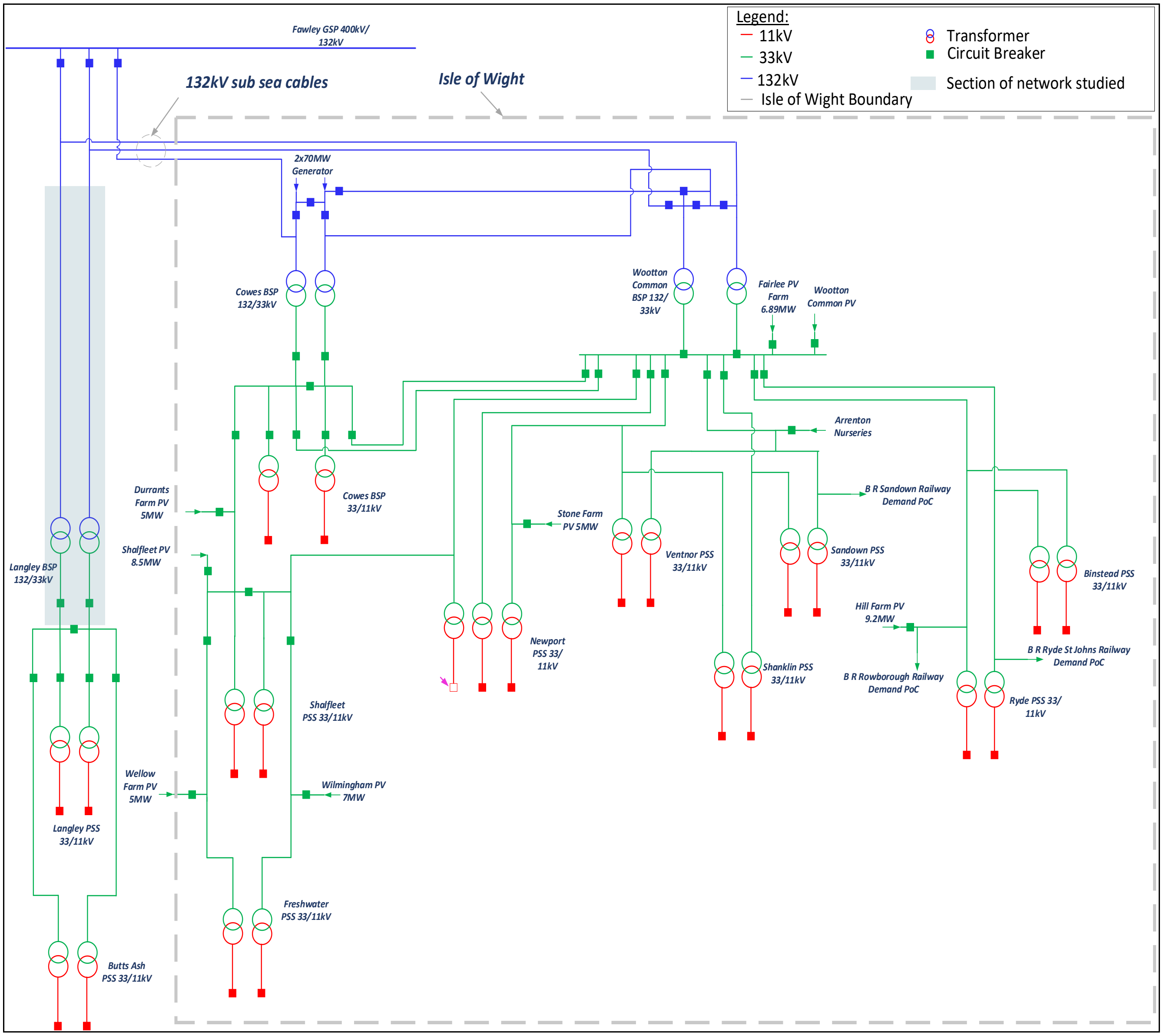

Figure 50 Network schematic with system need highlighted.

System Need Description

Here we are not considering the 132kV circuits from Langley BSP to Fawley GSP as these are shared with Wootton Common and have been studied in the previous section.
The existing arrangement at Langley BSP is two 132/33kV transformers with a rating of 45MVA. The firm capacity of Langley BSP is 45MVA as the transformers are the capacity limiting factor. Using the DFES scenarios and Power System Analysis we have identified a system need at Langley BSP from 2036 onwards (under the CT scenario).

System Need Timeline

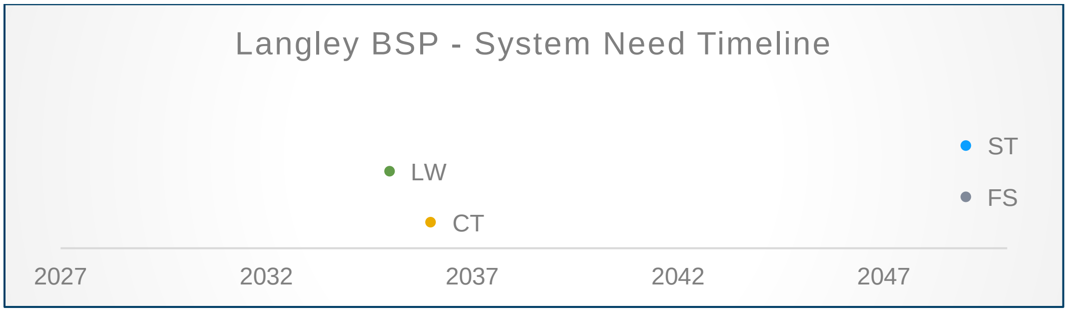

Figure 51 Langley BSP timeline.

