ESB NETWORKS

Distribution Network Development Plan

Part 1: Summary Document and Methodology Statement

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Executive Summary

In our Networks for Net Zero strategy[1], ESB Networks has committed to delivering a net zero ready electricity distribution network by 2040 to enable Ireland to achieve its legally binding net zero target by 2050. A key action in our strategy[1] is to publish a Ten-Year Distribution Network Development Plan (DNDP) as required under the Clean Energy Package[2] Directive (EU) 2019/944[3].

The purposes of DNDP are:

- To provide information to customers and stakeholders on currently installed distribution network capacity.
- To assess the future capacity of the distribution network to accommodate customer needs over the next 5 to 10 years, based on credible demand growth scenarios.
- To identify areas of the distribution network that require investment to address constraints, assessing the options available to ensure the network complies with the Distribution System Security and Planning Standards (DSSPS)[7] and technical limits of assets.
- To enhance transparency for customers and stakeholders regarding ESB Networks' plans to develop the distribution network to enable Ireland's transition to net zero.
- The DNDP is not intended to advise on existing or future capacity, or existing or future constraints on the transmission system..

The DNDP consists of a suite of three documents:

Part 1: A Summary Document and Methodology Statement (this document)

Part 2: A Distribution Network Development Report (DNDR)[4] providing detailed information on investment projects in each distribution network area that will add capacity (including non-load investments).

Part 3: A Network Scenario Headroom Report[5] consisting of capacity workbooks for demand and generation on the distribution system.

The Summary Document and Methodology Statement and the Distribution Network Development Report[4] are published for consultation and we would welcome your feedback on whether the information provided meets your requirements. Please submit feedback by 19 September 2025 to development.plans@esb.ie We will use your feedback to shape the final Distribution Network Development Plan which will be published by the end of 2025.

Note that ESB Networks' PR6 Business Plan[6], which was submitted to the Commission for Regulation of Utilities (CRU) in November 2024, outlines our proposed investments in the electricity network over the period 2026 – 2030. This includes our planned investment in network capacity to accommodate significant increases in renewable generation and rapidly growing customer demand. The Plan is currently being reviewed by the CRU, who will make a final determination on our planned investments in Q4 2025.

Contents

1. Introduction

1.1 Our role

ESB Networks is the electricity Distribution System Operator (DSO), Distribution Asset Owner (DAO), and onshore Transmission Asset Owner (TAO) in the Republic of Ireland. We work to meet the needs of 2.5 million electricity customers in Ireland, regardless of supplier, delivering the electricity network for Ireland's clean electric future.

1.2 Distribution Network Development Plan Overview

The Clean Energy Package is designed to facilitate the transition from fossil fuels to cleaner energy sources, aligning with the EU's commitments under the Paris Agreement to reduce greenhouse gas emissions. It aims to ensure that citizens have access to affordable, secure, and sustainable energy. Directive (EU) 2019/944[3] of the Clean Energy Package[2] mandates that electricity distribution system operators (DSOs) prepare and publish biennial distribution network development plans (DNDPs).

The purposes of DNDP are:

- To provide information to customers and stakeholders on currently installed distribution network capacity.
- To assess the future capacity of the distribution network to accommodate customer needs over the next 5 to 10 years, based on credible demand growth scenarios.
- To identify areas of the distribution network that require investment to address constraints, assessing the options available to ensure the network complies with the Distribution System Security and Planning Standards (DSSPS)[7] and technical limits of assets.
- To enhance transparency for customers and stakeholders regarding ESB Network's plans to develop the distribution network to enable Ireland's transition to net zero.
- To identify flexible services needs across the country.
- The DNDP is not intended to advise on existing or future capacity, or existing or future constraints on the transmission system.

The Distribution Network Development Plan (DNDP) consists of:

Part 1: A Summary Document and Methodology Statement (this document).

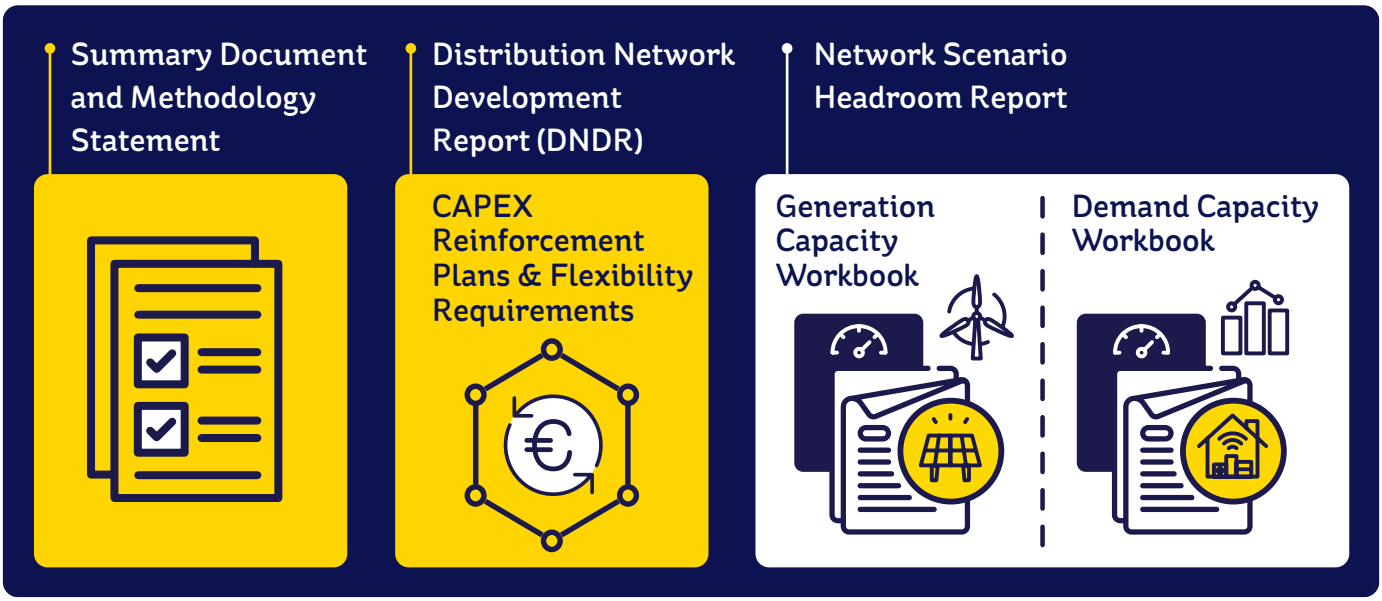
Part 2: A Distribution Network Development Report (DNDR)[5] which provides detailed information on investment projects in each distribution network area that will add capacity. It also includes non-load investments, such as asset replacements, and flexible services needs.

Part 3: A Network Scenario Headroom Report[6] consisting of two capacity workbooks - one for demand and one for generation on the distribution system. The Demand Capacity Workbook was published in December 2024 and the Generation Capacity Workbook was published in March 2025. Both workbooks will be updated by the end of 2025 and every year thereafter.

This document, the Summary Document and Methodology Statement (Part 1), explains ESB Networks approach to producing the DNDR (Part 2) and the Network Scenario Headroom Report (Part 3). Note that Parts 2 and 3 of the DNDP do not address available capacity on our low-voltage network nor the available transmission system capacity.

Figure 1 shows the document map for the Distribution Network Development Plan (DNDP) suite of documents.

Figure 1 – Document Map Distribution Network Development Plan



1.3 Document Structure and Overarching Process

The Summary Document and Methodology Statement explains how we produced Part 2, the Distribution Network Development Report[4] and Part 3, the Network Scenario Headroom Report[5]. The Summary Document and Methodology Statement is divided into sections, which cover the six steps in the process used to produce DNDP:

Figure 2 – Six step process in development of DNDP

- ***Section 2:*** Step 1, Forecast Scenarios, describes the assumptions we used to develop four forecast scenarios
- ***Section 3:*** Step 2, Network Assessment, describes how we carry out assessments to establish where, when and how much additional distribution network capacity is required for each of the forecasted scenarios
- ***Section 4:*** Step 3, Investment Appraisal, describes how we examine different distribution system reinforcement options
- ***Section 5:*** Step 4, Flexibility Needs, describes how we identify flexible services needs for each area
- ***Section 6:*** Step 5, DNDP Part 2, provides high level overview of the content in Distribution Network Development Report[5], reporting of investments identified through Steps 1-4.
- ***Section 7:*** Step 6, DNDP Part 3, provides high level overview of the content in Network Scenario Headroom Report[6], reporting of future capacity available on our network based on the four forecast scenarios and investments reported in Step 5.

