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Comparative Analysis of Electricity Distribution Network Investment Plans in the UK and Spain: Recommendations for the Spanish case

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Comparative Analysis of Electricity Distribution Network Investment Plans in the UK and Spain: Recommendations for the Spanish case

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Project Summary

Keywords: Regulation, Distribution Networks, Investment Plans, Comparative Analysis, United Kingdom, Spain

1. Introduction

The operation of electrical distribution networks ensures a constant energy supply and meets growing demand. The regulatory frameworks governing these networks play a significant role in shaping their performance and investment strategies. This final degree project (TFG) aims to conduct a comparative analysis of investment plans in electricity distribution networks in the UK and Spain, proposing practical recommendations to improve investment strategies in the Spanish context. The motivation for this study arises from the urgent need to modernize electrical distribution networks to enhance their efficiency, sustainability, and resilience in the face of increasing demand and the integration of renewable energies.

2. Study Objectives

The primary objective of this TFG is to identify effective investment planning practices in the UK that can be adopted by Spain to optimize its investment strategies in electrical distribution networks. The specific objectives include:

- Understanding the regulatory frameworks governing electrical distribution networks in the UK and Spain.

- Comparing the methods used to justify investments in electrical distribution networks, focusing on SP Energy Networks (SPEN) in the UK and i-DE Iberdrola in Spain.
- Identifying effective investment planning practices in the UK that contribute to sustainable and efficient energy distribution.
- Developing recommendations to improve investment plans in Spain, aligning them with successful practices observed in the UK.

3. Methodology

To carry out this comparative analysis, the investment plans of SP Energy Networks (SPEN) in the UK and i-DE Iberdrola in Spain will be used as representative examples. The UK's RIIO (Revenue = Incentives + Innovation + Outputs) model, which promotes detailed and economically justified investment planning, will also be compared with Spain's traditional model, which tends to be less detailed in project justification.

4. Regulatory Framework in the UK and Spain

4.1. United Kingdom: RIIO Model

The RIIO model, implemented by Ofgem in 2013, replaces the old RPI-X model and focuses on incentivizing innovation and efficiency through performance-based regulations. This model establishes regulatory periods of eight years (RIIO-ED1) and five years (RIIO-ED2), promoting long-term planning and the adoption of new technologies. Key components of the RIIO model include regulated revenues, financial incentives, promotion of innovation, and the delivery of specific outcomes valued by consumers and society.

4.2. Spain: Traditional Model

Spain's regulatory framework for electrical distribution networks is characterized by a cost-recovery approach and less detailed investment planning. Distribution companies present annual and multi-annual investment plans, which are reviewed and approved by regulatory authorities. These plans typically include a summary of projects without detailed economic justification, which can limit the ability to make informed investment decisions.

5. Investment Justification: Comparison between the UK and Spain

5.1. United Kingdom: SP Energy Networks (SPEN)

The investment justification process in the UK, exemplified by SPEN, includes a detailed assessment of future demand, network impact analysis, constraint mitigation strategies, and stakeholder engagement. Each project is thoroughly documented in Engineering Justification Papers (EJP), which follow a standardized and transparent structure, facilitating review and approval.

5.2. Spain: i-DE Iberdrola

In contrast, i-DE Iberdrola's investment plans in Spain typically consist of a main document and detailed annexes in TXT format. These documents provide a summary of planned projects, classified by type and distributed by autonomous communities. However, they lack the detailed economic justification and risk analysis present in the UK's EJP.

6. Comparative Analysis Results

The comparative analysis reveals that the UK's RIIO model, with its focus on detailed documentation and economic justification of projects, provides a solid basis for improving investment practices in Spain. The main advantages of the RIIO model include:

- Efficiency and Profitability: Detailed planning allows for informed decisions that optimize resource allocation and ensure cost-effective solutions.
- Sustainability: Adopting sustainable investment practices significantly contributes to the integration of renewable energy sources, supporting environmental goals and reducing carbon footprint.

- Resilience and Reliability: Improved investment strategies increase the resilience and reliability of the electrical distribution network, ensuring a constant energy supply.
- Regulatory Compliance: A structured approach to investment planning facilitates compliance with national and international regulations.

7. Recommendations for Spain

Based on the findings of the comparative analysis, the following recommendations are developed to improve investment plans in Spain:

- Adoption of a Structured Approach: Implement a more detailed and structured investment planning methodology, similar to the UK's EJP.
- Promotion of Innovation: Introduce financial incentives to promote the adoption of new technologies and sustainable practices.
- Stakeholder Engagement: Improve engagement with stakeholders to ensure their needs and concerns are considered in investment planning.
- Detailed Economic Analysis: Incorporate comprehensive economic analysis and justification for each project to facilitate informed decision-making.

8. Conclusions

Implementing the best practices of the RIIO model in Spain could significantly enhance the efficiency and sustainability of electrical distribution networks. The proposed recommendations aim to ensure that Spain's investment strategies can meet future demands and support the ongoing energy transition. Modernizing electrical distribution networks is essential to maintaining economic efficiency and service quality, while simultaneously promoting innovation and sustainability.

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Análisis comparativo de los planes de inversión en redes de distribución de electricidad en el Reino Unido y España: Recomendaciones para el caso español

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Resumen del Proyecto

Palabras clave: Regulación, Redes de Distribución, Planes de Inversión, Comparativo, Reino Unido, España

1. Introducción

El funcionamiento de las redes de distribución eléctrica asegura un suministro constante de energía y satisface la creciente demanda. Los marcos regulatorios que gobiernan estas redes juegan un papel significativo en la configuración de su desempeño y estrategias de inversión. Este trabajo de fin de grado (TFG) tiene como objetivo realizar un análisis comparativo de los planes de inversión en redes de distribución de electricidad en el Reino Unido y España, proponiendo recomendaciones prácticas para mejorar las estrategias de inversión en el contexto español. La motivación de este estudio surge de la necesidad urgente de modernizar las redes de distribución eléctrica para mejorar su eficiencia, sostenibilidad y resiliencia frente a la creciente demanda y la integración de energías renovables.

2. Objetivos del Estudio

El principal objetivo de este TFG es identificar prácticas eficaces de planificación de inversiones en el Reino Unido que puedan ser adoptadas por España para optimizar sus estrategias de inversión en redes de distribución eléctrica. Los objetivos específicos incluyen:

- Comprender los marcos regulatorios que rigen las redes de distribución eléctrica en el Reino Unido y España.
- Comparar los métodos utilizados para justificar las inversiones en las redes de distribución eléctrica, enfocándose en SP Energy Networks (SPEN) en el Reino Unido y i-DE Iberdrola en España.
- Identificar prácticas eficaces de planificación de inversiones en el Reino Unido que contribuyan a una distribución de energía sostenible y eficiente.
- Desarrollar recomendaciones para mejorar los planes de inversión en España, alineándolos con las prácticas exitosas observadas en el Reino Unido.

3. Metodología

Para llevar a cabo este análisis comparativo, se utilizarán los planes de inversión de SP Energy Networks (SPEN) en el Reino Unido e i-DE Iberdrola en España como ejemplos representativos. También se comparará el modelo RIIO (Revenue = Incentives + Innovation + Outputs) del Reino Unido, que promueve una planificación de inversiones detallada y justificada económicamente, con el modelo tradicional de España, que tiende a ser menos detallado en la justificación de proyectos.

4. Marco Regulatorio en el Reino Unido y España

4.1. Reino Unido: Modelo RIIO

El modelo RIIO, implementado por Ofgem en 2013, reemplaza el antiguo modelo RPI-X y se centra en incentivar la innovación y la eficiencia a través de regulaciones basadas en el desempeño. Este modelo establece periodos regulatorios de ocho años (RIIO-ED1) y cinco años (RIIO-ED2), promoviendo la planificación a largo plazo y la adopción de nuevas tecnologías. Los componentes clave del modelo RIIO incluyen ingresos regulados, incentivos financieros, fomento de la innovación y entrega de resultados específicos valorados por los consumidores y la sociedad.

4.2. España: Modelo Tradicional

El marco regulatorio de España para las redes de distribución eléctrica se caracteriza por un enfoque de recuperación de costos y una planificación de inversiones menos detallada. Las empresas de distribución presentan planes de inversión anuales y plurianuales, que son revisados y aprobados por las autoridades reguladoras. Estos planes suelen incluir un resumen de proyectos sin una justificación económica detallada, lo que puede limitar la capacidad de hacer decisiones informadas sobre inversiones.

5. Justificación de Inversiones: Comparación entre Reino Unido y España

5.1. Reino Unido: SP Energy Networks (SPEN)

El proceso de justificación de inversiones en el Reino Unido, ejemplificado por SPEN, incluye una evaluación detallada de la demanda futura, análisis de impacto en la red, estrategias de mitigación de restricciones y compromiso con los interesados. Cada proyecto se documenta exhaustivamente en los Engineering Justification Papers (EJP), que siguen una estructura estandarizada y transparente, facilitando la revisión y aprobación.

5.2. España: i-DE Iberdrola

En contraste, los planes de inversión de i-DE Iberdrola en España suelen consistir en un documento principal y anexos detallados en formato TXT. Estos documentos proporcionan un resumen de los proyectos planificados, clasificados por tipo y distribuidos por comunidades autónomas. Sin embargo, carecen de la justificación económica detallada y el análisis de riesgo presente en los EJP del Reino Unido.

6. Resultados del Análisis Comparativo

El análisis comparativo revela que el modelo RIIO del Reino Unido, con su enfoque en la documentación detallada y justificación económica de los proyectos, proporciona una base sólida para mejorar las prácticas de inversión en España. Las principales ventajas del modelo RIIO incluyen:

- Eficiencia y Rentabilidad: La planificación detallada permite tomar decisiones informadas que optimizan la asignación de recursos y aseguran soluciones rentables.
- Sostenibilidad: La adopción de prácticas de inversión sostenibles contribuye significativamente a la integración de fuentes de energía renovable, apoyando los objetivos medioambientales y reduciendo la huella de carbono.
- Resiliencia y Confiabilidad: Las estrategias de inversión mejoradas aumentan la resiliencia y confiabilidad de la red de distribución eléctrica, asegurando un suministro constante de energía.
- Cumplimiento Regulatorio: Un enfoque estructurado en la planificación de inversiones facilita el cumplimiento de normativas nacionales e internacionales.