2050 Peak Demands at Langley BSP

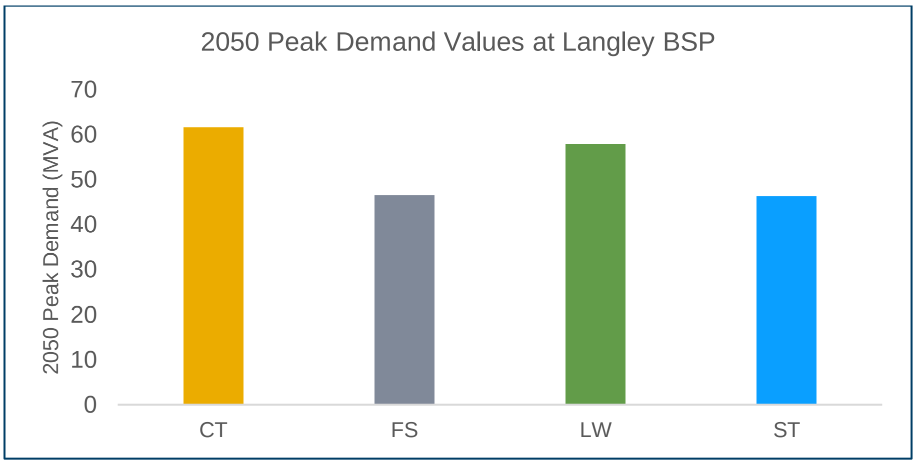

Figure 52 Langley BSP 2050 projected peak demands.

Proposed outline solution and potential next steps

Here, we have identified a load related future system need in 2036 (under the Consumer Transformation scenario). The asset health of the existing transformers is an important consideration when considering the future system. The existing 132/33kV transformers at Langley BSP have health indices of HI3 and HI4. This means that asset health can also be a driver for asset replacement in the medium-term future.
Transformer replacement at Langley BSP in 2036 will provide multiple benefits to the system:

- Improve transformer health of assets approaching end of life.
- Provide sufficient capacity out to 2050.

Transformers with a minimum nameplate rating of 60MVA will be sufficient in supplying the projected 2050 peak demands. If the health deteriorates prior to 2036 then 60MVA transformers are recommended to be procured early instead of replacing at a similar capacity.

d. Langley Primary Substation – future system needs: Demand 2034

System Need Description

Under an outage the remaining capacity at Langley PSS is related to the 33/11kV transformers. The nameplate capacity for each of the two transformers is 7.5MVA transformers with 15MVA emergency rating. During an outage it is assumed that the rating of the transformer is 15MVA which is the limiting factor for this PSS.

System Need Timeline

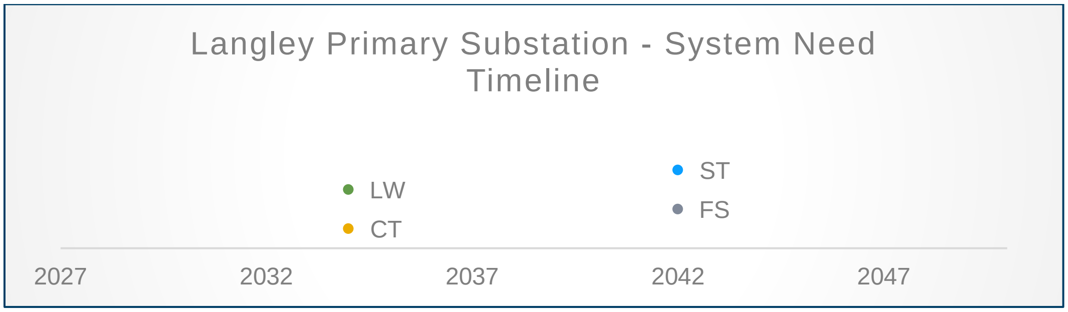

Figure 53 Langley primary substation timeline.

2050 Peak Demands at Langley Primary Substation

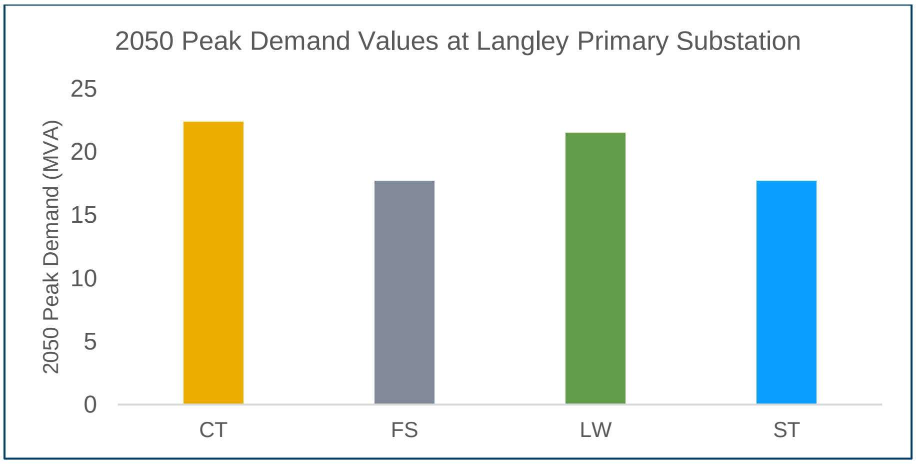

Figure 54 Langley primary substation 2050 projected peak demands.