1.4 Stakeholder Engagement

This document, together with the Distribution Network Development Report[4], is published for Consultation and we are inviting your feedback on whether the information provided meets your requirements. Please submit feedback by 19 September 2025 to development.plans@esb.ie We will use your feedback to shape the final Distribution Network Development Plan which will be published by the end of 2025.

Please consider the following questions in your feedback:

Part 1 – Summary Document and Methodology Statement:

1. Is there any other information you would like to see included in our Distribution Network Development Plan (DNDP)?
2. Do you make use of any other sources of information we publish? Capacity heatmaps[8], capacity workbooks[5], community toolkit[9], generation minimum cost calculator[10], other?
3. Do you agree with the structure/process we have followed to produce the Distribution Network Development Plan (DNDP)?
4. Do you have any comments on our four forecasting scenarios?

Part 2 – Distribution Network Development Report (DNDR)[4]:

1. Do you find the information contained within Distribution Network Development Report (DNDR)[4] useful? If not, how can we improve it?
2. How could/will our DNDR[4] be used by your business/community?

Part 3 – Network Scenario Headroom Report (NSHR)[5]:

1. Do you find the information contained within our capacity workbooks[5] tables useful? If not, how could it be improved?
2. How could/will our capacity workbooks[5] be used by your business/community?
3. Do you find the format of the capacity workbooks[5] helpful?
4. Are there any other comments or feedback you would like to make?

2. Forecast Scenarios

ESB Networks commissioned a study by Charles River Associates (CRA) to provide a detailed analysis of the demand growth rates and the peak demand values for the electricity distribution system in Ireland for the period 2025 to 2040. The scope of this study was to develop a set of scenarios that include the targets set out in Ireland's Climate Action Plan[12] and develop a forecasting tool that can calculate peak demand growth rates for the electricity distribution system, operated by ESB Networks, for the period 2025-2040. This was achieved by using econometrics to forecast baseline electricity demand growth based on historic patterns, and supplement it with additional modules to forecast new and more aggressive demand growth. For example, the electrification of transport, heating and industry is likely to increase electricity demand significantly.

We also commissioned a report by AFRY Management Consulting to review the best practice and learnings from comparative jurisdictions in preparing and publishing Distribution Network Development Plans.

Our network investment plan supports the delivery of key national and EU policies and frameworks, such as the National Development Plan[11], the Climate Action Plan[12] and the Housing for All programme[13]. In developing our assumptions and forecasts, we have therefore drawn on and carried out cross-checks against the targets set out in these national policy documents and external forecasts.

These include:

- **EU and National targets**, for example those set out in Climate Action Plan[12];
- **All-Island forecasts** published by EirGrid and SONI, such as Tomorrow's Energy Scenarios[14] and the All-Island Resource Adequacy Assessment[15]; and
- **Republic of Ireland-specific forecasts** produced by the SEAI[16] and ESRI[17].

Distribution Planning and Scenarios Purpose

The purpose of forecasting demand growth on distribution system and developing different scenarios is to inform distribution system planners of possible future demand requirements and different growth pace in a local area of the distribution network.
The growth rates and scenarios are not developed with the intention to inform transmission system requirements or the adequacy of the total system generation to support demand.

Distribution system planning is addressing granular localised problems, and each distribution system area could follow a different demand growth scenario. The assumption that all areas will follow the Base Scenario leading to the distribution system peak demand from Base Scenario by adding all distribution areas could be misleading. Transmission system planning is looking at issues such as the balance of supply and demand and the macro development plans of the national transmission system, so many different factors have to be considered.

ESB Networks' distribution planning is aligned alongside the strategy to deliver a Net Zero Ready Distribution Network by 2040 and Build Once for 2040 as explained in more detail in Networks for Net Zero Strategy.

When planning a reinforcement for the Distribution network the planner is concerned with multiple local factors and is less concerned with the macro issues of the transmission system. The growth scenarios enable the planner to ensure that the solution planned locally is robust to many future growth scenarios. Under Build once for 2040 concept the idea is that a solution is chosen which will provide capacity locally over the long-term. This reduces the likelihood that a second reinforcement will need to be carried out if a more conservative approach was taken in terms of future demand forecast.

The growth forecasts however are just one of multiple factors informing the planning.

We develop our network to accommodate our customers' needs. We do this using forecasts. Section 2.1 below describes the four forecast scenarios around which we have built our distribution network development plans.

Our forecasts are developed through extensive engagement with stakeholders to ensure they are regionally reflective. Peak demand and growth rates are developed for each of the 34 geographical areas shown in Figure 3. The forecasted levels up to 2040 for each of the scenarios are represented in Section 2.2.

ESB Networks regularly update growth forecasts and scenarios with data available at the time. The scenarios presented in this report were prepared in 2024. Any new data that has become available since the scenarios were prepared will be updated in the next revision of DNDP.

Figure 3 – Distribution System Geographical Areas

2.1 Scenario Overview

This section of the Summary Report and Methodology Statement presents the methodology, rationale and results of the analysis carried out to calculate peak demand and consumption growth rates for the electricity distribution system in Ireland for the period (2025-2040). The results presented herein are an update of the original calculations presented in the Distribution Network Capacity Pathways Report[18] which were also used in the Network Capacity Headroom Report 2024[5].

ESB Networks developed several scenarios for growth rates, with specific assumptions underpinned by CAP, Project Ireland 2040, ESRI housing scenarios, AFIR and CSO data. Each scenario is modified to consider different roll out of specific targets (e.g. electrification of transport and heat). However, they all meet and deliver our strategic goal of net zero distribution network by 2040.

Forecast analysis for all scenarios is split into following assessments: baseline demand, electrification of transport, electrification of heat, large and extra-large energy users, and distributed energy resources and flexibility.

All scenarios are modelled using regional data, extensive stakeholder engagement and connection pipelines.

Key assumptions characterising each of the scenarios are described as follows.

Base Scenario
This scenario meets the CAP[12] targets and takes a more realistic approach to data centre growth in Ireland.

- **Baseline** residential demand grows in line with base housing projections from ESRI[17]. Baseline commercial and industrial demand growth follows historical growth rates. Time of Use (ToU) tariffs penetration continues observed growth.
- **EV deployment** follows CAP 2024[12] targets. Electrification continues linearly post 2030. Number of chargers required to be built each year to meet peak load base case scenario for passenger EVs (19,000 chargers by 2030). 100% bus electrification by 2035. 10% of Zero Electric HGV (ZEHGV) target met by 2030, 25% met by 2040. 41% smart charging penetration by 2030, 85% by 2040 in line with residential ToU tariff penetration.
- **Residential heat** follows CAP 2024 targets[12]. 10% of district heat target of 2.7 TWh met by heat pumps. **Commercial heat** reaches target of 50,000 commercial buildings with heat pumps by 2030. 100% of new public buildings, 50% of new agricultural buildings and 75% of new commercial buildings fit heat pumps. **Industrial heat** targets designed to reach CAP[12] emissions abatement of 1.2 Mt CO2 for 2030. 14% electrification of low-grade heat by 2025 (out of heat that is electrifiable) and 26% low-grade heat electrification by 2030 (out of heat that is electrifiable).
- **Large and extra-large energy users:** No new data centres are connected by 2030. DART develops as is laid out by the Department of Transport / Iarnród Éireann in Ireland. All other extra large customers show no individual load growth by 2030.
- **Flexibility and Distributed Energy Resources:** 2.7 GW of solar on the distribution system is matched with 1080 MW of battery storage. Additional Demand Side Response (DSR) assumed to achieve 11.2% reduction in peak demand from unabated levels.

Conservative Scenario

This scenario takes a more conservative approach to electrification of heat and transport.