7. Recomendaciones para España

Basándose en los hallazgos del análisis comparativo, se desarrollan las siguientes recomendaciones para mejorar los planes de inversión en España:

- Adopción de un Enfoque Estructurado: Implementar una metodología de planificación de inversiones más detallada y estructurada, similar a los EJP del Reino Unido.
- Fomento de la Innovación: Introducir incentivos financieros para promover la adopción de nuevas tecnologías y prácticas sostenibles.
- Participación de los Interesados: Mejorar el compromiso con los interesados para asegurar que sus necesidades y preocupaciones sean consideradas en la planificación de inversiones.
- Análisis Económico Detallado: Incorporar un análisis económico exhaustivo y justificación de cada proyecto para facilitar la toma de decisiones informadas.

8. Conclusiones

La implementación de las mejores prácticas del modelo RIIO en España podría mejorar significativamente la eficiencia y sostenibilidad de las redes de distribución eléctrica. Las recomendaciones propuestas buscan asegurar que las estrategias de inversión de España puedan satisfacer las demandas futuras y apoyar la transición energética en curso. La modernización de las redes de distribución eléctrica es esencial para mantener la eficiencia económica y la calidad del servicio, promoviendo al mismo tiempo la innovación y la sostenibilidad.

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Chapter 1

1. Introduction

The efficient and reliable operation of electricity distribution networks ensures a steady energy supply and meets growing demand. The regulatory frameworks governing these networks play a significant role in shaping their performance and investment strategies. The insights presented in this chapter are drawn from Chapters 4 and 5 of "Regulation of the Power Sector" by Tomás Gómez (GÓME13).

This thesis aims to conduct a comparative analysis of investment plans for electricity distribution networks in the United Kingdom and Spain. By identifying effective practices and highlighting areas for improvement, the study seeks to suggest ways in which Spanish investment strategies could be enhanced to align more closely with the successful models observed in the UK.

1.1 Problem Statement

Electricity distribution networks need significant investments to ensure reliability, efficiency, and sustainability. The development and performance of these networks are heavily influenced by the regulatory frameworks and investment plans that oversee them.

In the UK, the RIIO (Revenue = Incentives + Innovation + Outputs) model promotes detailed documentation for each investment project. These documents typically include sections on the introduction and background, technical governance process, project need justification, options considered, detailed analysis, costs and feasibility analysis, and risk evaluation and conclusions (SPEN21). This thorough approach allows for comprehensive justification of investments based on anticipated demand growth and economic analysis of alternatives.

In contrast, Spain's approach involves less detailed documentation for investment projects. The investment plans often consist of a summary document listing numerous projects within each autonomous community, providing basic information such as the investment volume, expected year of service, project status, and purpose (IBER22). This enumeration of investments lacks the detailed justification and economic analysis seen in the UK.

This disparity between the UK and Spain's investment plans presents a significant challenge. Spain's current approach may not provide sufficient insights for optimising investment decisions, integrating renewable energy sources, and advancing smart grid technologies. The lack of detailed project justification could hinder the ability to make informed investment choices.

This thesis addresses the gap between the detailed, justified investment plans in the UK and the less detailed, aggregated investment plans in Spain. By conducting this comparative analysis, the study will analyse how Spain can enhance its regulatory framework and investment strategies by adopting best practices from the UK's approach.

1.2 Study Objectives

This thesis aims to comprehensively analyse investment plans for electricity distribution networks in the United Kingdom and Spain. The objective is to identify effective practices in the UK and highlight areas where improvements in Spanish plans could be made. This will suggest ways in which Spanish investment strategies can align more closely with the successful models observed in the UK. The main objectives are:

Regulatory Framework Overview

As an introduction and support to the main objectives, the first objective is to understand the regulatory frameworks that govern electricity distribution in the UK and Spain. This includes a detailed examination of the UK's RIIO model versus the traditional regulatory regime overseen by Spain's CNMC (Comisión Nacional de los Mercados y la Competencia; National Commission on Markets and Competition). This additional objective will provide an understanding of these frameworks and will clarify how they influence the respective countries' investment strategies and outcomes.

Investment Justification Comparison

One of the main objectives is to compare the methods used to justify investments in electricity distribution networks, focusing on SP Energy Networks (SPEN) in the UK and i-DE Iberdrola in Spain as key examples. This comparison aims to assess the quality of the justifications provided by different investment approaches. Through this analysis, the study will show how each company addresses regulatory requirements, technological challenges, and strategic goals in their investment plans.

Effective Practices in Investment Planning

The following objective is to identify effective investment planning practices found in the UK, specifically those that contribute to sustainable and efficient energy distribution. The analysis will explore how incorporating detailed sections in investment plans, as commonly done in the UK, could enhance investment justifications in Spain. This objective will help identify improvements that could strengthen Spain's investment strategies, resulting in better regulatory compliance, sustainability, and transparency.

Development of Recommendations for Spain

Finally, based on the insights gained from the comparative analysis, this thesis will develop recommendations for improving investment plans in Spain. The aim is to propose how Spain might incorporate certain successful UK practices to refine its approach to investment planning in the electricity distribution sector.

These objectives will guide the research and analysis throughout the thesis, aiming to bridge the gap between the current practices in Spain and the more detailed and economically justified approaches seen in the UK.

1.3 Motivation

The motivation for this thesis arises from the urgent need to improve the efficiency, sustainability, and resilience of electricity distribution networks. As countries worldwide work towards more sustainable energy systems, the role of these networks becomes more important. They must not only meet growing energy demands but also integrate more renewable energy sources and adopt advanced technologies like smart grids.

Spain, like many other countries, faces significant challenges in modernising its electricity distribution network. The current regulatory framework and investment strategies may not fully support the needed innovations and efficiency improvements (GÓME13). In contrast, the United Kingdom has adopted the RIIO model, which has shown promising results in encouraging detailed investment planning and promoting long-term sustainability and efficiency (GÓME13).

This thesis is motivated by the desire to bridge the gap between Spain's current practices and the successful models observed in the UK. The goal is to provide actionable recommendations that will enhance Spain's investment strategies, ensuring that the country's electricity distribution network can meet future demands and support the ongoing energy transition.

Understanding and improving investment justifications is crucial for several reasons:

- Efficiency and Cost-Effectiveness: Detailed investment plans, as seen in the UK, help in making informed decisions that optimize resource allocation and ensure cost-effective solutions (GÓME13).
- Sustainability: Adopting best practices in investment planning can significantly contribute to integrating renewable energy sources, thereby supporting environmental goals and reducing carbon footprints (GÓME13).
- Resilience and Reliability: Improved investment strategies can enhance the reliability and resilience of the electricity distribution network, ensuring a consistent energy supply even with growing demands and unforeseen challenges (GÓME13).
- Regulatory Compliance: A more structured approach to investment planning can lead to better regulatory compliance, helping to meet both national and international standards and requirements (GÓME13).

The motivation behind this thesis is not only academic but also practical. By providing insights and recommendations based on the comparative analysis of the UK and Spain, this research aims to contribute to the development of more robust, efficient, and sustainable electricity distribution networks in Spain.

1.4 Scope and Limitations

This thesis focuses on a comparative analysis of two specific investment plans for electrical distribution networks: SP Energy Networks (SPEN) in the UK and i-DE Iberdrola in Spain. While the analysis is based on these particular documents, the intention is to treat the findings as indicative of broader investment planning practices in each country. This approach allows for general conclusions about the nature of electrical distribution investment strategies in the UK and Spain, providing insights that may apply to similar utilities and regulatory environments.

Scope

- Regulatory Frameworks (additional and supportive):
  - Examination of the UK's RIIO model and Spain's traditional regulatory framework governed by the CNMC.
  - Analysis of how these frameworks influence investment strategies and outcomes in each country.
- Investment Plans:
  - Detailed analysis of investment plans from SP Energy Networks (SPEN) in the UK and i-DE Iberdrola in Spain.
  - Assessment of the justification methods used in these plans, including economic analysis, project need justification, and risk evaluation.
- Best Practices and Recommendations:
  - Identification of effective practices from the UK that could be beneficial if implemented in Spain.
  - Development of tailored recommendations to enhance Spain’s investment strategies and regulatory framework.

Limitations

- Representativeness:
  - While SPEN and i-DE Iberdrola are significant players in their respective markets, they may not cover all aspects of investment planning practices

across the UK and Spain. This study assumes that the chosen plans are sufficiently indicative of each country's approaches to allow for broader insights.

- Temporal and Regulatory Dynamics:
  - The conclusions drawn are based on the status of regulatory and market conditions as they exist at the time of the plans' publication. Changes in policies or market conditions that occur after these plans were developed could impact the relevance and applicability of the findings.
- Data Availability:
  - The analysis is limited to the availability of detailed investment plans from SPEN and i-DE Iberdrola. Other relevant data from additional companies or regions may not be included.
- Implementation Feasibility:
  - The recommendations provided are based on the comparative analysis and may require further validation through practical implementation studies to assess their feasibility and effectiveness in the Spanish context.

These scope and limitations will guide the research, ensuring a focused analysis while acknowledging potential constraints that may affect the generalizability of the findings.

Chapter 2

2. Electricity Distribution Systems

Electricity distribution networks are critical for the reliable and efficient delivery of power. As demand increases and the integration of renewable energy sources becomes more prevalent, modernising these networks is essential.

2.1 Importance of Modernising Electricity Distribution Networks

2.1.1. The Role of Distribution Networks in the Overall Power System

Distribution networks are the backbone of the electricity supply chain, delivering power from transmission systems to end-users. Their efficient operation is vital for the stability and reliability of the entire power system.