Proposed outline solution and potential next steps

An intervention at Langley Primary substation will be required to provide sufficient capacity on the network for projected 2050 peak demands. Similar timelines are presented for Butts Ash primary substation and Langley BSP. Solutions deployed should complement one another, this may include HV load transfers between Butts Ash primary substation and Langley primary substation to balance the projected load growth across the two primaries and prevent unnecessary spend on increasing the capacity of both primary substations.
As Butts Ash primary transformers have better health ratings, it could be suggested that these transformers are not upgraded, instead assets are replaced at Langley primary substation and some of the projected future load at Butts Ash can be transferred here.

e. Butts Ash Primary Substation – future system needs: Demand 2036

System Need Description

Under the CT scenario, it has been projected that there is a system need at Butts Ash primary substation in 2036 (Winter). The N-1 (winter) capacity of the circuit is 28.7MVA and the (nameplate) capacity of the transformer is 30MVA, the projected 2036 Winter loading of these assets is projected to be 102.9% and 98.5% respectively. As a result, there is a system need at Butts Ash primary. Although the circuit loading exceeds 100% and the transformers loading falls just below, it makes sense for the intervention on the two assets to be grouped together rather than 2 separate sets of work at the primary substation.

System Need Timeline

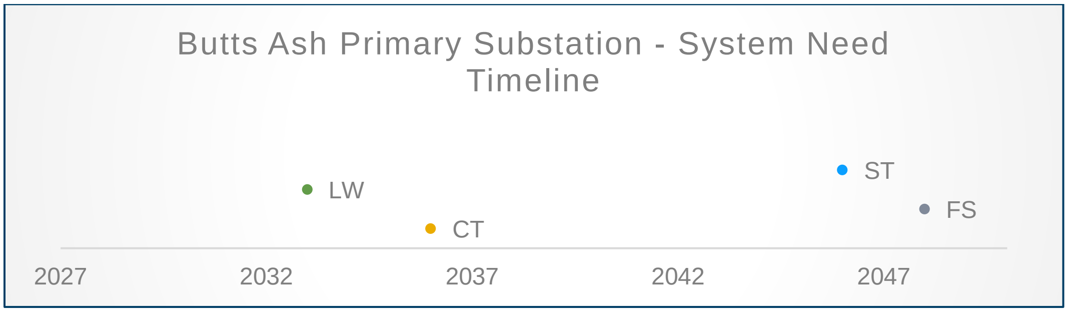

Figure 55 Butts Ash primary substation timeline.

2050 Peak Demands at Butts Ash Primary Substation

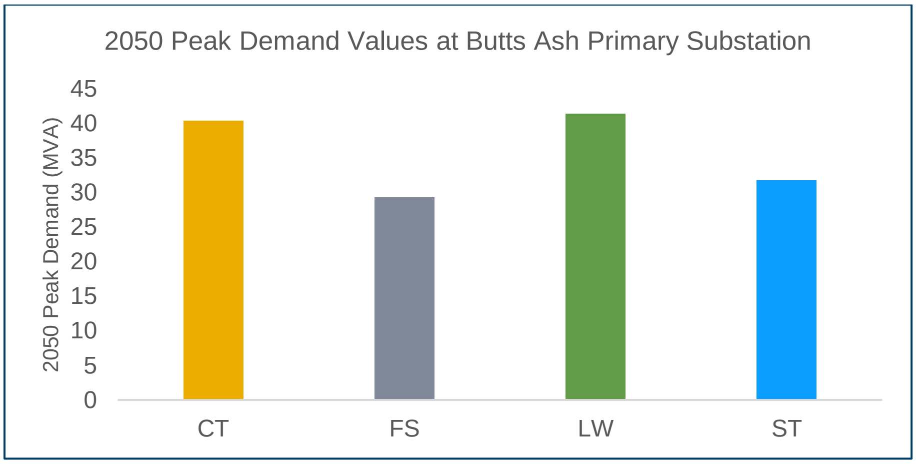

Figure 56 Butts Ash primary substation 2050 projected peak demands.

Proposed outline solution and potential next steps

From 2036 onwards, a system need has been identified (under the CT scenario). There are 2 transformers at Butts Ash PSS and each of these is fed by 6km of 33kV circuit. One potential solution would be to reinforce the existing assets. The 33/11kV transformers at Butts Ash are both currently HI1, however, they are currently 25 years old with an expect lifetime of 38 years. By 2036, these assets will be 37 years old and therefore reaching their expected end of life. Replacement of these assets with higher rated transformers (potentially 33/11kV 20/40MVA CER) in 2036 will align with the expected end of life for the assets.

Alongside this, the 33kV feeding circuits will also need to be reinforced. A total of 12km (2 x 6km) of 33kV circuit will need to be reinforced and should have a minimum winter rating of 40MVA to enable the nameplate capacity of the transformers and provide capacity for the projected demand at the primary substation.

f. Freshwater Primary Substation - future system needs: Demand 2038

System Need Description

Freshwater primary substation is fed via 33kV circuits shared with Shalfleet. Between Shalfleet and Freshwater each circuit has a 33kV connected PV farm connected. Under a first circuit outage, the limiting factor at Freshwater is the 33/11kV transformer. The 15MVA nameplate rating of the Freshwater transformers was taken to be the firm capacity at the substation.