- **Baseline** residential demand grows in line with conservative housing projections from ESRI[17]. Baseline commercial and industrial demand growth follows historical growth rates. Time of Use (ToU) tariffs penetration doubles from observed growth.
- **EV deployment** in Ireland follows the track of EV deployment in Norway (631,000 EVs by 2030). Number of chargers required to be built each year to meet peak load base case scenario for passenger EVs (19,000 chargers by 2030). Only 1,200 e-buses deployed by 2030. 100% bus electrification by 2035. All ZEHGV targets to be met by alternative fuels. 75% smart charging penetration by 2030, 100% in 2040 in line with residential ToU tariff penetration.
- **Residential heat:** All available subsidies removed. 0% of district heat target met by heat pumps. **Commercial heat:** 100% of new public buildings, 50% of new agricultural buildings and 75% of new commercial buildings fit heat pumps. **Industrial heat** 5% of high-grade and low-grade heat is electrified by 2030. The remaining fossil fuel powered industrial heat appliances are replaced with hydrogen and biomass appliances in order to reach CAP[12] emission abatement targets.
- **Large and extra-large energy users:** No new data centres are connected by 2030. DART develops as is laid out by the Department of Transport / Iarnród Éireann in Ireland. All other extra large customers show no individual load growth by 2030.
- **Flexibility and Distributed Energy Resources:** 2.7 GW of solar on the distribution system is matched with 1080 MW of battery storage. No Demand Side Response (DSR) assumed.

Aggressive Scenario

This scenario takes more aggressive assumptions for electrification of heat and no consideration of constraint areas for large and extra-large energy users.

- **Baseline** residential demand grows in line with aggressive housing projections from ESRI[17]. Baseline commercial and industrial demand growth follows historical growth rates. Time of Use (ToU) tariffs penetration remains static from 2024 levels.
- **EV deployment** follows CAP 2024[12] targets. Electrification continues linearly post 2030. Number of chargers required to be built each year to meet EC suggestion of 10 EVs / charger (94,000 chargers by 2030). 2,000 e-buses deployed by 2030. 100% bus electrification by 2035. 100% of HGVs electrified by 2040. 17% smart charging penetration by both 2030 and 2040 in line with residential ToU tariff penetration.
- **Residential heat** follows CAP 2024[12] targets. 100% of new builds fitted with heat pumps by 2024. 90% of district heat target met by heat pumps by 2030. **Commercial heat** reaches target of 50,000 commercial buildings with heat pumps by 2030. 100% of new public buildings, new agricultural buildings and new commercial buildings fit heat pumps. **Industrial heat:** 35% low-grade heat electrification and 64% high-grade heat electrification by 2025 (out of heat that is electrifiable), 55% low-grade heat electrification and 88% high-grade heat electrification by 2030 (out of heat that is electrifiable).

- **Large and extra-large energy users:** No consideration of constraint areas. New data centres connections based on the applications in the queue at the time of the CRU direction in 2021[19]. DART develops as is laid out by the Department of Transport / Iarnród Éireann in Ireland. All other extra large customers show no individual load growth by 2030.
- **Flexibility and Distributed Energy Resources:** 2.7 GW of solar on the distribution system is matched with 1080 MW of battery storage. No Demand Side Response (DSR) assumed.

Best-View Scenario

This scenario uses a mixture of assumptions from the three previously aforementioned scenarios in order to create one that represents the most likely growth path going forward. Given uncertainty around targets for industrial heat electrification and the required subsidies needed to achieve heat pump goals the best view generally takes the approach of what is most likely to be achieved for each demand component.

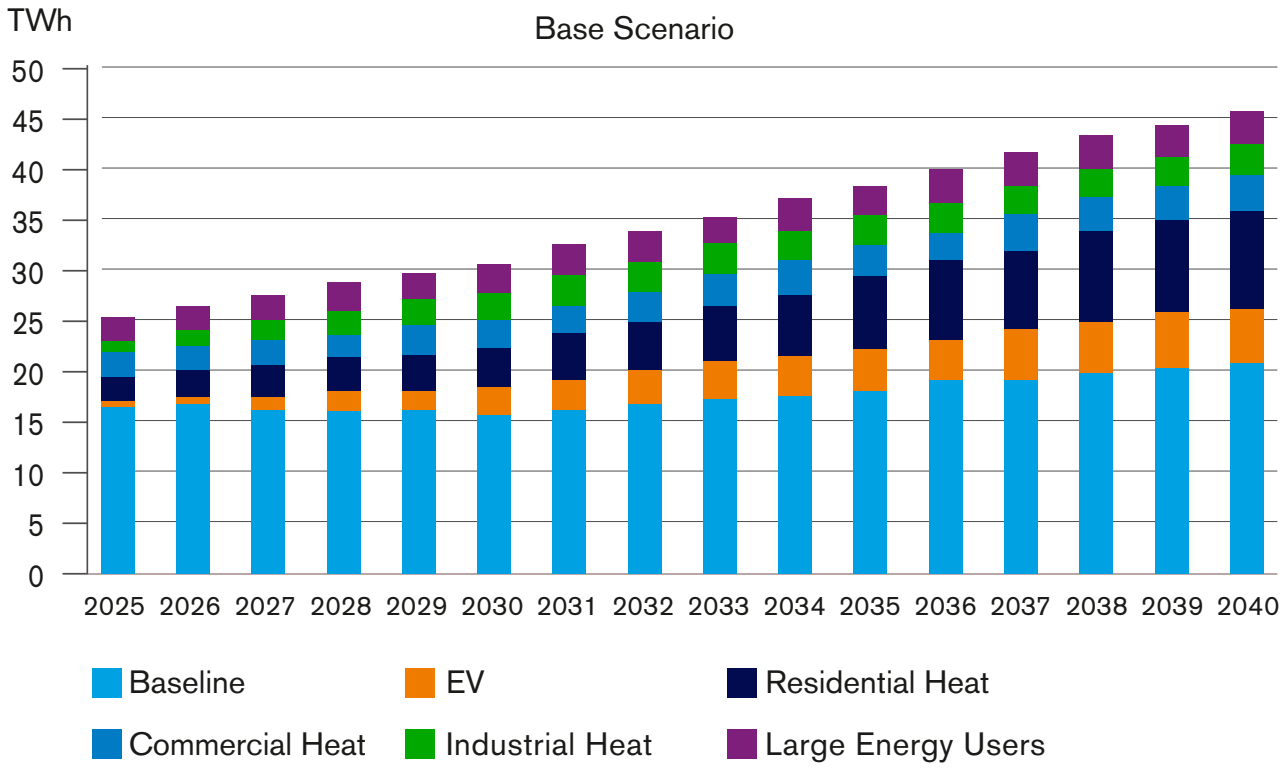
- **Baseline** residential demand grows in line with base housing projections from ESRI[17]. Baseline commercial and industrial demand growth follows historical growth rates. Time of Use (ToU) tariffs penetration continues observed growth.
- **EV deployment** in Ireland follows the track of EV deployment in Norway (631,000 EVs by 2030). Number of chargers required to be built each year to meet peak load base case scenario for passenger EVs (19,000 chargers by 2030). 100% bus electrification by 2035. 10% of Zero Electric HGV (ZEHGV) target met by 2030, 25% met by 2040. 41% smart charging penetration by 2030, 85% by 2040 in line with residential ToU tariff penetration.
- **Residential heat** 90% of new builds fit with heat pump. **Commercial heat** reaches target of 50,000 commercial buildings with heat pumps by 2030. 100% of new public buildings, 50% of new agricultural buildings and 75% of new commercial buildings fit heat pumps. **Industrial heat:** No Industrial heat electrification by 2030, 5% electrification by 2040.
- **Large and extra-large energy users:** No new data centres are connected by 2030. DART develops as is laid out by the Department of Transport / Iarnród Éireann in Ireland. All other extra large customers show no individual load growth by 2030.
- **Flexibility and Distributed Energy Resources:** 2.7 GW of solar on the distribution system is matched with 1080 MW of battery storage. No Demand Side Response (DSR) assumed.