The electricity industry has traditionally been dominated by national or regional monopolies that require significant regulatory oversight to ensure efficiency and prevent overcharging. Since electricity distribution networks are natural monopolies due to their high capital costs and extensive infrastructure needs, modernising them is crucial to maintaining economic efficiency and service quality. Distribution companies need proper regulatory frameworks to ensure operate efficiently, maintain fair pricing and provide high-quality service. Without regulation, these monopolies could exploit their market position. It could lead to higher prices and lower quality services for consumers. Effective regulation ensures distribution companies can recover their investments, promoting innovation and incentivising efficiency (GÓME13).

2.2.2. Challenges Posed by Aging Infrastructure and Increasing Demand

Many distribution networks worldwide face challenges due to ageing infrastructure that needs significant upgrades. Additionally, rising electricity demand places further strain on these systems, needing enhancements to capacity and resilience.

Outdated infrastructure can lead to increased operational costs and reduced reliability. This situation is worsened by growing demand, which requires the infrastructure to be more robust and capable of handling larger loads without compromising service quality.

Factors Driving Increased Demand

1. Electrification of transport: The adoption of electric vehicles (EVs) significantly drives up electricity demand. Electric car sales are expected to reach around 17 million in 2024, making up over 20% of all cars sold worldwide. Despite concerns about costs and incentives, global sales remain strong. In early 2024, sales grew by 25% compared to early 2023. Market share could reach 45% in China, 25% in Europe, and over 11% in the US, driven by competition, falling prices, and policy support (ALŠA23).
3. 2. Electrification of heating: The shift towards electric heat pumps in both, residential and commercial buildings, replacing the current fossil-fuel heating systems, is another driver of electricity demand. According to the American Council for an Energy-Efficient Economy (ACEEE), the increasing adoption of heat pumps will demand updates in distribution networks to handle additional load (NADE23). Economic and population growth: Emerging markets and developing economies are seeing significant increases in energy consumption due to economic growth and rising living standards. ExxonMobil projects that global transportation-related energy demand will grow more than 30% from 2021 to 2050, driven by economic and population growth (EXMO24).

2.2.3. Integration of Renewable Energy Sources and the Rise of Smart Grids

The shift towards renewable energy sources, such as solar and wind, introduces variability and complexity into the distribution network. Smart grid technologies, which enable real-time monitoring and control, are essential for managing this complexity and ensuring a stable supply.

Integrating renewable energy sources presents both opportunities and challenges for distribution networks. The variability of renewable generation requires advanced management and control systems, such as smart grids, to maintain balance and reliability.

Smart grids allow better demand response, improved fault detection, and enhanced overall network efficiency.

2.2 Key Components of Distribution Networks

Physical Components

Distribution networks include essential physical parts like substations, transformers, and distribution lines. Substations connect the high-voltage transmission system to the lower-voltage distribution network, delivering electricity to end-users. Transformers reduce the voltage to safe levels for residential and commercial use. Distribution lines then carry the electricity from substations to consumers (ELEC24).

Effective management of these physical components is crucial for the development and maintenance of the grid. Building and upgrading substations and laying distribution lines, especially in densely populated urban areas, require careful planning to minimise disruptions and ensure efficient operation.

Operational Components

The operational parts of distribution networks include advanced control systems, metering infrastructure, and comprehensive maintenance practices. Distribution Management Systems (DMS) and Supervisory Control and Data Acquisition (SCADA) systems are key technologies allowing real-time grid monitoring and control. Also, OMS (Outage Management System) is integrated with SCADA and DMS to increase efficiency in distribution operations by providing outage management, improving response times, and enhancing customer service (TAYL09). These systems help maintain voltage stability, manage load distribution, and quickly address outages.

Good maintenance is essential for reliable network operation. Regular checks and planned maintenance help prevent failures, while prompt repairs are crucial for quickly restoring service during outages. The integration of smart grid technologies enhances these maintenance practices by enabling better automation, improved fault detection, and more effective demand response and energy efficiency measures.

2.3 Regulatory Challenges and Innovations

Modernising electricity distribution networks involves addressing various challenges that are technical, economic, and regulatory. These challenges must be navigated to improve the efficiency, reliability, and sustainability of the power supply.

Technical Challenges

One of the significant technical challenges is integrating distributed energy resources (DERs) like solar panels and wind turbines into the existing grid. The traditional grid, designed for one-way power flow from centralised power plants to consumers, must now handle two-way power flows due to DERs. This requires significant upgrades in grid infrastructure, such as advanced inverters and smart grid technologies, to maintain stability and reliability (HEND17).

Advanced automation schemes, such as fault location, isolation, and service restoration (FLISR), are being used to improve reliability. These schemes are monitored and controlled in real time by supervisory control and data acquisition (SCADA) systems. Additionally, "four quadrant" smart inverters with modern DER facilities provide low-cost voltage support and control voltage fluctuations on the distribution system (HEND17).

Economic Challenges

Economic incentives play a crucial role in promoting grid modernisation. Policies such as net-zero metering, which allow consumers to sell excess power back to the grid, have encouraged the adoption of renewable energy technologies. However, these policies can create economic imbalances, where consumers without solar panels may end up paying more to support the grid infrastructure costs used by those with solar installations. This highlights the need for regulatory frameworks that fairly distribute the costs and benefits of grid modernisation (HEND17).

Energy storage technologies promise to mitigate the variability of renewable DERs. However, regulatory barriers and outdated practices can slow their adoption (HEND17).

Regulatory Challenges

Effective regulation is essential in distribution as it is a natural monopoly. Proper regulation ensures that distribution companies can recover their investments and operate efficiently while providing high-quality service. Traditional cost-of-service regulation often fails to incentivise efficiency and innovation. In contrast, incentive-based regulation, such as price or revenue caps, can encourage better performance but requires careful design to balance risks and rewards.

One of the main regulatory challenges is ensuring grid reliability and resilience as renewable energy sources become more common. The variability and intermittency of these sources require strong regulatory support for investments in energy storage and advanced grid management tools to maintain grid stability (HEND17).

Another significant regulatory challenge is addressing cybersecurity and privacy concerns. As the grid becomes more digitalised, it is increasingly vulnerable to cyber threats. Regulatory frameworks must develop standards to protect against these threats while ensuring consumer data privacy (HEND17).

In conclusion, modernising electricity distribution networks involves overcoming substantial technical, economic, and regulatory challenges. By addressing these challenges through adaptive regulatory policies, the power sector can become more efficient and reliable.

2.4 Strategic Investments in Distribution Networks

Strategic investments in distribution networks are crucial for improving reliability, efficiency, and sustainability. These investments are guided by key criteria and can significantly impact the overall performance and resilience of the power system.

Criteria for Prioritising Investments

Investments in distribution networks are prioritised based on criteria like reliability, efficiency, and sustainability. Reliability investments aim to reduce outages, improving service quality for consumers. Efficiency-related investments focus on cutting operational costs and energy losses, enhancing the network's economic performance. Sustainability investments aim to integrate renewable energy sources and support the transition to a low-carbon energy system.

Distribution networks must adapt to changing demand patterns and the integration of distributed generation. Investments often target upgrading ageing infrastructure, incorporating smart grid technologies, and enhancing the network's capacity and resilience to handle new challenges, like the increasing use of renewable energy and the electrification of transport.

Examples of Successful Investment Strategies

In the UK, the RIIO (Revenue = Incentives + Innovation + Outputs) model encourages network companies to invest strategically by linking their revenue to performance outcomes (GÓME13). This approach drives companies to focus on long-term value for consumers and innovate in areas like smart grid development and renewable energy integration.

In Spain, traditional investment strategies focus on expanding network capacity and upgrading infrastructure to meet growing demand and regulatory requirements. These investments are essential for maintaining the reliability and sustainability of the distribution network in a rapidly changing energy landscape.

Analysis of Financial and Technical Benefits

Strategic investments in distribution networks offer significant financial and technical benefits. Financially, these investments reduce operational costs, delay the need for new generation capacity, and improve economic efficiency. Technically, they enhance the network's reliability and resilience, reduce energy losses, and help integrate renewable energy sources.

According to BCG, combining advanced scenario modelling with digital tools and human expertise is essential for making better investment decisions and cutting costs. This approach helps visualise the current state, predict future scenarios, and optimise decisions, leading to a more efficient and resilient power distribution system. This strategy supports net-zero targets and improves coordination and transparency in the energy distribution network (DANK22).

Using advanced technologies like smart grids and automation systems allows for better monitoring and control of the network, leading to more efficient and reliable operations. These technologies also support demand response initiatives, reducing peak demand and optimising the use of existing infrastructure.

By prioritising investments based on clear criteria and using innovative regulatory frameworks, distribution companies can achieve a more sustainable and resilient electricity system. These strategic investments benefit not only network operators but also provide significant advantages to consumers and society, ensuring a reliable electricity supply and supporting the transition to a cleaner energy future (OECD24).

2.5 Future Trends and Considerations

The landscape of electricity distribution is evolving, driven by technological advancements, regulatory changes, and shifting market dynamics. This section explores the emerging trends and key considerations shaping the future of distribution networks.

Emerging Technologies

Advanced technologies such as distributed energy resources (DERs), including renewable sources like solar panels and wind turbines, and smart grids are transforming traditional grid structures. DERs reduce transmission losses but introduce challenges in managing power quality and bidirectional power flows. Smart grids, equipped with real-time monitoring and automated control systems, enable efficient grid management and support the integration of renewable energy sources (HEND17).

Policy and Regulatory Developments

Evolving regulatory frameworks are essential to support new technologies and changing market dynamics. Regulatory policies must evolve to support new business models and technologies, such as DERs and smart grids. Incentive-based regulation encourages innovation and long-term investments in grid infrastructure, balancing consumer interests with those of utility companies. Policies promoting renewable energy and energy efficiency are crucial for transitioning to a low-carbon economy (HEND17).

Long-Term Considerations

Decarbonisation will drive significant changes in grid infrastructure and operations. As countries aim to meet climate goals, the integration of renewable energy will expand, requiring grid upgrades. Increased electrification of transport and heating will also raise electricity consumption, necessitating strategic investments in capacity and management systems. Cybersecurity is critical as grids become more interconnected, increasing the risk of cyber-attacks (HEND17).