System Need Timeline

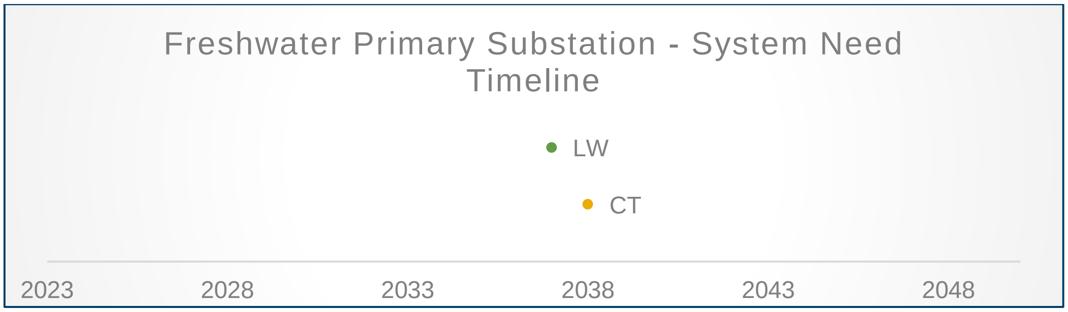

Figure 57 Freshwater primary substation timeline.

2050 Peak Demands at Freshwater Primary Substation

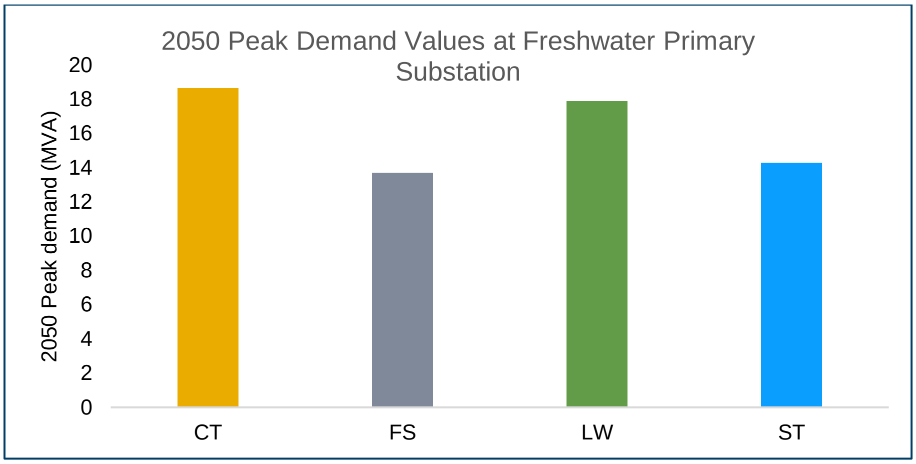

Figure 58 Freshwater primary substation 2050 projected peak demands.

Proposed outline solution and potential next steps

From Figure 58, we can see that in 2050 the peak demand at Freshwater is projected to be 18.65MVA. As this is 124% of the transformer firm capacity, depending on the load curve and ambient temperature at the time of the peak demand it may be possible for the existing asset to handle the projected 2050 demand. Flexible services could also be procured at the primary substation to reduce the peak demand and mitigate the need for asset replacement. The system need should be re-assessed as new DFES projections are released to ensure a solution is deployed to satisfy the system need ahead of 2038.

g. Newport Primary Substation – future system needs: Demand 2040

System Need Description

Newport primary substation is fed by three transformers but at any one time only two will be actively supplying the primary substation. This is because if all three transformers were to feed the primary at once the fault level would exceed the rating of the circuit breakers at the site. Replacement of these circuit breakers has been triggered by a customer connection (ETD672); the current forecast works complete date is 2027.

The three 33/11kV transformers at the site are all rated at 30MVA. The load of the primary is not split evenly across the two in service transformers. As one of the transformers is not usually in service, the N-1 capacity of Newport Primary Substation is the same as the intact network.

Analysis shows that under the CT scenario, the transformer supplying 66% of the total primary load will exceed its nameplate rating in 2040. The 33kV circuit from Wootton Common that feeds this transformer is overloaded in the following year.

System Need Timeline

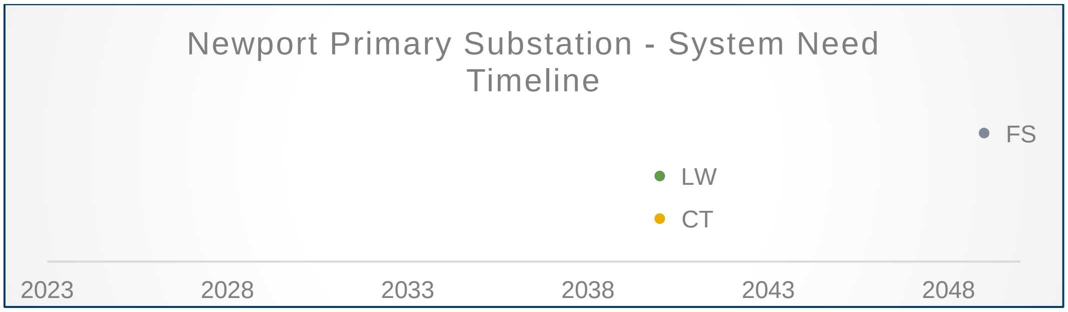

Figure 59 Newport primary substation timeline.