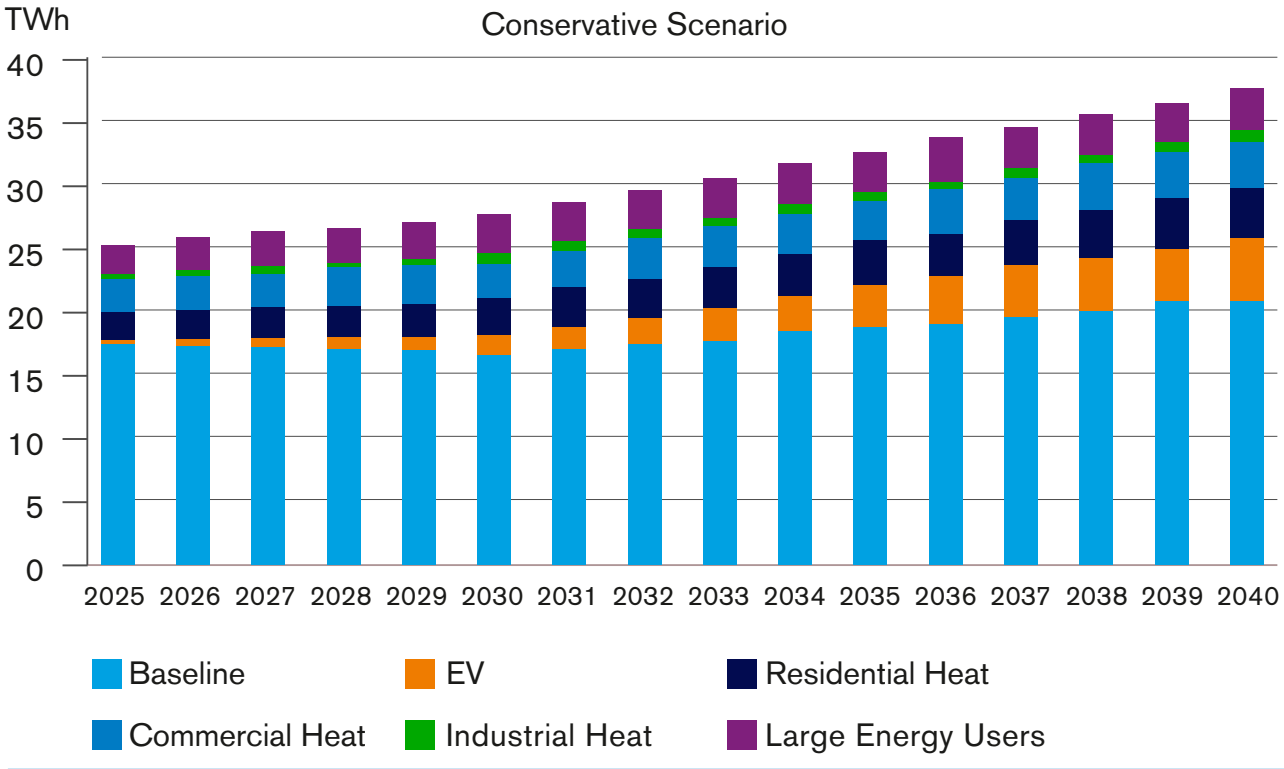
2.2. Distribution System Demand

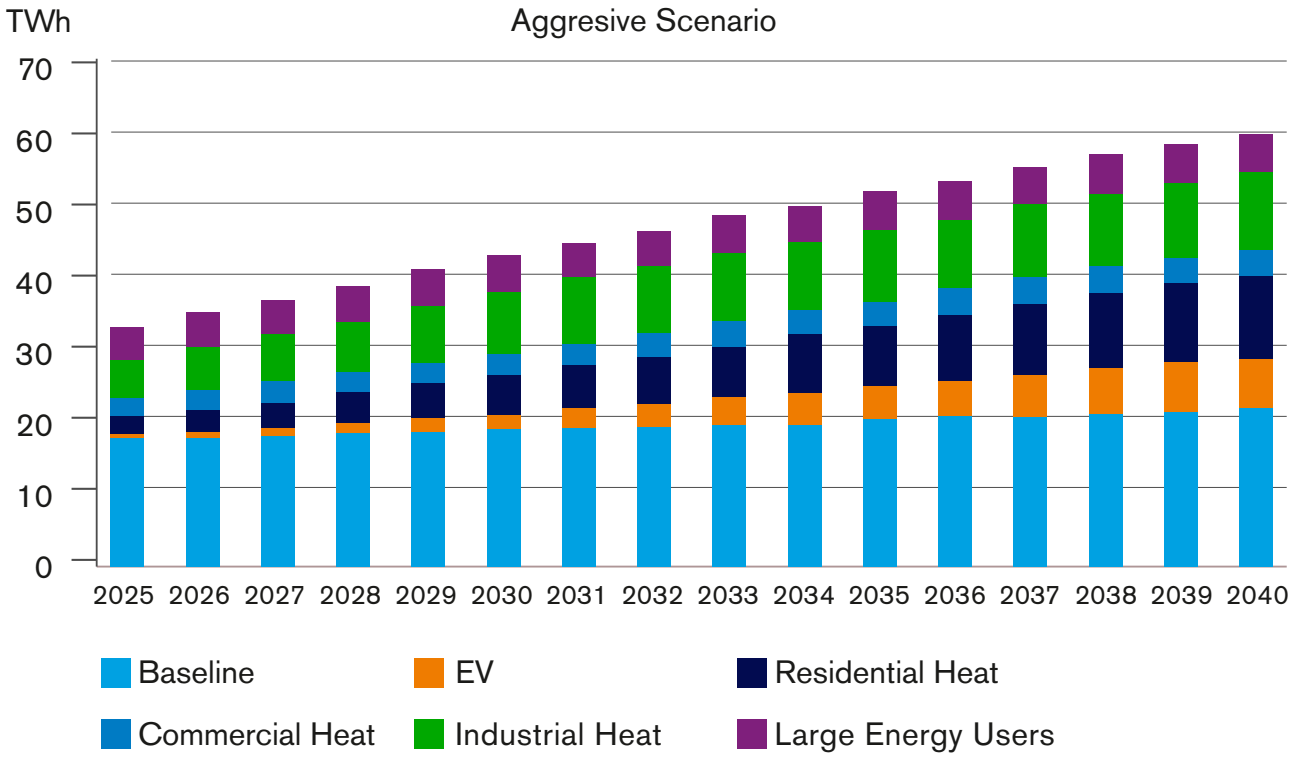
Total Distribution System Consumption

Total distribution system consumption up to 2040 for each of the four scenarios as described in Section 2.1 is shown in Figure 4.