In conclusion, the future of electricity distribution networks will be shaped by technological advancements, regulatory frameworks, and broader economic and environmental trends. Strategic investments and robust regulatory mechanisms are essential for ensuring a sustainable, reliable, and efficient electricity distribution system (HEND17).

Chapter 3

3. Regulatory Frameworks in the UK and Spain

This chapter provides a detailed analysis of the regulatory frameworks used in electricity distribution in the UK and Spain. It highlights the key characteristics of each framework and examines their impacts on investment strategies in the electricity distribution network.

3.1. Regulatory Framework in the UK (RIIO Model)

This section explores the regulatory framework of the UK's electricity distribution networks under the RIIO (Revenue = Incentives + Innovation + Outputs) model.

The RIIO model was introduced by Ofgem in 2013, replacing the previous RPI-X framework. The transition to the RIIO model marked a significant shift towards a more comprehensive approach to regulation. The new model addressed the limitations of the previous one and encouraged long-term planning and innovation in the energy sector. The primary objectives of the RIIO model (OFGE22) are to:

- Encourage network companies to deliver safe and reliable services.
- Promote efficient and sustainable investment.
- Foster innovation to meet future energy challenges.
- Ensure that the benefits of these improvements are shared with consumers.

3.1.1. Key Components of the RIIO Model

This section explores the RIIO model's regulatory framework, focusing on its components: revenues, incentives, innovation, and outputs.

Revenues

The RIIO model sets revenue allowances for network companies based on their projected costs and performance targets. These allowances are reviewed periodically to ensure they remain appropriate. The revenue model includes mechanisms to adjust for inflation, changes in demand, and other factors affecting cost-of-service delivery. The aim is to provide a stable revenue stream that supports long-term investment while protecting consumers from unnecessary cost increases (SPEN24).

Incentives

The RIIO model includes financial incentives to encourage network companies to improve their performance across various dimensions. These incentives promote efficiency, customer service, and network reliability. They are designed to reward companies for exceeding performance targets and penalise them for underperformance. (SPEN24).

Innovation

Innovation is fundamental in the RIIO model. Ofgem has established the Network Innovation Competition (NIC) and the Network Innovation Allowance (NIA) to provide funding for research, development, and demonstration projects. These initiatives aim to ease the adoption of new technologies and practices that enhance the efficiency and sustainability of the electricity distribution network (SPEN24).

Outputs

The RIIO model emphasises delivering specific outputs that are important to consumers and society. These outputs include everything customers value such as safety, social obligations, reliability, environment, connections and customer satisfaction (SPEN24). By linking revenue to these outputs, the RIIO framework ensures that network companies are accountable for delivering tangible benefits. Clear and measurable output targets drive improvements in network performance.

3.1.2. RIIO-ED

The RIIO price control framework is implemented through specific periods, known as RIIO-ED1 and RIIO-ED2, which cover electricity distribution (OFGE22).

RIIO-ED1 (2015-2023, 8 year periodic review)

The first electricity distribution price control under the RIIO framework began in April 2015 and ran until March 2023. It encouraged network companies to deliver value for money while focusing on performance improvements, innovation, and customer satisfaction. It set specific allowances and incentives for companies to manage their operations efficiently and invest in network reliability and resilience.

RIIO-ED2 (2023-present, 5 year periodic reviewt)

Building on RIIO-ED1, RIIO-ED2 started in 2023 and continues to emphasise efficiency, innovation, and output delivery. The framework sets new targets and allowances, encouraging further improvements in network reliability, customer service, and environmental performance. It addresses emerging challenges such as the integration of renewable energy sources and the advancement of smart grid technologies.

3.1.3. Regulatory Processes and Mechanisms in RIIO

This section outlines the key regulatory processes and mechanisms within the RIIO framework, including price controls, performance-based regulation, and periodic reviews.

- Price Controls: These can take the form of price caps or revenue caps.
    - Price Caps: Set the maximum prices network companies can charge for their services over a specified period, incentivising cost management while delivering high-quality service (GÓME13).
    - Revenue Caps: Set the maximum total revenue a company can earn over a specified period, encouraging cost reduction and efficiency (GÓME13).

- Performance-Based Regulation: Links revenue allowances to performance against predefined outputs and targets, encouraging continuous improvement and innovation (GÓME13).
- Periodic Reviews: Conducted every certain amount of years to evaluate the effectiveness of price controls and performance-based regulation mechanisms, ensuring responsiveness to market conditions and consumer needs (OFGE22).

3.2. Regulatory Framework in Spain (Traditional Model)

This section explores the regulatory framework of Spain's electricity distribution networks.

3.2.1. Model in Spain

Spain's regulatory framework for electricity distribution is characterised by a cost-of-service approach on capital expenditures, ensuring utilities can cover their investment costs and earn a reasonable return while providing reliable service. Tariffs are based on service costs, including operational and capital expenses.

- Annual and Multi-Year Investment Plans: Distribution companies submit annual and multi-year investment plans to the Ministry of Industry, Energy, and Tourism and the respective Autonomous Communities or Cities of Ceuta and Melilla. These plans outline projects, technical characteristics, budgets, and timelines (CNMC22).
- Approval Process: Investment plans are reviewed and approved by the previously mentioned regulatory bodies to ensure they meet necessary standards and provide value for money (CNMC22).
- Volume of Investment: The maximum allowable investment volume is capped annually based on a percentage of Spain's GDP (CNMC22).

3.2.2. Quality of Service and Performance Monitoring

Spain's regulatory framework includes specific standards for quality of service, ensuring reliable electricity supply for consumers.

- Reliability of Supply: Measures how often and how long power outages last, with companies minimising disruptions and maintaining standards through regular checks and reports (CNMC22).
- Voltage Quality: Ensures voltage levels stay within set limits to avoid damaging consumer appliances, with necessary infrastructure and technology in place (CNMC22).
- Customer Service: Focuses on how quickly and effectively companies address consumer issues, evaluated through audits and customer surveys, with rewards for good service and penalties for poor performance (CNMC22).

Regulatory authorities continuously monitor performance through comprehensive reporting and inspections. Non-compliance can result in fines, mandatory improvement plans, and other corrective measures, while exceeding expectations may lead to financial incentives or public recognition.

3.3. Comparison of Regulatory Frameworks and Their Influence on Investments

This section compares the regulatory frameworks in the UK and Spain, highlighting their key characteristics and impacts on investment strategies. It is derived from sections 3.1 and 3.2.

3.3.1. Key Characteristics of the Regulatory Frameworks

RIIO Model in the UK

- Focus on innovation and efficiency through financial incentives and performance-based regulation.

- Long-term planning with five-year regulatory periods, providing stability and predictability.
- Price controls using revenue caps (limits on the total revenue Distribution Network Operators (DNOs) can collect).

Cost-of-Service Model in Spain

- Ensures cost recovery and fair return for utilities.
- Tariffs based on service costs.
- Requires detailed annual and multi-year investment plans aligned with regulatory standards.
- Includes strict standards for reliability, voltage quality, and customer service, with continuous performance monitoring.

3.3.2. Impact on Investment Strategies

UK (RIIO Model)

Encourages innovation and efficiency through financial incentives, promoting the adoption of new technologies and prioritising efficiency, reliability, and customer satisfaction. Long-term regulatory periods provide stability for strategic investments.

Spain (Cost-of-Service Model)

Focuses on maintaining and improving reliability and quality of supply. Detailed investment plans ensure alignment with regulatory standards but may offer fewer incentives for innovation.

3.3.3. Comparative Analysis

Comparing the RIIO model in the UK with the cost-of-service model in Spain reveals distinct regulatory approaches.

- Innovation and Efficiency: The RIIO model provides stronger incentives for innovation and efficiency. Spain's model emphasises reliability and cost recovery.
- Investment Planning: Both require detailed investment planning, but the RIIO model's long-term approach offers more stability. Spain's plans ensure regulatory alignment but may limit flexibility for innovation.
- Performance Monitoring: The UK model includes more performance metrics (customer engagement and satisfaction, quality of supply, security of supply) tied to financial outcomes. Meanwhile, the Spanish model has some metrics for security and quality of supply that also have associated financial outcomes/incentives.

In conclusion, the regulatory frameworks in the UK and Spain shape investment strategies in different ways, reflecting their priorities and regulatory philosophies. The RIIO model's focus on innovation and performance drives continuous improvement, while Spain's cost-of-service model ensures reliability and cost recovery through detailed planning and regulatory oversight.

Chapter 4

4. Methodology for Investment Justification in the UK

This chapter will explore the methodology used in the United Kingdom to justify investments in the electricity distribution network. To do so, we will use an investment plan created by SP Energy Networks (SPEN21) that will serve as a representative example of the broader UK methodology. By examining the investment justification approach for a specific project, the *Maentwrog – Porthmadog 33kV Reinforcement*, we aim to provide a comprehensive understanding of the steps involved in the UK context. Additionally, this analysis will reference the guidelines and frameworks provided in *Ofgem's Engineering Justification Papers for RIIO-ED2* (OFGE21).

Each section of this chapter represents a step in the structured process followed by UK entities to create a detailed document for investment justifications, the Engineering Justification Paper (EJP). These steps ensure that all aspects of the project, from initial need identification to detailed risk assessment, are thoroughly evaluated and documented.

4.1. Standardised Front Cover

The front cover of investment justification documents in the UK provides an overview of the project's key details and sets the context for the subsequent analysis.

It should include the following elements (OFGE21, SPEN21):

Title of the Project	
Issue	The issue version, along with dates and comments on updates made in each version.
Scheme Name	The title of the project. It helps identify the project quickly and indicates the scope of work.
Activity	A brief description of the primary activity involved in the project.
Primary Investment Driver	The main reason for the investment (e.g., addressing thermal constraints, enhancing reliability, or meeting regulatory requirements).
Reference	A unique identifier for the document (e.g., ED2-LRE-SPM-005-CV1-EJP).