2050 Peak demands at Newport Primary Substation

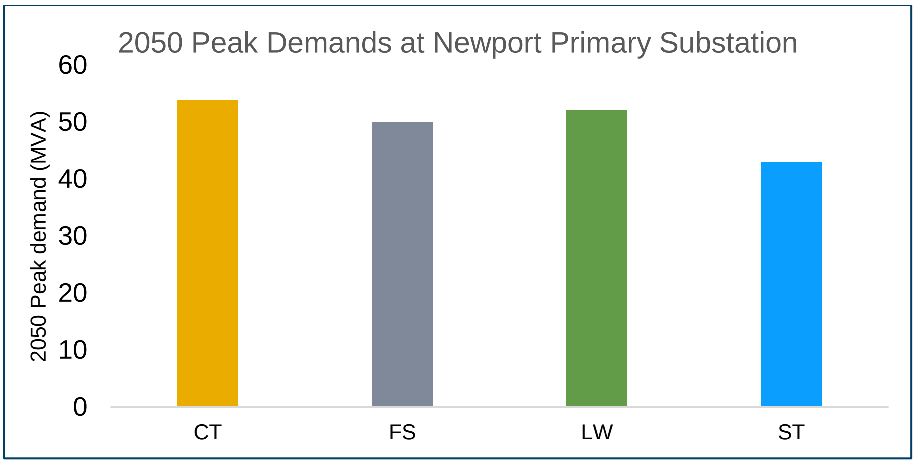

Figure 60 Newport primary substation 2050 projected peak demands.

Proposed outline solution and potential next steps.

As can be seen in Figure 60, the projected 2050 peak demand is 53.9MVA under the CT scenario. This does not exceed the capacity of the two in-service transformers (2 x 30MVA) is not exceeded if the load is shared evenly. The two transformers have the same impedance values, so the uneven loading is a result of the different feeding circuit lengths and impedances. In order to resolve we could add 3.7km of 33kV circuit so that both transformers were both connected directly to Wootton Common BSP. This would be dependent on space at the Wootton Common 33kV busbar for installation of a new 33kV circuit breaker.

h. Ventnor-Sandown 33kV shared circuits – future system needs: Demand 2040

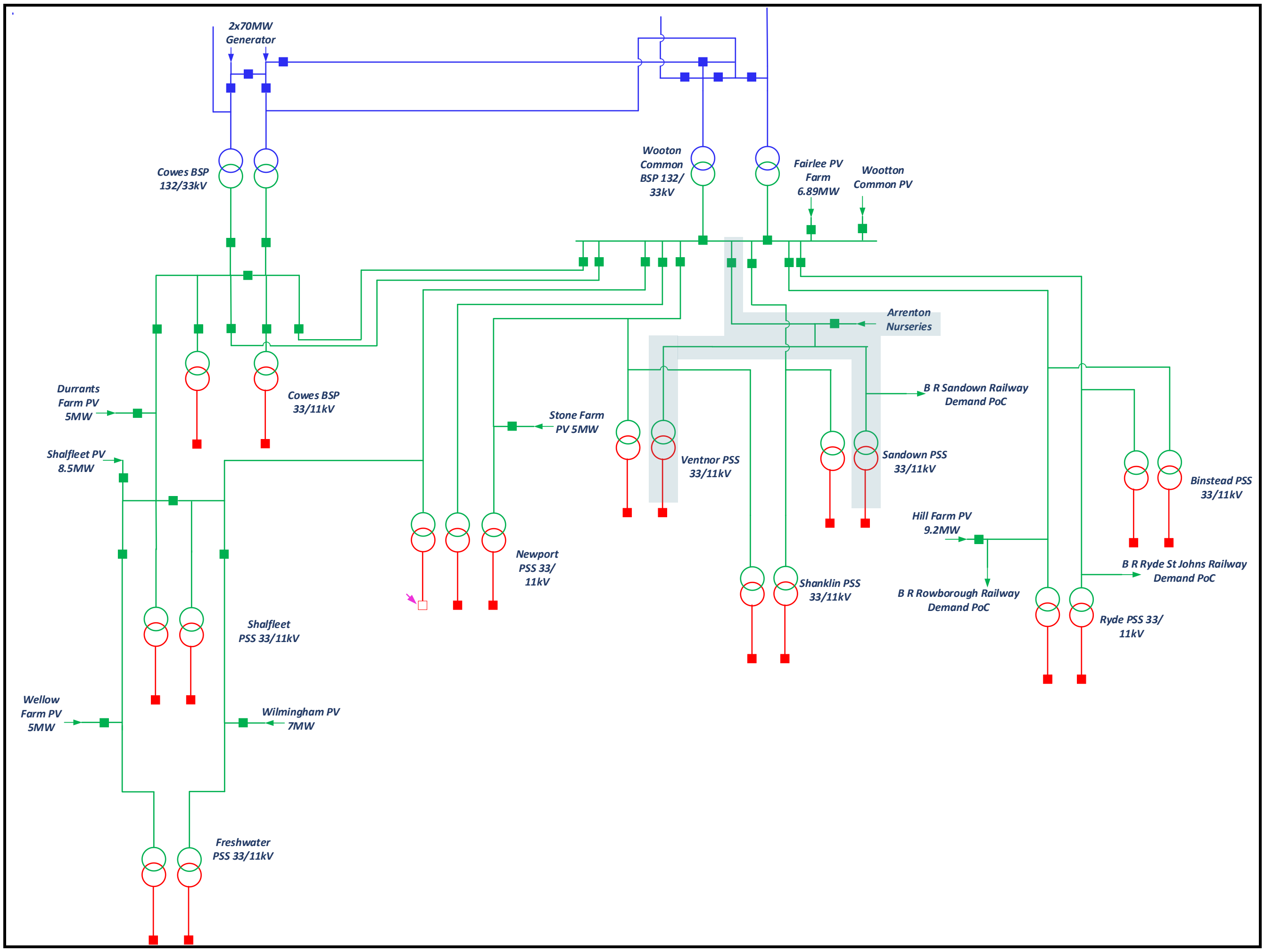

Figure 61 Network schematic with system need highlighted.