Figure 4 – Total distribution system consumption for four scenarios






TWh
Aggresive Scenario
70
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10
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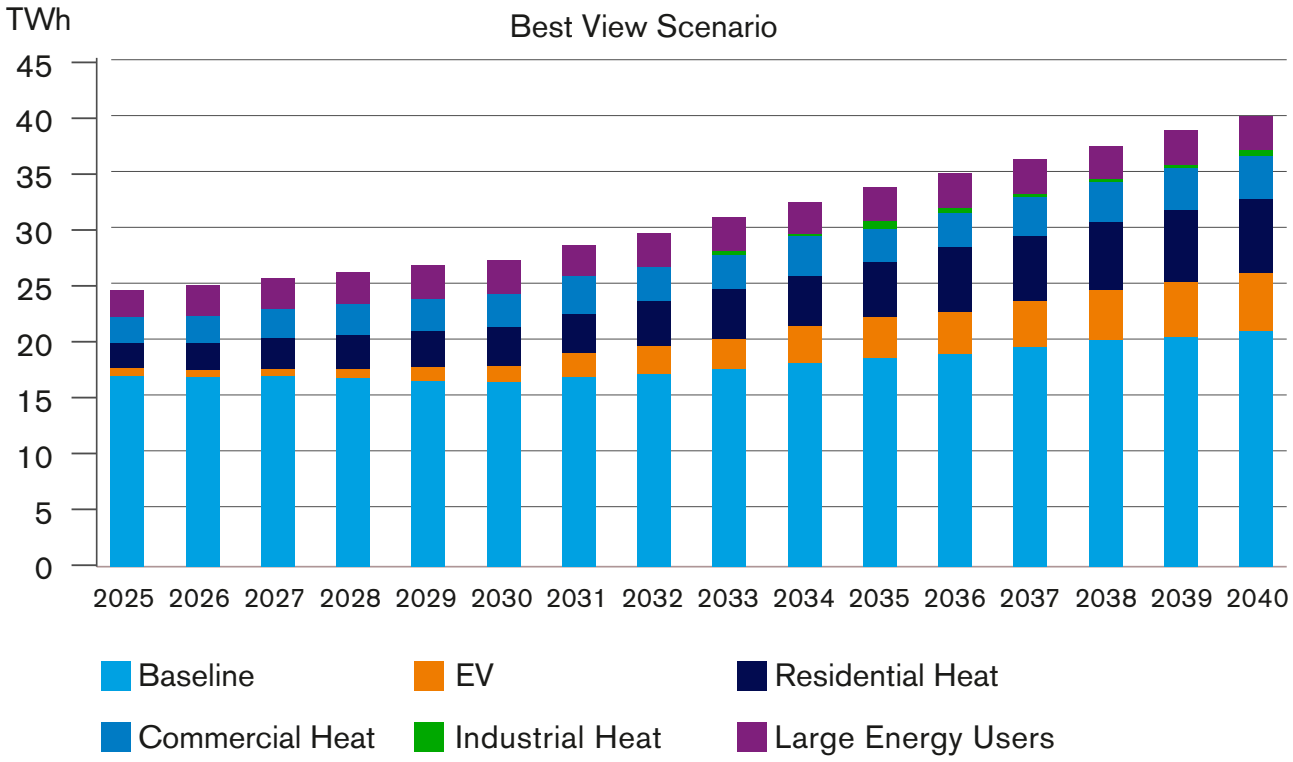
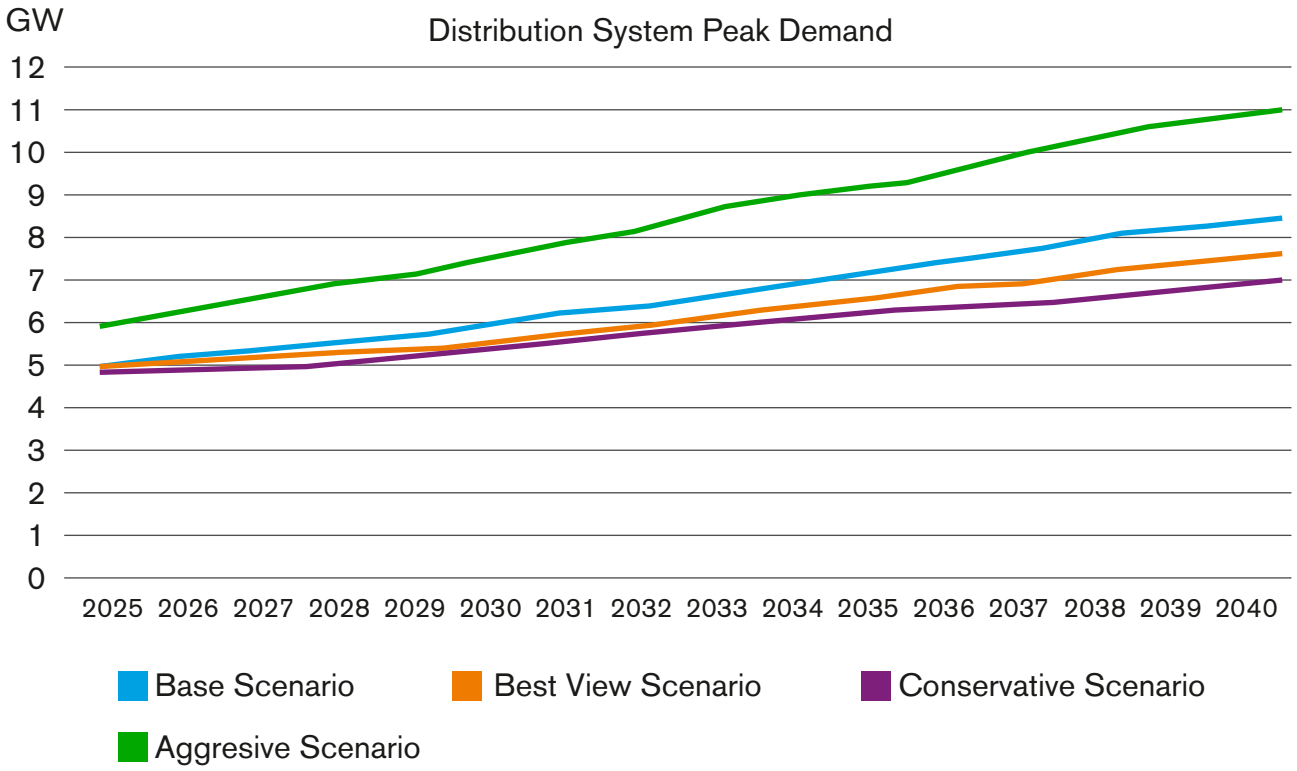
2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
Baseline
EV
Residential Heat
Commercial Heat
Industrial Heat
Large Energy Users


TWh
Best View Scenario
45
40
35
30
25
20
15
10
5
0
2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
Baseline
EV
Residential Heat
Commercial Heat
Industrial Heat
Large Energy Users

Distribution System Peak Demand

Total distribution system peak demand, including losses, for four scenarios is shown in Figure 5.

Figure 5 – Total distribution system peak demand (including losses)



Distribution system peak demand (MW), including distribution system losses assumed at 7%, for each geographical area in 2030 is presented in Table 1.

Table 1 - Distribution system peak demand (MW), including distribution system losses, for each geographical area in 2030

	Base Scenario	Conservative Scenario	Aggressive Scenario	Best View Scenario
Arklow	106	97	118	100
Athlone	126	109	159	114
Ballina	75	67	101	71
Bandon	130	116	165	117
Castlebar	74	65	105	69
Cavan	167	152	205	157
Clonmel	108	100	132	101
Cork City	258	230	327	232
Drogheda	130	113	160	116
Dublin Central	492	453	646	465
Dublin North	1,085	1,020	1,513	1,039
Dublin South	619	578	804	592
Dundalk	109	95	130	97
Dunmanway	89	79	112	80
Ennis	126	111	172	112
Enniscorthy	143	129	161	137
Fermoy	157	140	198	141
Galway	148	134	178	139
Kilkenny	122	115	139	119
Killarney	115	105	133	107
Killybegs	77	70	90	75
Letterkenny	117	107	136	116
Limerick	141	129	176	130
Longford	94	84	109	90
Mullingar	115	93	154	95
Newcastlewest	106	98	129	98
Portlaoise	119	110	138	114
Roscrea	109	98	135	101
Sligo	139	122	171	128
Thurles	103	94	126	96
Tralee	107	98	121	104
Tuam	104	93	131	97
Tullamore	122	112	146	116
Waterford	128	121	151	123
National	5,920	5,434	7,539	5,548

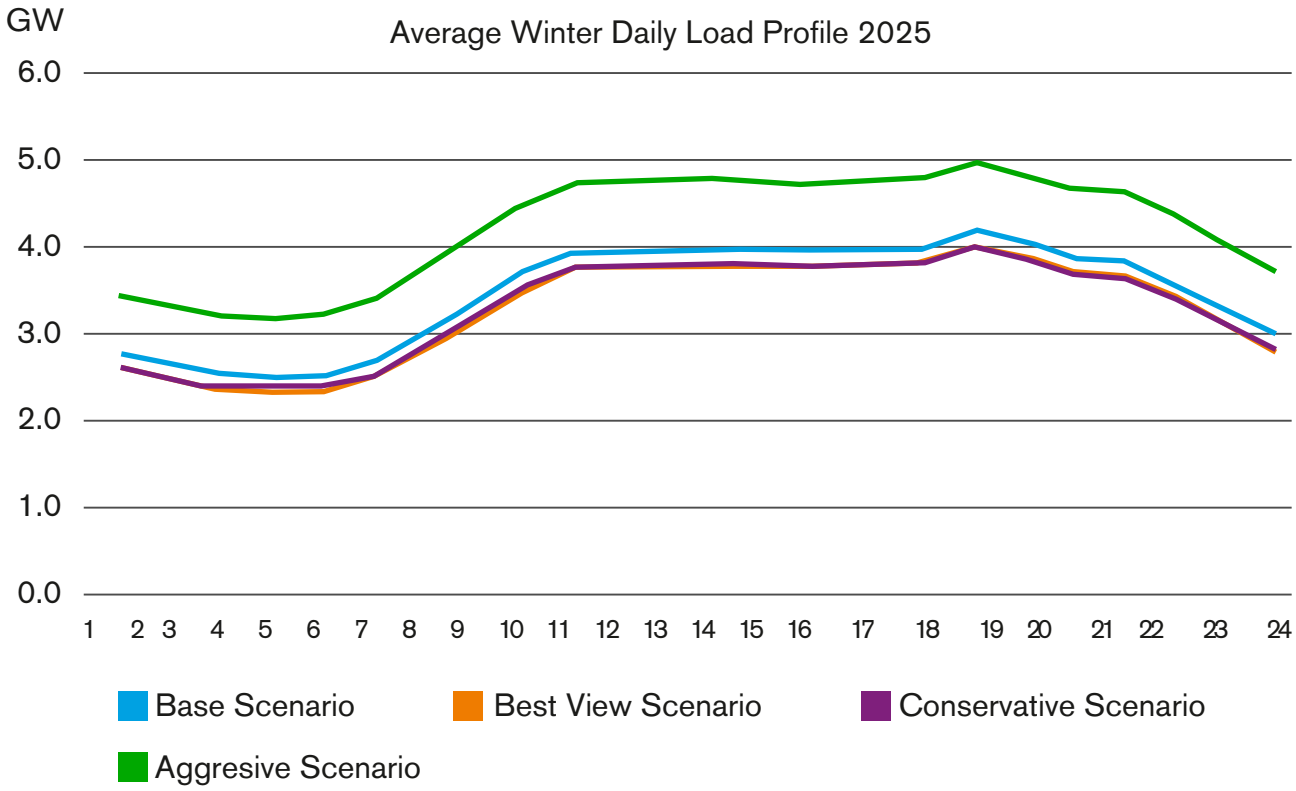
Growth rates for each geographical area for the period 2025 – 2030, for all four scenarios, are presented in Table 2.