<table>
<tr><td>Output Type</td><td colspan="3">List of project's expected outcomes (e.g. specific performance metrics, load indices…).</td></tr>
<tr><td>Cost</td><td colspan="3">The estimated total cost of the project (across all Price Control Periods, not just RIIO-ED2).</td></tr>
<tr><td>Delivery Year</td><td colspan="3">The planned timeline for the project's completion. If the program is delivered in stages over several years, list each relevant year.</td></tr>
<tr><td>Reporting Table</td><td colspan="3">A reference to the Business Plan Data Tables where the project's details (volumes/costs/output) will be documented.</td></tr>
<tr><td>Outputs Included in Previous Plans</td><td colspan="3">Information on whether the project's outputs were included in previous investment plans. In this section, only indicate Yes or No. If you select Yes, provide detailed information in the "Deliverability and Risk" section later in the document.</td></tr>
<tr><td>Business Plan Section</td><td colspan="3">The section of the business plan that the project supports. This links the project to the broader strategic goals.</td></tr>
<tr><td>Primary Annex</td><td colspan="3">References to annexes that provide additional details. This indicates where further detailed information can be found.</td></tr>
<tr><td rowspan="2">Spend Apportionment</td><td>ED1</td><td>ED2</td><td>ED3</td></tr>
<tr><td colspan="3">The allocation of costs across different regulatory periods (e.g., ED1, ED2, ED3…), showing how the investment is phased over time. Interpret ED3 as ED3+, meaning if costs are forecasted for ED4, include them in the ED3 box here and explain in the document text.</td></tr>
</table>

Table 1: Standardised Front Cover of UK's Electricity Distribution Network Investment Plans

By standardising the front cover across all investment justification documents, UK entities ensure consistency and transparency in how projects are presented and evaluated. This approach helps follow a structured and efficient review process.

4.2. Technical Governance Process

The technical governance process ensures that each investment project in the electricity distribution network is reviewed and approved systematically at various stages before final implementation. Below is a general guide outlining the key steps involved in the technical governance process.

4.2.1. Technical Governance Steps

The technical governance steps are (SPEN21):

1. Project Scope Development

- IP1: Initial Proposal
- IP1(S): Scope Confirmation (when applicable)

2. Technical/Engineering Approval

- IP2: Major System Project Approval
- IP2(C): Supplementary Approval (when applicable)
- IP2(R): Restricted Technical Approval (when applicable)

3. Financial Authorization

- IP3: Financial Authorization

4. Project Variation and Monitoring

- IP4: Variation Request

The table below provides detailed descriptions of the purpose of each step (SPEN21):

Step	Purpose
IP1: Initial Proposal	To request project inclusion in the investment plan and to undertake project design work or request a modification to an existing project.
IP1(S): Scope Confirmation	Confirms project needs case and provides an initial view of the Project Scope.
IP2: Major System Project Approval	Technical/Engineering approval for major system projects by the System Review Group (SRG).
IP2(C): Supplementary Approval	A Codicil or Supplement to a related IP2 paper.

IP2(R): Restricted Technical Approval	Restricted Technical/Engineering approval for projects such as asset refurbishment or replacement projects which are essentially on a like-for-like basis and not requiring a full IP2.
IP3: Financial Authorization	Financial Authorisation document (for schemes > £100k prime)
IP4: Variation Request	Application for variation of project due to change in cost or scope

Table 2: Overview of Technical Governance Steps

4.2.2. Inclusion in the Engineering Justification Document

Each Distribution Network Operator (DNO) should incorporate the technical governance steps into their EJP (OFGE21). This ensures that all projects are reviewed and approved consistently.

- Indication of Phase (SPEN21): The EJP should indicate the phase of the technical governance process that the project is currently in (e.g., IP1, IP1(S), IP2, IP2(C), IP2(R), IP3, IP4).
- Standard Sections (SPEN21): The EJP should also include the following standardised sections:

PART A - Project Information: Summarises the key details of the project.

- Project Title: Name of the project.
- Project Reference: Unique identifier for the project.
- Decision Required: Specific approval or decision needed for the project.
- Summary of Business Need: Justification for the project, including the primary drivers and objectives.
- Summary of Project Scope, Change in Scope, or Change in Timing: Description of the work to be done, any changes in scope, and timeline adjustments.
- Expenditure Forecast: Detailed cost estimates, including tables referenced on the front cover in the Reporting Table section, outlining costs and projected spending over the project's different periods.

PART B - Project Submission: Details the project submission, including:

- Proposed by: Name and signature of the person proposing the project, and date of proposal.
- Endorsed by: Name and signature of the endorser, and date of endorsement.

PART C - Project Approval: Includes the project approval details with:

- Approved by: Name and signature of the approver, and date of approval.

4.3. Introduction

The introduction in UK investment plans for electricity distribution networks provides an overview of the project. It sets the stage for the detailed analysis and justification that follows.

Elements of the Introduction in UK Investment Plans (OFGE21, SPEN21)

1. Project Context:
    - Description of the Geographical Area: Includes a description of the geographical area and the specific part of the network affected by the project.
    - Overview of the Current Supply Situation: Provides key statistics such as the number of customers served and the existing infrastructure.
2. Environmental and Historical Context:
    - Environmental Considerations: Highlights any environmental considerations relevant to the project area, such as national parks.
    - Historical Considerations: Includes any historical considerations relevant to the project area, such as historical sites.
3. Drivers for the Project:
    - Primary Investment Driver: Details the main factors driving the need for the project (e.g., expected increases in demand from electric vehicles, heat pumps, or other sources).
    - Secondary Investment Drivers: Identifies any secondary factors influencing the project.

- Regulatory Requirements: Mentions any regulatory requirements, ensuring compliance with national or regional regulations.

4. Project Objectives:
    - Objectives of the Project: States the objectives of the project, such as improving thermal capacity, enhancing reliability, or supporting future demand growth.
5. Proposed Solutions:
    - Technical Measures: Outlines the technical measures proposed to address the identified needs, such as installing new circuits, upgrading existing infrastructure, or contracting flexibility services.
    - Timeline: Provides a timeline for the project, including key milestones and expected completion dates.
6. Financial Considerations and Timeline:
    - Estimated Costs: Presents the estimated costs of the project.
    - Investment Timeline: Details the timeline for investment, including the expected year of delivery.

4.4 Background Information

4.4.1 The Asset

- Description of the Asset: Provide a detailed description of the asset or asset grouping that the proposal pertains to. This includes naming specific assets where practical (OFGE21).
- Current Condition and Performance: Detail the current condition and performance of the asset. Use data and evidence to support the asset's operational status and any issues or risks associated with it (OFGE21).
- Existing Network Overview: Include geographic and technical details of the existing network (SPEN21).

4.4.2 Type of Investments

Load-related Investments

- Need for Investment: Explain the need for investment by substantiating it against a range of plausible planning scenarios. This includes clear articulation of the risks associated with no investment (OFGE21).
- Strategic Ahead of Need: If the investment is ahead of need, provide a rationale with clear risks and benefits (OFGE21).
- Network Supply and Capacity: Provide current network supply and circuit capacity information, including tables and figures to illustrate (SPEN21).
- Embedded Generation and Demand Connections: Detail existing embedded generation and demand connections, including types, status, and capacity (SPEN21).

Non-load Related Investments

- Evidence of Condition and Risk: Include evidence of the reported condition and risk, linked to anticipated deterioration. Additional asset condition data should be provided as far as reasonably practicable (OFGE21).
- Fault Levels: Discuss current fault levels and any related issues impacting the network (SPEN21).

4.5. Needs Case

The "Needs Case" section in UK investment plans for electricity distribution networks outlines the fundamental reasons for the proposed project. It provides a detailed justification based on current and future network requirements, ensuring that all stakeholders understand why the investment is necessary.

In the following sections, we will cover the elements that are included in the “Needs Case” section (OFGE21, SPEN21):

4.5.1. Forecast Demand

The “Forecast Demand” section presents projections of future demand, explaining the methodologies and data sources used to develop these forecasts. This information is vital for demonstrating the anticipated growth and identifying potential constraints that the project aims to address. For example, SPEN uses actual system measurement data from Process Instrumentation (PI) systems and Distribution Future Energy Scenarios (DFES) to develop their forecasts. This section should include:

- System Forecast: This part should include an overview of the expected demand growth across the entire system. It should explain how the forecasts were developed, including any models or tools used.
- Local Considerations: Detail any region-specific factors that could impact demand forecasts. This includes local development plans, economic trends, and stakeholder feedback. Highlight how local engagement and consultations have informed the demand forecasts. For instance, SPEN held stakeholder engagement sessions to refine their understanding of local economic growth plans and other drivers.
- Scenario Analysis: Examine different future energy scenarios and their impact on demand. Scenarios might include varying rates of adoption for technologies like electric vehicles and heat pumps, changes in consumer behaviour, and policy-driven initiatives. It's important to justify the predictions of these scenarios using credible sources and methodologies. SPEN, for example, uses DFES which includes scenarios such as "Balanced Net Zero", "Leading the Way", and "Consumer Transformation", among others. These scenarios consider compliance with Net Zero targets and are endorsed by stakeholders like the Electricity System Operator (ESO) and the Climate Change Committee (CCC).

4.5.2. Baseline View

This section should provide a baseline assessment of the current network performance and capacity. It establishes the starting point from which future demands and constraints will be evaluated.

The following components should be included:

- Current Demand and Capacity: Show the current demand levels and available capacity within the network.
- Utilisation Metrics: Analysis of utilisation rates can help identify current or potential constraints. Understanding how much of the network's capacity is being used and where potential bottlenecks may occur.
- Load Indices: Use load indices to evaluate the network's capacity to meet future demand. Load indices offer a measurable assessment of network performance under various demand scenarios, highlighting areas that may require reinforcement.

Example from SPEN (SPEN21)

All this information can be organised in tables summarising baseline demand, capacity, and utilization metrics.