System Need Description

The Ventnor-Sandown 33kV shared circuit feeds Arreton Nurseries, British Rail Ryde-Sandown Railway, one of primary transformers at Sandown, and one of the primary transformers at Ventnor.

The Consumer Transformation scenario indicated that under an N-1 condition, there is a risk of a thermal overloading on the shared circuit. The risk arises from outages on the following circuits:

- From Wootton Common towards the tee to Ventnor and Stone Farm PV.
- From Wootton Common towards the tee to Shanklin and Sandown.

Under these outages, the first leg of the Ventnor-Sandown 33kV shared circuit (highlighted to the figure above), will be overloaded in 2040. This 6.8km of 33kV circuit currently has a winter rating of 44MVA.

System Need Timeline

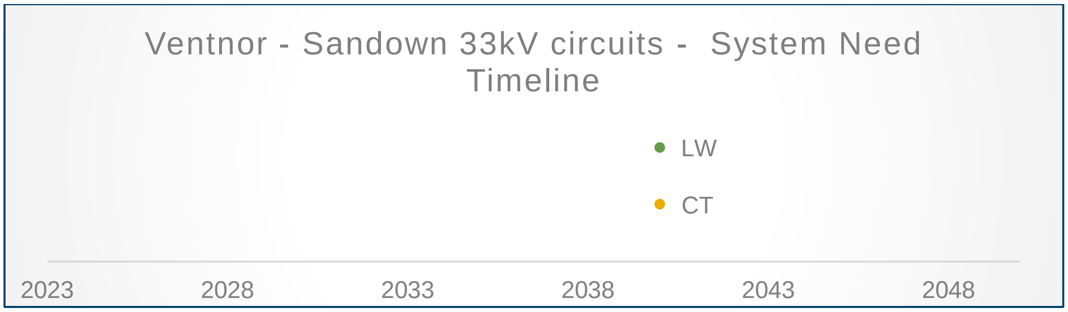

Figure 62 Ventnor - Sandown 33kV circuits timeline.

2050 Peak Demands on the 33kV circuit (under the outage condition)

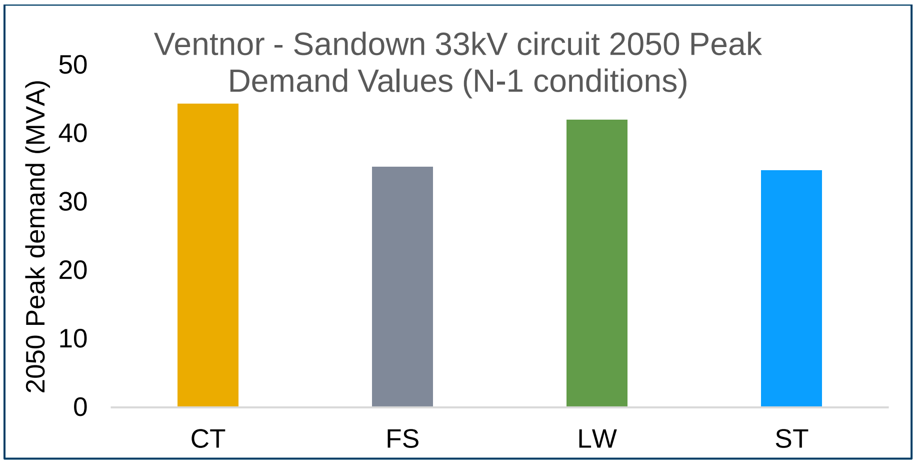

Figure 63 Ventnor - Sandown 33kV circuit 2050 projected peak demands.

Proposed outline solution and potential next steps

Thermal capacity not overloaded in 2040, but in a later year when considering projected demands and the firm capacity of the relevant circuit section. From modelling it becomes clear that the thermal overload in 2040 is the result of voltage drop. The circuit thermal rating of 44MVA is projected to only be exceeded by 0.34MVA in 2050, this could likely be managed through a flexible solution.

Here, we are considering thermal/capacity limitations, a solution will need to be deployed to resolve the voltage drop identified.

Appendix E Future Demand System Needs 2041-2050

a. Ventnor Primary Substation - future system needs: Demand 2041

System Need Description

Ventnor is fed from two 33kV circuits, one which is shared with Sandown primary substation, and the other shared with Shaklin and Newport primary substations.
The transformers on site are derated by the 11kV singles connecting into them brining their capacity down to 13.8MVA in Summer and 15.3MVA in winter. The nameplate rating for the transformers is 15MVA with an emergency rating of 30MVA. The circuits which go to the tee points are rated at 20.2MVA winter rating and 16.8MVA summer rating.
There is a planned new connection on the incoming circuit connected between the tee of the Ventnor-Shanklin-Newport shared circuits and Ventnor PSS. This connection is a 20MW tidal generator which has triggered the circuit reinforcements from its connection point back to the tee. When modelled this connection could potentially cause circulating current at the Ventnor PSS transformers, the solution to prevent this from happening is yet to be determined but may cause the reinforcement and point of connection to change.