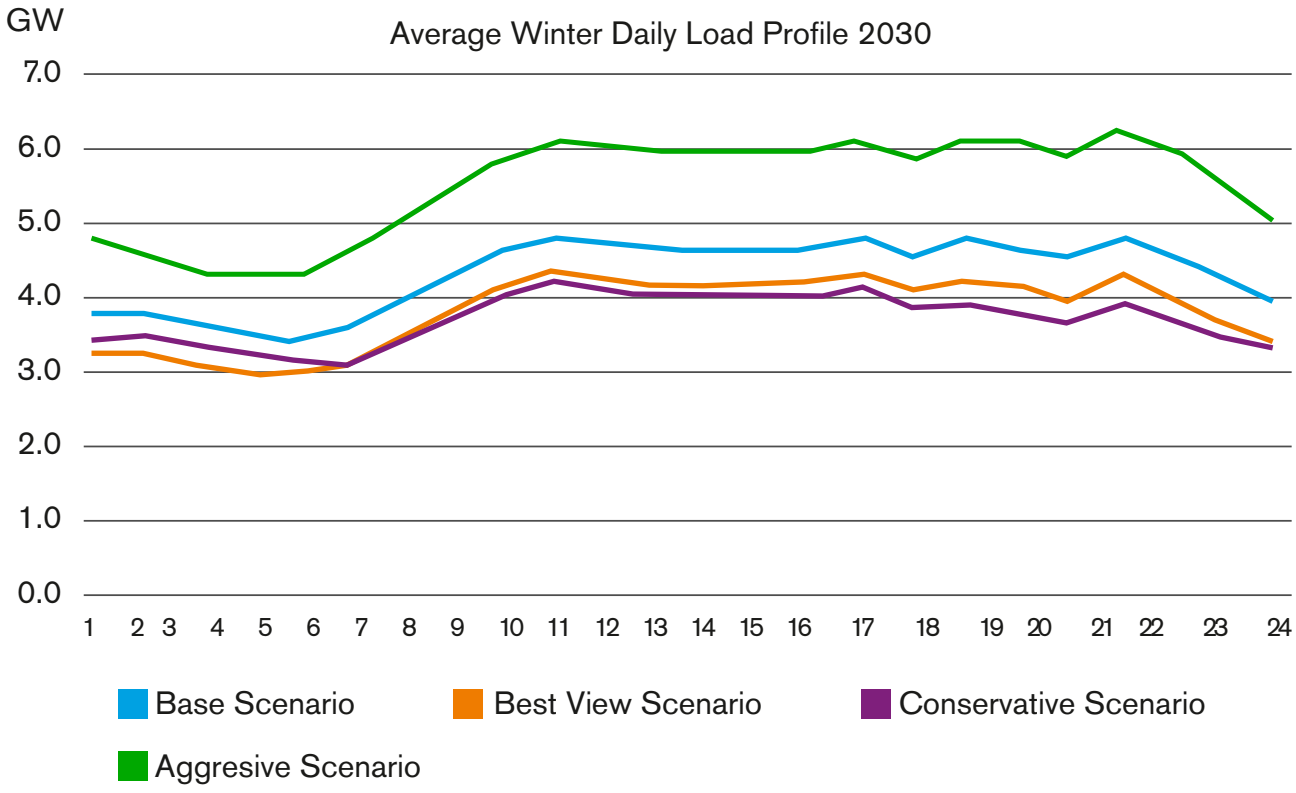
Table 2 - Distribution system peak demand growth rates for each geographical area for the period 2025 – 2030

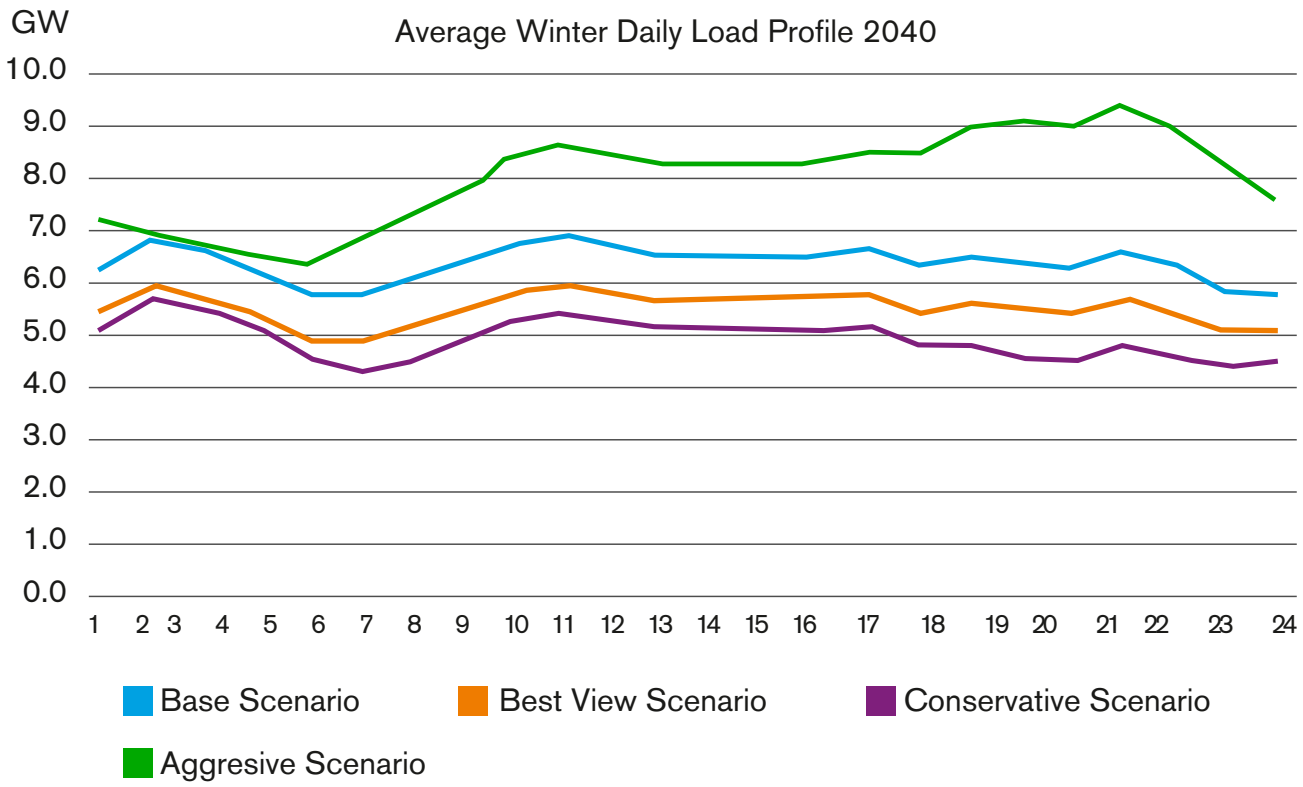
	Base Scenario	Conservative Scenario	Aggressive Scenario	Best View Scenario
Arklow	3.3%	2.0%	4.4%	2.6%
Athlone	3.4%	1.5%	5.2%	2.4%
Ballina	2.5%	0.8%	4.8%	1.9%
Bandon	3.7%	2.5%	5.1%	2.7%
Castlebar	2.4%	0.7%	4.9%	1.7%
Cavan	3.2%	2.0%	4.9%	2.5%
Clonmel	2.9%	2.0%	4.6%	2.2%
Cork City	3.7%	2.5%	5.1%	2.7%
Drogheda	3.9%	2.3%	5.3%	2.8%
Dublin Central	4.2%	3.1%	7.1%	3.6%
Dublin North	4.6%	3.8%	5.7%	4.2%
Dublin South	4.0%	3.1%	5.8%	3.5%
Dundalk	4.0%	2.5%	5.4%	2.7%
Dunmanway	3.7%	2.5%	5.1%	2.7%
Ennis	3.4%	2.0%	6.0%	2.2%
Enniscorthy	2.9%	1.3%	4.6%	2.4%
Fermoy	3.6%	2.5%	5.1%	2.7%
Galway	3.0%	1.9%	4.7%	2.4%
Kilkenny	2.6%	1.8%	4.3%	2.2%
Killarney	3.0%	1.7%	4.3%	2.1%
Killybegs	2.6%	1.1%	4.0%	2.3%
Letterkenny	2.6%	1.0%	3.9%	2.3%
Limerick	3.1%	2.2%	5.0%	2.3%
Longford	2.7%	1.2%	4.4%	2.3%
Mullingar	4.1%	1.6%	5.7%	2.1%
Newcastlewest	3.1%	2.3%	4.8%	2.4%
Portlaoise	2.9%	2.0%	4.7%	2.4%
Roscrea	3.0%	1.8%	4.8%	2.2%
Sligo	3.1%	1.4%	4.8%	2.3%
Thurles	3.0%	1.9%	4.8%	2.3%
Tralee	2.7%	1.4%	4.3%	2.4%
Tuam	2.8%	1.5%	4.8%	2.2%
Tullamore	3.2%	2.1%	4.1%	2.7%
Waterford	2.7%	2.1%	4.3%	2.3%
National	3.6%	2.6%	5.2%	3.0%