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Winter (N-1)													
Forecast Demand (MVA)	68.8	72.3	74.2	75.7	78.3	80.5	84.4	88.2	93.6	99.8	106.4	112.6	119.0
Firm Capacity (MVA)	69.6	69.6	69.6	69.6	69.6	69.6	69.6	69.6	69.6	69.6	69.6	69.6	69.6
Utilisation (%)	99	104	107	109	112	116	121	127	134	143	153	162	171
Load Index	LI3	LI5	LI5	LI5	LI5	LI5	LI5	LI5	LI5	LI5	LI5	LI5	LI5

Table 3: SP Energy Networks Baseline View Forecast

4.5.3. Network Impact Assessment

The "Network Impact Assessment" section evaluates the impact of forecasted demand on the network, identifying specific constraints and challenges. Clearly outline the methodologies and data sources used. This assessment will help understand and predict the areas where the network may face issues under future demand scenarios.

During this section, the following elements should be covered:

- Identification of Constraints: This part should identify the various types of constraints that the network might face under different demand scenarios. Constraints could include, but are not limited to, thermal, voltage, capacity, and stability constraints.

Example of Constraints from SPEN

- Thermal Constraints: Analyse the thermal capacity limits of the network, identifying sections that may exceed their thermal capacity during peak demand periods.
- Voltage Constraints: Assess the stability of voltage levels, identifying sections where voltage may fall outside acceptable ranges under projected loads.

- Mitigation Strategies: Outline potential strategies to mitigate identified constraints, such as the use of flexibility services, network reinforcements, demand-side management, or other innovative solutions, to maintain network stability and performance.

Examples of mitigation strategies from SPEN

- Flexibility Services: Determine the necessary capacity for flexibility services to handle demand and alleviate constraints. Calculate the amount of time the network is at risk and the flexible capacity needed to address the identified constraints. Flexibility services may involve using flexible resources like demand response, energy storage, and distributed generation to enhance stability and reliability.

4.5.4. Stakeholder Engagement and Regulatory Compliance

These sections do not need to be separate; however, it would be beneficial to include this information within the "Needs Case" section.

Stakeholder Engagement

Summarise the engagement with stakeholders and how their input has shaped the "Needs Case" section. Effective stakeholder engagement ensures that the project considers the needs and concerns of all relevant parties. For example, SPEN's EJP stated that councils emphasised the importance of supporting economic growth with robust infrastructure.

Regulatory Compliance

Summarise how the proposed project meets regulatory requirements and aligns with policy goals. This ensures the project complies with relevant regulations. For example, SPEN's project supports the UK's Net Zero targets by enabling the connection of low-carbon technologies and improving grid resilience.

4.6. Optioneering

The "Optioneering" section in UK investment plans for electricity distribution networks outlines the process of evaluating and selecting the best solution for the proposed project. This section ensures that all potential options are considered (OFGE21, SPEN21). To complete this section, the following steps must be followed:

1. Identification of Options
    - List All Potential Options: Begin by identifying a list of all possible options for addressing the identified needs and constraints.
2. Reason for Rejection
    - Document Rejections: For each option that is not selected, provide a clear and concise explanation of the reasons for its rejection.

- Include All Considered Options: Even the options that are not selected should be documented with their respective reasons for rejection to show that a thorough evaluation was conducted.

3. Preferred Option Selection:
   - Identify Preferred Option: Based on the comparative assessment, identify the preferred option that best meets the project's objectives and evaluation criteria.

Example from SPEN (SPEN21)

#	Options	Status	Reason for Rejection
(a)	No Intervention	Rejected	The thermal overloading is close to the protection settings of the circuit and may lead to potential cascade tripping of the group and loss of supplies to over 18000 customers. The 33kV group network will be "Non-compliant" with security of supply requirements as per EREC P2/7.
(...)			
(h)	New 60MVA 132/33kV grid transformer at Four Crosses.	Considered (Option 1)	-
(...)			
(k)	Contract with Flexibility Services to manage the network constraint and establishment of new 33kV circuit between Maentwrog to Porthmadog.	Considered (Option 3) - Proposed	-
(...)			

Table 4: SP Energy Networks Longlist of solution options

4.7 Detailed Analysis and Costs

This section aims to evaluate all options, clearly explaining the rationale behind the preferred choice. For each investment, it is essential to present the detailed scope of the options considered and discounted by the network companies. This includes an analysis of the risks, costs, and benefits considered to inform the need for the intervention and the proposed solutions. The detailed analysis should ensure that all aspects of the project are thoroughly examined and documented, facilitating an informed decision-making process.

Key elements to include in this section are (OFGE21):

- Sensitivity Analysis of Preferred Options
- Cost Benefit Analysis (CBA)
- Rationale for the Selected Option
- Predicted Costs and Timing of Investment
- Regional Variations and Exceptional Costs
- Cost Maturity and Confidence
- Risk and Contingency - this section will also link to the detailed risk assessment in section 4.8.

It is important to note that the elements covered in sections 4.7 and 4.8 can be integrated into the Engineering Justification Paper (EJP) best to suit the narrative and rationale of the preferred options. For instance, SPEN organises these elements in a different order to the one presented in this section with this objective. They follow a more coherent order for understanding their rationale in this project.

Example from SPEN (SPEN21)

1. Evaluation of All Considered Options: SPEN analysed multiple options for the Maentwrog – Porthmadog project, including summaries and detailed cost breakdowns for each. For the preferred option, they provided an investment timeline, proposed substation location, cable route, and proposed works in the 33kV circuit.
2. Cost-Benefit Analysis (CBA) Results: SPEN's CBA for the Maentwrog – Porthmadog project demonstrated that reinforcing the network yields significant long-term benefits. The table below presents the NPV results for each option.

Options considered	Decision	Comment	10 years	15 years	30 years	45 years
Baseline: New 33kV 11kms circuit between Maentwrog grid to Porthmadog	Rejected	Discounted based on lower NPV against proposed option.	-	-	-	-
Option 1: Installation of new 132/33kV GT at Four Crosses fed from 33kms XLPE cable from Trawsfynydd GSP.	Rejected	Discounted based on higher scheme cost and lower NPV against proposed option.	-£23.26	-£32.07	-£37.29	-£41.31
Option 2: Establishment of new 33kV circuit to Porthmadog by looping into existing circuit between Maentwrog grid to Harlech primary substation.	Rejected	Discounted based on higher scheme cost and lower NPV against proposed option.	-£0.90	-£1.21	-£1.40	-£1.54
Option 3: Combination of flexibility services and baseline reinforcements.	**Adopted**	The proposed option enables to manage the network constraints during reinforcement delivery and renders better value to the customers.	£0.11	£0.04	-£0.00	-£0.04
Option 4: Installation of new 132/33kV GT at Porthmadog which is to be fed from 15.5kms XLPE cable from Trawsfynydd GSP.	Rejected	Discounted based on higher scheme cost and lower NPV against proposed option.	-£13.00	-£17.70	-£20.48	-£22.61

Table 5: SP Energy Networks cost benefit analysis results

A cost-benefit analysis (CBA) was conducted to compare the NPVs of various options. The table below shows the results for easy comparison. The baseline and rejected options have negative NPVs across all payback periods, indicating higher costs than benefits. The preferred option shows a slightly positive NPV at 10 and 15 years, suggesting a better financial outcome. Despite the 30 and 45-year NPVs being negative, they are less negative than the alternatives, making this the best long-term financial option.

3. Rationale for the Selected Option: SPEN justified the selection of the preferred option for the Maentwrog – Porthmadog project by comparing all alternatives and highlighting the technical and economic advantages. Specifically, the preferred option was chosen because:
    - Technical Advantages: It managed network constraints more effectively than other options, by combining flexibility services with baseline reinforcements.
    - Economic Advantages: It provided the best result in the Cost Benefit Analysis.

4. Sensitivity Analysis:
   i. Future Pathways Analysis:
      SPEN's analysis of the Maentwrog – Porthmadog project assessed sensitivity to future pathways like increased adoption of electric vehicles and heat pumps. This involved evaluating the impact on load and expenditure required for network reliability under different scenarios, such as Baseline, Consumer Transformation, and Leading the Way.
   ii. Losses Sensitivity:
      Additionally, SPEN evaluated the sensitivity of the proposed options to system losses. SPEN ensured that the design minimised system losses without compromising system performance or economic viability by optimising conductor sizes and configurations.
5. Regional Variations and Site-Specific Factors: SPEN's Maentwrog – Porthmadog project required extra considerations due to its location within the Snowdonia National Park and adjacent to the Llyn Peninsula Area of Outstanding Natural Beauty, among other environmental and historical areas in this location.
6. Cost Maturity and Confidence: Based on SPEN's detailed methodologies, historical data usage, and comprehensive cost assessments, it can be inferred that their cost maturity and confidence are high.

4.8 Deliverability and Risk

This section will provide commentary on the ability of the organization to deliver the proposed volumes and outputs associated with the proposals, detailing key risks.

It will detail the following (OFGE21):

- A summary of the outputs.
- The volume delivery profile on a year-by-year basis.
- A reference detailing the track record in ED1.
- Any proposed investment/outputs were included in the company's RIIO-ED1 plan.
- Any deliverability constraints and key delivery risks and mitigations.

It is also important to reiterate that the elements discussed here can be organised in the EJP according to the specific narrative structure that best supports the justification of the investment as does SPEN.

Example from SPEN (SPEN21)

1. Summary of Outputs: The proposed option involves establishing a new 33kV circuit between Maentwrog grid and Porthmadog substation and extending 33kV switchboards. It also includes contracting flexibility services from 2023/24 to 2025/26 to support the network during delivery. The project aims to release 20MVA capacity by the end of 2026/27.
2. Volume Delivery Profile: The project begins in 2024/25, with key milestones including the completion of the new 33kV circuit and the capacity release of 20MVA by 2026/27. The annual delivery profile ensures steady progress, mitigating risks related to resource allocation and unforeseen delays.
3. RIIO-ED1 Outputs: No outputs from this project are expected within the RIIO-ED1 period, as it is fully funded within RIIO-ED2. This ensures that the project's costs and benefits are appropriately allocated within the designated regulatory period.
4. Deliverability Constraints and Key Risks: The primary delivery risks include obtaining necessary approvals and managing traffic for the new 33kV circuit route. SPEN plans to mitigate these risks through proactive engagement with local authorities and comprehensive planning.
5. Cost and Volumes Profile: The project's cost and volumes profile includes a detailed breakdown of expenditures and resource allocation over the timeline, ensuring transparency and effective monitoring. For example:

   Total costs for the project are estimated at £5.794 million. The annual expenditure is distributed over the project timeline, with major spending occurring in 2024/25 and 2025/26.