Outside of these reinforcements caused by an individual customer connection, a system need arising from demand is projected for 2041. The system need is identified under an N-1 condition with demand projections from the CT scenario. When considering the 2050 peak demands we can see that the reason for this overload is due to voltage drop across the 132kV network. This system need should be re-assessed following details on the 132kV subsea cable scheme introduced in the 'Future System Needs 2024-2028' section.

System Need Timeline

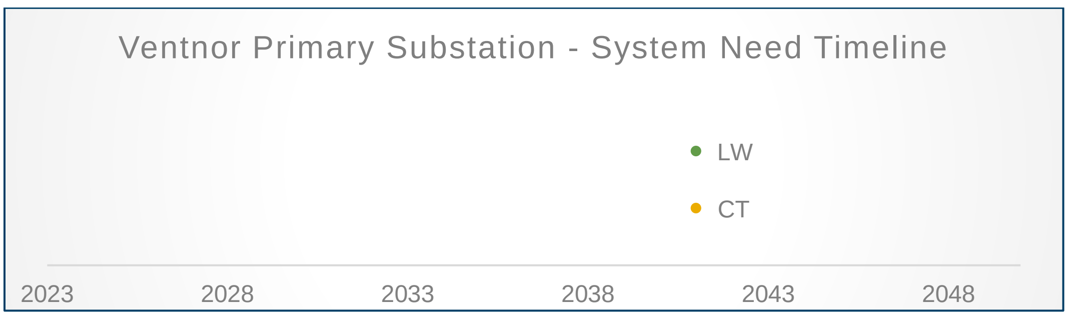

Figure 64 Ventnor primary substation timeline.

2050 Peak Demands on Ventnor Primary Substation

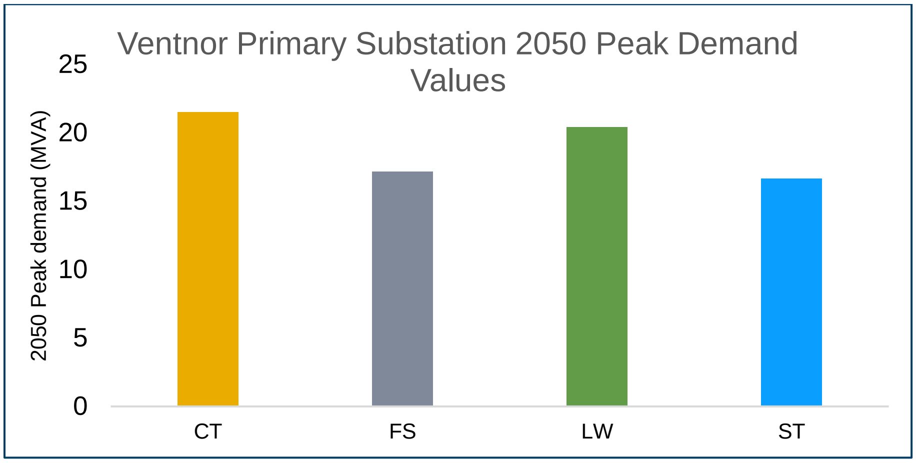

Figure 65 Ventnor primary substation 2050 projected peak demands.

Proposed outline solution and potential next steps.

This system need should continue to be monitored and studied following the completion of the 132kV scheme. This will allow for confirmation that reinforcement is required. The long-term projection of this system need allows for this later study to be valid without risk of asset overload in the medium term.

b. Binstead Primary Substation – future system needs: Demand 2042

System Need Description

Under an N-1 condition at Binstead Primary Substation a system need has been identified in 2042 (Winter) under the Consumer Transformation scenario. The system need arises at the primary transformer under an N-1 condition, the current firm capacity of 15MVA is not projected to be sufficient.
There is only a system need under two of the DFES scenarios (LW and CT) with the two others (ST and FS) not highlighting a system need ahead of 2050.

System Need Timeline

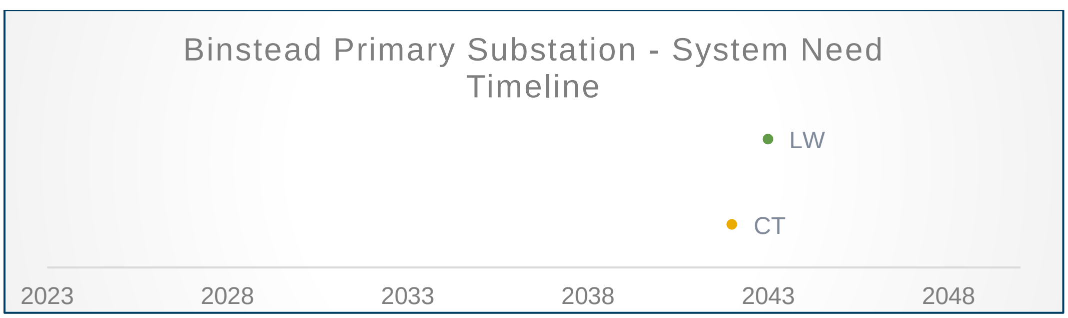

Figure 66 Binstead primary substation timeline.