Average winter daily load profile for distribution system for 2025, 2030 and 2040 is shown in Figure 6.

Figure 6







Comparison against external sources

In this section, we provide a comparison of our demand forecasts against other Distribution System Operators (DSOs).

The comparable forecast period for UK DSOs is the RIIO-ED2 period (2023-2028). Each of the UK DSOs release a business plan in accordance with this forecast period with corresponding electricity peak demand forecasts. Whilst these plans discuss the analysis conducted for RIIO-ED2, not all publish growth rates. The following paragraphs outline the growth rates which are published.

Scottish Power forecast a CAGR of 2.44% for the RIIO-ED2 period. The forecast considers domestic, industrial, and commercial electricity use, heat pump penetration, electric vehicle penetration, and district heating.

Western Power forecast a CAGR of 3.37% for the RIIO-ED2 period. The forecast includes baseline electricity consumption growth (for residential, commercial, and industrial users), heat pump penetration, electric vehicle penetration, and demand side flexibility.

Northern Powergrid forecast a CAGR of 1.98% for the least aggressive scenario and 3.98% for the most aggressive scenario. The forecasts consider EV penetration, heat pump penetration, demand side flexibility, and baseline electricity growth for domestic, industrial, and commercial customers.

Scottish and Southern Power forecast a CAGR of 4.98%. The forecast considers EV penetration, heat pump penetration, data centre development, solar PV microgen and minigen, and baseline residential, commercial, and industrial heat electricity growth.

A common theme amongst the DSOs in the UK is that industrial heat electrification is not considered in the forecasts. Northern Powergrid discuss in their business plan that they expect industrial heat to decarbonise via hydrogen (particularly benefited from the fact that Teesside in Northeast England is set to become a large hydrogen hub in the forecast year). Unlike Ireland, the UK does not have specific industrial heat electrification targets.

2.3. Distribution System Generation

Ireland must significantly increase RES-E connections to the electricity network and integrate a substantial number of LCTs by 2040 to decarbonise the energy, transport, and heating sectors. A share of those renewables will be connected directly to the distribution system.

Whilst small scale distributed energy resources, such as rooftop solar, are included in our forecast scenarios described in Section 2.1, the utility scale generation is processed through a regulated Enduring Connection Policy (ECP) process. Distribution system reinforcements required to connect these generators are assessed on the project-by-project basis.

Renewable Hubs[20] are an initiative that is being progressed as part of ESB Networks' Networks for Net Zero Strategy[1]. These are projects where capacity will be created based on the known pipeline of wind/solar projects with planning permission or in the planning process. Five renewable hubs have been developed in collaboration with industry stakeholders including the Transmission System Operator (TSO), Department of Climate, Energy and the Environment (DCEE), Commission for Regulation of Utilities (CRU) and the renewables industry.

Key benefits of the renewable hubs include:

- Facilitating more community projects connecting to the grid
- Connecting more renewables in an optimal manner
- Providing enhanced certainty to industry
- Reducing barriers to entry for renewable generators as generators who connect through a renewable hub will be charged on a per MW basis

3. Network Assessments

The DNDP uses forecasts to analyse and identify future network requirements. Over the coming years, the electricity distribution network must support a step change in the amount of renewable generation connected to the distribution network, and meet significantly increased demand from customers across all sectors resulting from the electrification of heat, transport, and industry. This will require considerable investment and will in turn serve to fundamentally transform the ability of the electricity system to empower and enable Ireland to reach net zero. There has been a significant increase in the quantity and scale of connection applications for both demand and generation to the distribution system over the last 2-3 years.

In this section, we have outlined our approach to assessing the capacity of the existing network to accommodate this level of growth, including our assessment of where, when and how much capacity will be needed in the future. In addition to simply increasing network capacity, we will also need to fully understand the impact of energy decarbonisation on the distribution system. This will require enhanced modelling capability.

By the end of 2025, we will have the ability to combine our high voltage (distribution 110 kV and 38 kV network) and medium voltage network models, enabling us to analyse all network between the low-voltage network and transmission network using a single model. This will enhance our ability to aggregate demand, including the effects of demand diversity at any point in the network, and accelerate the analysis required to develop investment plans. The combined model will also allow us to automate evaluation of multiple scenarios, providing the ability to assess distribution network capacity on a timed/flexible connection basis for the first time.

To determine distribution network reinforcement needs, we undertook the following assessments.

- Determination of demand growth rate forecasts for the area. Growth rates and scenarios are just one of many inputs to the planning process. They give a useful set of possible future network demand needs.
- Review of HV network and HV station peak demand figures (Special Load Reading) over the previous three-year period.
- Review of HV substation transformer Load Index (LI) rating. Each HV substation is assigned a rank from LI1 to LI5, where LI5 indicates the most heavily loaded stations. Each substation also has assigned risk points. This metric indicates substations that are most heavily loaded and with the highest number of customers connected.
- Review of HV substation asset age and condition.
- Assessment of major new customer applications; new demand loads seeking connection in the local area such as DART+, EV superchargers, large housing developments, ports, industry, dairy plants etc.
- Review of HV network operations under both normal and fault/outage scenarios.
- Completion of steady state power system analysis of the distribution network under both normal and fault/outage scenarios. These studies determine constraints on the network whereby network infrastructure becomes non-compliant with the standards specified in DSSPS[7].
- Once a project to develop a new HV substation is identified, it will provide a step change in local capacity and so the solution is robust for multiple growth rates at that location.

Ensuring alignment with ESB Networks' strategy[1] and 'Build Once for 2040 policy' is also a critical part of the process to ensure that the distribution network and supporting services such as demand management are designed and developed to meet the anticipated needs of customers in 2040.

Load Indices Definition

Load indices were developed by Ofgem, the UK energy regulator, to objectively measure the capacity utilisation of network assets and how close they are to maximum capacity. A scale of 1 - 5 is used. LI5 rating means that assets (e.g. transformers or substations) have reached full capacity and mitigation measures are required. LI4 means that substations are fully utilised, and mitigation should be considered. Whilst LIs are typically calculated on an annual basis, tracking changes in LIs over time can also provide a useful overview of asset loading status. For example, a rising LI indicates growing load and higher loading of assets. The outcomes can be used to provide an overview of network performance and be used to assist in prioritisation of investments or targeting of specific projects for delivery.

The definition of the different categories of LIs applicable to ESB Networks are outlined in the table below.

LI ranking	Definition
LI1	Significant spare capacity
LI2	Adequate spare capacity
LI3	Highly utilised
LI4	Fully utilised, mitigation requires consideration
LI5	Fully utilised, mitigation required

4. Investment Appraisal

Following the network assessments and identification of network constraints in each area, an Investment Appraisal (IA) is completed to determine the optimum network reinforcement to be carried out in the area.

The IA examines different distribution system reinforcement options, from both a technical and costs perspective and identifies the optimum solution.

Potential reinforcement options are evaluated to determine which solution best meets the network requirements over both the long-term and short-term time periods.