Key Tables:

- Summary of Reinforcement Costs and Volumes: Provides a breakdown of costs and volumes for each project component.
- Cost Incidence Over the Project Period: Illustrates how total costs are distributed across different years, showing the annual financial commitment.

6. Environmental Considerations: SPEN ensures environmental impacts are minimised through careful planning and execution. For the Maentwrog – Porthmadog project, considerations include:
   - Environment and Sustainability
   - Operational and Embodied Carbon Emissions
   - Supply Chain Sustainability
   - Resource Use and Waste
   - Biodiversity/Natural Capital
   - Preventing Pollution
   - Visual Amenity
   - Climate Change Resilience

4.9. Conclusions

This section should provide a concise summary of the main conclusions and recommendations derived from the detailed analysis of costs, deliverability, and risk assessment. The conclusion reinforces the rationale for the preferred option and outlines significant findings and recommendations for moving forward. The goal is to provide a clear and definitive statement justifying the proposed investment based on the presented evidence.

Chapter 5

5. Methodology for Investment Justification in Spain

In this chapter, we will explore the methodology used in Spain to justify investments in the electricity distribution network. We will use Iberdrola's "Investment Plan 2023-2025 in the Valencian Community" as a representative example of the investment plans presented by autonomous communities in Spain (IBER22). Additionally, we will refer to the "Report on Annual and Multiannual Investment Plans of Companies Owning Electricity Distribution Facilities for the Period 2022-2024" by the CNMC to provide a broader overview (CNMC22). These documents will help us analyse and understand the structure and content of investment plans in Spain.

Typically, investment plans consist of a main document that provides context for all the projects belonging to an autonomous community and their respective annex that offers information about the projects (IBER22).

5.1 Main Investment Document

The main investment document provides context for the planned investments, ensuring an understanding of the goals and expected outcomes. The following sections elaborate on the typical structure and content of this document.

5.1.1 Introduction

The introduction section of investment plans for Spanish electricity distributors sets the context for the document. It generally includes the following elements (IBER22):

1. Purpose of the Document: This part states the primary objectives of the investment plan.
2. Regulatory Framework: References the relevant laws, decrees, and resolutions that the plan adheres to. This provides legitimacy and ensures that the document complies with national and regional regulations.

3. Scope of the Document: Defines the temporal and geographical coverage of the investment plan, specifying the period it covers and the specific autonomous community it belongs to.

Example from Iberdrola (IBER22)

- Purpose and Scope of the Document:
    - Iberdrola's plan states that the purpose of the document is to present the comprehensive investment plans for the electricity distribution network for the period 2023-2025 in the Valencian Community, following Article 39 of Decree Law 14/2020 of the Generalitat Valenciana.
- Regulatory Framework:
    - The preparation and submission process of the investment plans is regulated by Article 16 of Royal Decree 1048/2013, of December 27. The format and content are established by the Resolution of June 3, 2022, published in the BOE on June 10, 2022.

5.1.2 Defining Objectives in Investment Plans

The objectives section outlines the main goals of the investment plan. These objectives typically include meeting the growth in demand, improving the efficiency and sustainability of the network, increasing the resilience and reliability of the network, and promoting digitalisation and integration of renewable energies (IBER22).

Example from Iberdrola (IBER22)

- Meeting the Growth in Demand and Distributed Generation: Ensuring the network can accommodate new demands and connect distributed generation facilities.
- Improving Network Efficiency and Sustainability: Focusing on reducing losses, managing demand, and adopting sustainable technologies.
- Increasing Network Resilience and Reliability: Enhancing supply quality and minimising interruptions.

- Promoting Digitalisation and the Integration of Renewable Energies: Implementing automation and integrating energy storage systems.

5.1.3 Investments by Project Type

Spanish electricity distributors typically include a section in their investment plans that classifies investments by project type. This approach organises the extensive list of planned projects into manageable and understandable categories. While this method helps in summarising and organising the investment data, it can also be seen as somewhat simplistic. The section generally includes (IBER22):

- Categorisation of Investments: Investments are grouped into broad categories based on their nature and purpose. Common categories include high voltage and low voltage network developments, substation renewals, smart grid projects, and efficiency improvements.
- Summary Figures: Each category is accompanied by a total investment figure. This provides a high-level overview of the financial allocation for each type of project without delving into the specifics of individual projects.
- Annual Breakdown: The total investment for each category is often broken down by year, showing how funds are allocated over the planning period (e.g., 2023, 2024, 2025).

Example from Iberdrola

Project	Investment 2023	Investment 2024	Investment 2025
Development of High and Medium Voltage Networks	€36,732,444	€30,340,226	€18,643,520
Substation Renewals	€16,271,550	€21,392,134	€18,644,670
High Voltage Line Renewals	€183,416	€0	€624,162
Medium Voltage Line Renewals	€412,870	€451,852	€398,350
Low and Medium Voltage Network Extensions	€6,527,458	€6,661,069	€6,456,493
Medium and Low Voltage Network Development	€17,536,533	€21,139,013	€28,076,676
Medium and Low Voltage Network Renewals	€42,299,812	€44,008,060	€42,843,055
Smart Grid Enhancements	€27,720,501	€29,023,690	€27,104,607
Efficiency Improvements	€22,333,597	€19,786,049	€14,948,247
Gross Investment	**€170,018,181**	**€172,802,093**	**€157,739,779**
Revenue	-€12,219,456	-€7,921,340	-€6,968,441
Net Investment	**€157,798,725**	**€164,880,753**	**€150,771,338**

Table 1: Categorised Investment Figures for Iberdrola's 2023-2025 Investment Plan in Comunidad Valenciana

5.1.4 Presenting Investment Plans in TXT Format:

In Spanish investment plans for electricity distribution, the presentation of detailed project information is often done through annexes provided in a TXT format. This section briefly explains the format and purpose of these annexes, which include comprehensive data about each planned project.

5.2 Detailed Annex

The detailed annexes provide specific information about the projects included in the investment plans. According to the guidelines from the Boletín Oficial del Estado (BOE22), these annexes must follow a standardised format and include specific data fields for each project. The following sections outline the required contents of these annexes and provide an example from Iberdrola's investment plan for the Valencian Community (IBER22).

Note*: The codes used in the annexes are in Spanish, and their English meanings are provided for clarity.*

5.2.1 Macroeconomic Values Considered by the Distributor

The investment plans should start by providing the macroeconomic values considered by the distribution company. This section sets the economic context for the investment plan. It includes (BOE22):

- ANIO_PERIODO (Year Period): Specifies each year in the investment plan period.
- CREC_PIB (GDP Growth): Annual GDP growth percentage as forecasted by the Ministry of Economic Affairs and Digital Transformation.
- PIB_PREV (Estimated GDP): Nominal GDP for each year, based on the annual variation forecast.
- LIMITE_SECTOR (Sector Investment Limits): Total sector investment limit for the year, as specified by Article 16.1 of Royal Decree 1048/2013.

- INC_DEMANDA_SECTOR (Sector Demand Increases): Increase in electrical system demand in TWh, as established in system planning.

Example from Iberdrola (IBER22)

ANIO_PERIODO	CREC_PIB	PIB_PREV	LIMITE_SECTOR	INC_DEMANDA_SECTOR
2023	5,23	1381,27	1796	0
2024	4,01	1436,7	1868	0
2025	3,73	1490,35	1937	0

Table 2: Macroeconomic Values Considered by the Distributor from Iberdrola's Investment Plans

5.2.2 Summary of Investments Included in the Plan

The summary table provides a snapshot of the total planned investments, summarising financial commitments and project scope. It includes (BOE22):

- ANIO_PERIODO (Year Period): Specifies each year included in the investment plan period.
- LIMITE_EMPRESA (Company Limit): Investment limit for the distribution company (in euros) for the specified year, according to Article 16.2 of Royal Decree 1048/2013, considering possible increases as per Article 9.4 of Royal Decree 1125/2021.
- DEMANDA_EMPRESA_P0 (Company Demand Forecast): Forecasted demand for the distribution company (in MWh) for the year prior to the start of the investment plan period.
- INC_DEMANDA_EMPRESA_PRV (Expected Demand Increase): Forecasted increase in demand for the distribution company (in MWh) for the specified year of the investment plan period.
- FRRI (Retribution Rate Adjustment Factor): Retribution Rate Adjustment Factor, as specified in Article 16.10.e) of Royal Decree 1048/2013 and Circular 2/2019 by the CNMC.

- VPI_SUPERADO_PRV (Exceeded Investment Limit): Indicates if the investment volume with retribution rights exceeds the established limit for the specified year.
    - SI: exceeds the limit
    - NO: does not exceed the limit
- VOL_TOTAL_INV_PRV (Total Investment Volume): Total planned investment volume, including subsidies and transfers, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- AYUDAS_PRV (Planned Subsidies): Planned subsidies for the projects, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- FINANCIACION_PRV (Financing Details): Financing details for the projects, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- VPI_RETRIBUIBLE_PRV (Eligible Remuneration Volume): Volume of eligible remuneration investment, in euros, including the Retribution Rate Adjustment Factor (FRRI).
- NUM_PROYECTOS (Number of Projects): Total number of projects included in the distributor's investment plan for the specified year.
- VOL_TOTAL_INV_BT_PRV (Total Low-Voltage Investment Volume): Total planned investment volume for low-voltage networks, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- VOL_TOTAL_INV_GR_PRV (Total High-Voltage Investment Volume): Total planned investment volume for high-voltage networks aimed at increasing grid capacity for new electricity generation and self-consumption installations, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- VOL_TOTAL_INV_PRV_PRTR (Total PRTR Investment Volume): Total planned investment volume for projects identified with PRTR, including subsidies and transfers, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- AYUDAS_PRV_PRTR (Planned PRTR Subsidies): Volume of planned subsidies for PRTR projects, in euros, excluding the Retribution Rate Adjustment Factor (FRRI) and the amounts corresponding to subsidies from PRTR funds.