2050 Peak Demands on Binstead Primary Substation

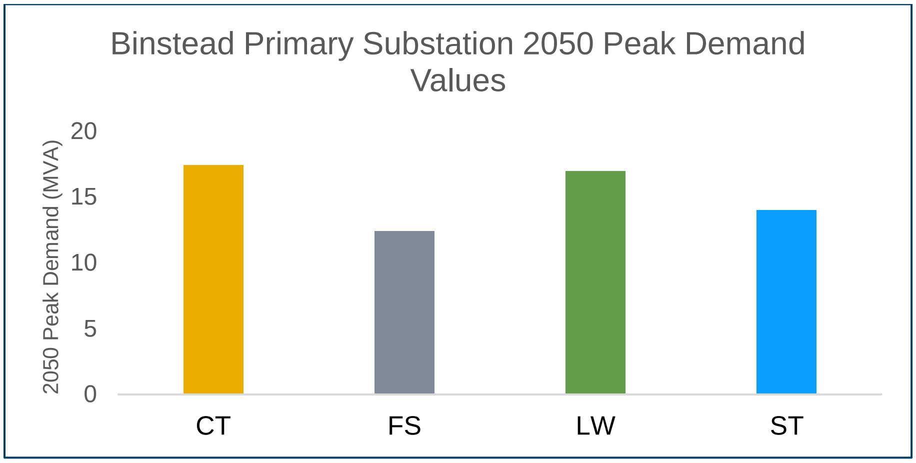

Figure 67 Binstead primary substation 2050 projected peak demands.

Proposed outline solution and potential next steps.

The firm capacity exceedance projected at Binstead is for the early 2040s. The demand above firm capacity in 2050 is less than 2MVA. Due to this relatively small exceedance and also uncertainty over projected demands ~20 years in the future, no asset replacement/addition is proposed here.

Instead, this system need could be managed through procurement of flexible services. In the future there may be increased capacity at Ryde, and load transfers of 2MVA or less could be employed to ensure that demands under Binstead PSS remain below the firm capacity of the substation.

c. Shanklin Primary Substation – future system needs: Demand 2042

System Need Description

Shanklin Primary Substation is fed from two circuits, one shared with Sandown, and the other shared with Ventnor and Newport Primary substations.

The capacity limiting factor at Shanklin is the primary transformers, these are each rated to 30MVA. Under an N-1 condition the CT scenario projects a system need from 2042 onwards.

When considering the 2050 peak demands we can see that the reason for this overload is due to voltage drop across the 132kV network. This system need should be re-assessed following details on the 132kV subsea cable scheme introduced in the ‘Future System Needs 2024-2028’ section.

System Need Timeline

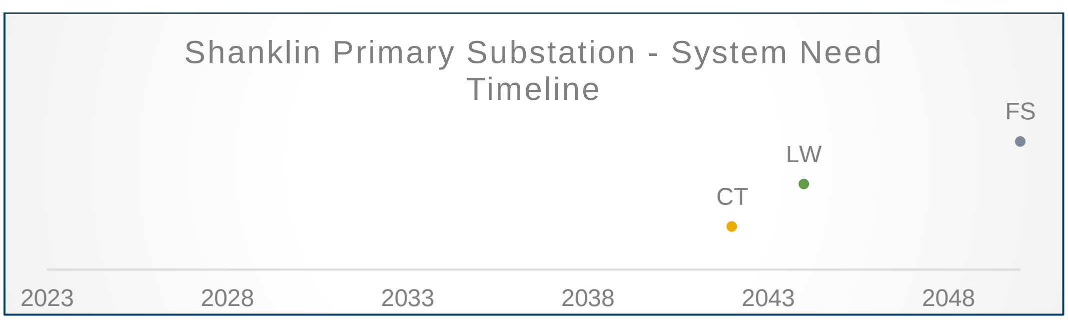

Figure 68 Shanklin primary substation timeline.

2050 Peak Demands on Shanklin Primary Substation

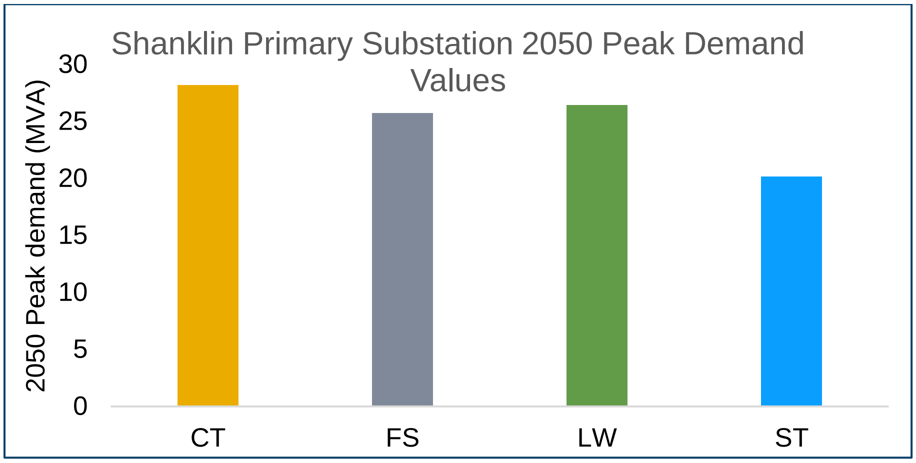

Figure 69 Shanklin primary substation 2050 projected peak demands.

Proposed outline solution and potential next steps.

This system need should continue to be monitored and studied following the completion of the 132kV scheme. This will allow for confirmation that reinforcement is required. The long-term projection of this system need allows for this later study to be valid without risk of asset overload in the medium term.

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