Related network issues such as asset age and condition, kW losses, HV substation load indices, security of supply standards, network operations, large customer connections and the loadings on the adjacent substations or networks are also considered.

Typical options for reinforcements include uprating the existing plant (transformers, underground cables and overhead lines) or construction of new HV network assets.

A "Build Once for 2040" approach is taken to ensure that network solutions implemented now are adequate to meet the needs of customers in 2040.

This project evaluation process is summarised in the Investment Appraisal document which identifies the preferred network solution (intervention) project to be progressed.

5. Flexibility Needs

Identification of Flexible Services Needs

The flexible services needs identified were based on available capacity and load on the distribution system only. In parts of the country - in particular in Dublin - capacity is further constrained based on transmission system constraints. In such areas, the flexible services identified may not fully address challenges with the connection of new demand. Consideration on this issue will be further explored as part of the Flexible Needs Assessment work to be initially published in Q3 2026.

To identify flexible services needs* for each area, we follow the process described below:

- We identify locations where there is a shortfall in station transformer capacity to accommodate customer needs.
- We identify which of these locations have a capital reinforcement project which has already been identified for delivery in the next price review period (PR6 in this case), but where the estimated timeline for delivery of reinforcement project is not aligned with the estimated need.
- Once the locations above have been identified the following steps are taken
  - *The previous full year load profile is assessed.*
  - *Growth in the area is applied to a full load profile.*
  - *The MW need is equal to the largest shortfall (between demand and capacity) over the course of the year.*
  - *The MWh need is based on anytime over the course of the full year when demand exceeds capacity.*

Other points of note

- The flexible needs assessment typically does not include new demand (only growth of the existing demand is included). However, in some locations, most notably Dublin, where there is significant new demand contracted but not yet connected, additional contracted demand is also considered.
- Where new demand (contracted but not yet connected) is considered this is referenced within the Zone Summary** in DNDR[4].
- There are places across the country where there is a shortfall in capacity, but capital reinforcement projects have not been identified for delivery in PR6. In these locations, an estimate of the flexible services need is calculated using the recently published Network Scenario Headroom Report[5].
- While the need for flexibility will vary depending on location, it is generally expected that flexibility will be required during the winter period (October-March) and the peak hours of 4pm to 8pm. Where the need at the location is expected to be for different delivery periods, this will be stated in the zone summary in DNDR[4].
- The outcome of this analysis is not intended to represent a procurement plan for flexible services.

* *Flexible services needs are based on MW and MWh need and based on normal feeding arrangements. For the purpose of this document flexible needs are assessed to address demand shortfalls only*

** *For future new load enquiries, it may be possible to meet from the provision of flexible services, or from new customers entering into flexible connection agreements for a period of time.*

6. DNDP Part 2 – Distribution Network Development Report

Sections 2-4 of this document describe how we applied our forecast, carried out network assessments and examined various options to deliver additional distribution network capacity. Distribution Network Development Report[4] (DNDR) provides detailed information on investment projects in each distribution network area that will add capacity.

While the investment projects detailed in the DNDR[4] will deliver vast majority of the additional network capacity needed, the DNDP requires that all interventions to increase capacity are included in the report. We have therefore included investments that drive down losses, and asset replacement investments which also enhance network capacity, even though this isn't the primary reason for investment.

Table 3 indicates the HV project types that are referenced in the DNDR[5].

Driver	Description
Substation Capacity	These projects refer to the construction of a new HV substation or the addition of transformer capacity to an existing HV substation.
Circuit Capacity	These projects refer to the construction of a new HV line/cable or the uprating of an existing line/cable with higher capacity conductor.
Substation Capacity (Renewable Hubs)	Renewable Hubs are HV substations where additional capacity is being added to facilitate connection of a number of renewable generators.
Security of Supply	These projects will improve security of supply by adding new circuits or transformers to improve network reliability under fault or maintenance outages.
Asset Replacement (HV Substations)	These projects will replace aging assets such as switchgear or transformers within HV substation that have reached 'end of life'
Asset Replacement (Underground cables)	These projects involve the replacement of aging underground cables that have reached 'end of life'. Typically, when cables are replaced, the new cable has a higher capacity than the existing cable.
Asset Replacement (Overhead lines)	These projects involve the refurbishment of a 38 kV overhead line and will typically include replacing conductor with higher capacity conductor where appropriate.
Short Circuit Level	Upgrade kA rating of switchgear to maintain adequate short-circuit levels on the system.

7. DNDP Part 3 – Network Scenario Headroom Report

The Network Scenario Headroom Report[5] (NSHR) consists of two capacity workbooks - one for demand and one for generation on the distribution system. The capacity workbooks project the future headroom capacity at stations based on different growth rate scenarios as described in Section 2.

Capacity workbooks[5] provide indicative "headroom" capacity available for new demand and generation connections at existing 110 kV and 38 kV substations. Forecasts are produced for every year up to 2030, and for every five years after that out to 2050. The workbooks indicate the spare or “headroom” capacity available at a station under the four different growth rate scenarios. Please note that the information provided is indicative. There can be upstream network limitations on high-voltage (HV) feeders and transmission system feeders that will limit capacity at local substations.

In order to secure capacity for a new connection, customers are advised to follow the new connection application process available on the ESB Networks website www.esbnetworks.ie.

Version 1.0 of the capacity workbooks include reinforcement projects that are planned for the Price Review 5 (PR5) period. The workbooks indicate the spare or “headroom” capacity available at a station under four different growth rate scenarios. The results presented in Version 1.0 of the capacity workbooks[5] are based on the original growth rates scenario calculations presented in the Distribution Network Capacity Pathways Report[18].

Version 2.0 of the capacity workbooks will be released by the end of 2025 and will include reinforcement projects planned for the PR6 period (2025 – 2030). These projects will address many of the emerging capacity constraints. The results presented in Version 2.0 of the capacity workbooks will be an update of the original calculations and will be based on four growth rate scenarios as described in Section 2 of this report.

8. Glossary

Abbreviation	Meaning
AFIR	Alternative Fuels Infrastructure Regulation
BSP	Bulk Supply Point
CAP	Climate Action Plan
CRU	Commission for the Regulation of Utilities
DAO	Distribution Asset Owner
DART	Dublin Area Rapid Transit
DCEE	Department of Climate, Energy and the Environment
DER	Distributed Energy Resources
DG	Distributed Generator
DNDP	Distribution Network Development Plan
DNDR	Distribution Network Development Report
DSO	Distribution System Operator
DSR	Demand Side Response
ECP	Enduring Connection Policy
ESRI	The Economic and Social Research Institute
EU	European Union
EV	Electric Vehicle
GW	Gigawatt (1GW = 1,000,000,000 watts)
GWh	Gigawatt-Hour
HP	Heat Pump
HV	High Voltage
kV	Kilovolt
kVA	Kilovolt-Amperes
kWh	Kilowatt-Hour
LCT	Low Carbon Technology
LV	Low Voltage

Abbreviation	Meaning
MV	Medium Voltage
MVA	Megavolt-Amperes
MW	Megawatt (1MW = 1,000,000 watts)
NSHR	Network Scenario Headroom Report
PR6	Price Review 6
PV	Photovoltaic
RES	Renewable Energy Sources
RESS	Renewable Energy Support Scheme
SSG	Small-Scale Generation
TAO	Transmission Asset Owner
TSO	Transmission System Operator
TWH	Terawatt-Hour
V	Volt

9. References

1. ESB Networks' Networks for Net Zero Strategy
2. The Clean Energy Package
3. Directive - 2019/944 - EN - EUR-Lex
4. DNDP, Part 2: Distribution Network Development Report
5. DNDP, Part 3: Network Scenario Headroom Report
6. ESB Networks Price Review 6 Business Plan Business Plan
7. Distribution System Security and Planning Standards
8. Capacity Heatmaps
9. Community Toolkit
10. Generation Minimum Cost Calculator
11. National Development Plan
12. Climate Action Plan 2024
13. Housing for All
14. Tomorrow's Energy Scenarios (TES)
15. AIRAA 2025-2034 Inputs and Assumptions - Ireland.pdf
16. National-Energy-Projections-Report-2024.pdf
17. Population projections, the flow of new households and structural housing demand | ESRI
18. Distribution Network Capacity Pathways Report
19. CRU21124-CRU-Direction-to-the-System-Operators-related-to-Data-Centre-grid-connection-.pdf
20. Commission for Regulation of Utilities, Renewable Hubs pilot

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