- FINANCIACION_PRV_PRTR (PRTR Financing Details): Volume of planned third-party financing for PRTR projects, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- VPI_RETRIBUIBLE_PRV_PRTR (Eligible PRTR Remuneration Volume): Volume of eligible remuneration investment for PRTR projects, in euros, including the Retribution Rate Adjustment Factor (FRRI).
- NUM_PROYECTOS_PRTR (Number of PRTR Projects): Total number of PRTR projects included in the distributor's investment plan for the specified year.

Example from Iberdrola (IBER22)

ANIO_PERIODO	LIMITE_EMPRESA	DEMANDA_EMPRESA_P0	INC_DEMANDA_EMPRESA_PRV	FRRI	VPI_SUPERADO_PRV
2023	712067000	93990	838	1.084.859	NO
2024	721533000	94836	845	1.084.859	NO
2025	575371000	95690	853	1.084.859	NO

VOL_TOTAL_INV_PRV	AYUDAS_PRV	FINANCIACION_PRV	VPI_RETRIBUIBLE_PRV	NUM_PROYECTOS	VOL_TOTAL_INV_BT_PRV
875005686.5	0	162981891.1	772445419.1	12522	47035718.82
864861438.5	0	143390027.2	782694754.1	10950	49888089.86
723921337.8	0	148915805.5	623799923.9	9589	40285799.32

Table 3: Summary of Investments Included in the Plan from Iberdrola's Investment Plans

5.2.3 Summary Table of Investments Included in the Investment Plan - Regional Breakdown

The summary table of investments included in the plan by autonomous community breakdown provides detailed information about how investments are distributed across different regions (BOE22). It includes (BOE22):

- CODIGO_CCAA (Community Code): Code representing the autonomous community where the distribution activity is carried out.
- ANIO_PERIODO (Year Period): Specifies each year in the investment plan period.

- VOL_TOTAL_INV_PRV_CCAA (Total Investment Volume): Total planned investment volume for the autonomous community, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- AYUDAS_PRV_CCAA (Planned Subsidies): Planned subsidies for projects in the autonomous community, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- FINANCIACION_PRV_CCAA (Financing Details): Volume of planned third-party financing for projects in the autonomous community, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- VPI_RETRIBUIBLE_PRV_CCAA (Eligible Remuneration Volume): Volume of eligible remuneration investment for projects in the autonomous community, in euros, including the Retribution Rate Adjustment Factor (FRRI).
- NUM_PROYECTOS_CCAA (Number of Projects): Total number of projects included in the investment plan for the autonomous community.
- VOL_TOTAL_INV_BT_PRV_CCAA (Low-Voltage Investment Volume): Total planned investment volume for low-voltage networks in the autonomous community, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- VOL_TOTAL_INV_GR_PRV_CCAA (High-Voltage Investment Volume): Total planned investment volume for high-voltage networks in the autonomous community, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- VOL_TOTAL_INV_PRV_CCAA_PRTR (PRTR Investment Volume): Total planned investment volume for PRTR-identified projects in the autonomous community, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- AYUDAS_PRV_CCAA_PRTR (Planned PRTR Subsidies): Planned subsidies for PRTR-identified projects in the autonomous community, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- FINANCIACION_PRV_CCAA_PRTR (PRTR Financing Details): Planned third-party financing for PRTR-identified projects in the autonomous community, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- VPI_RETRIBUIBLE_PRV_CCAA_PRTR (Eligible PRTR Remuneration Volume): Volume of eligible remuneration investment for PRTR-identified

projects in the autonomous community, in euros, including the Retribution Rate Adjustment Factor (FRRI).

- NUM_PROYECTOS_PRTR (Number of PRTR Projects): Total number of PRTR-identified projects included in the investment plan for the autonomous community.

Example from Iberdrola (IBER22)

CODIGO_CCAA	ANIO_PERIODO	VOL_TOTAL_INV__PRV_CCAA	AYUDAS_PRV_CCAA	FINANCIACION_PRV_CCAA
10	2023	200388785	0	42590057.81
10	2024	208909992.7	0	44029239.22
10	2025	173866553.7	0	23095215.63

VPI_RETRIBUIBLE_PRV_CCAA	NUM_PROYECTOS_CCAA	VOL_TOTAL_INV_BT_PRV_CCAA
171189370.2	2771	15880578.32
178872371.5	2953	16801894.83
16365642.5	2645	7377918.42

Table 4: Summary of Investments Included in the Plan (Regional Breakdown) from Iberdrola's Investment Plans

5.2.4 Projects Included in the Investment Plan

This section provides information about each project included in the investment plan. The section typically includes (BOE22):

- COD_PROYECTO (Project Code): Unique project code that remains unchanged until the project is completed and the installations are operational.
- NOMBRE (Name): Name of the project.
- CODIGO_CCAA_1 (Community Code 1): Code of the autonomous community where the project will be executed, corresponding with the INE code of the community.
- CODIGO_CCAA_2 (Community Code 2): Code of the autonomous community where the project will end if it spans multiple communities, corresponding with the INE code of the community.

- MEMO_DESCRIPTIVA (Descriptive Memo): Brief explanatory description of the project.
- VOL_TOTAL_INV_PREV_PROY (Total Planned Investment Volume): Total planned investment volume for the project, including aids and transfers, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- AYUDAS_PRV_PROY (Planned Subsidies): Planned subsidies for the project, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- FINANCIACION_PRV_PROY (Project Financing): Volume of third-party financing and transfers planned for the project, in euros, excluding the Retribution Rate Adjustment Factor (FRRI).
- VPI_RETRIBUIBLE_PRV_PROY (Eligible Retribution Investment Volume): Total planned investment volume for the project, eligible for system retribution in year N+2, including the Retribution Rate Adjustment Factor (FRRI).
- ESTADO (Status): Indicates the status of the project:
    - 0: Project without modifications.
    - 1: Project with modifications.
    - 2: New project.

Example from Iberdrola (IBER22)

CODIGO_PROYECTO	NOMBRE	CODIGO_CCAA_1	CODIGO_CCAA_2	MEMO_DESCRIPTIVA
00235372-P2019-CAT-25	INSTALACION SANT C. -200299M2- C/ BADAMERDE GARCIA	10	10	MEMORIA DEL PROYECTO: 00235372-P2019-CAT-25
00231111-P2019-0345	ST MANSGANA (ALJU) LIUBR HUERTO V ALIENTO	10	10	MEMORIA DEL PROYECTO: 00231111-P2019-0345
00257887-P2019-0456	SYMSONIA AGAR CURR DIGRIN DOOR	10	10	MEMORIA DEL PROYECTO: 00257887-P2019-0456

VOL_TOTAL_INV_PRV_PROY	AYUDAS_PRV_PROY	FINANCIACION_PRV_PROY	VPI_RETRIBUIBLE_PRV_PROY	ESTADO
3730	0	0	3281.61	2
17200	0	0	15161.6	2
17720	0	0	16111.6	2

Table 5: Projects Included in the Investment Plan from Iberdrola's Investment Plans

Note: *This example only includes the first three projects included in Iberdrola's plan. This list is ~60 pages long in the original document.*

5.2.5 High Voltage Distribution Lines

The investment plans include a section on high-voltage distribution lines. This section provides the following information about each high-voltage project planned (BOE22):

- COD_PROYECTO (Project Code): Unique code for the project, to remain unchanged until completion and commissioning.
- FINALIDAD (Purpose): Purpose type code.
  - AB: Connections to the barrier
  - ND: New Demand
  - AN: Adaptation to non-state regulations
  - RE: Renovation of equipment
  - GR: Increase in generation access capacity
  - RR: Rest
- IDENTIFICADOR_PY (Project Identifier): Unique identifier of the projected installation, to remain unchanged until commissioning.
- CINI_PRV (CINI Code): Standardized Identification Codes of installations according to the Circular 8/2021.
- COD_TIPO_INST (Installation Type Code): Code for the type of installation based on Order ITC/260/2015 and Circular 8/2021.
- CODIGO_CCAA_1 (Autonomous Community Code 1): INE code of the autonomous community where the line runs.
- CODIGO_CCAA_2 (Autonomous Community Code 2): INE code of the second autonomous community if the line crosses more than one region.
- ANIO_PREV_APS (Planned Year of Service): Year when the projected installation is planned to be commissioned.
- LONGITUD_PRV (Planned Length): Total length of the line in kilometers.
- CAPACIDAD_PRV (Planned Capacity): Total kVA of the line.

- VOL_INV_PREV (Planned Investment Volume): Total planned investment volume for the projected installation, including aids and transfers.
- AYUDAS_PRV (Planned Aids): Aids planned for the project in euros.
- FINANCIACION_PRV (Planned Financing): Volume of planned third-party financing for the project in euros.
- VPI_RETRIBUIBLE_PRV (Planned Eligible Investment Volume): Total planned investment volume for the project, eligible for remuneration under the retribution rate system.
- ESTADO (Status): Project status.
  - 0: No modifications
  - 1: With modifications
  - 2: New project
- ACTUACION_ELEGIBLE_PRTR (Eligible PRTR Action): Indicates if the action is eligible for subsidies under the PRTR funds.
  - PRTR: Candidate for eligibility
  - No: Not eligible

Example from Iberdrola (IBER22)

COD_PROYECTO	FINALIDAD	IDENTIFICADOR_PY	CINI_PRV	COD_TIPO_INST	CODIGO_CCAA_1	CODIGO_CCAA_2	ANIO_PREV_APS
00001906-10055493	ND	L80030309_1	I20411MO	TI-9VZ	10	10	2023
0002187-10055301	ND	L80030406_6	I20411MO	TI-9VZ	10	10	2023
0002203-10047577	ND	L80030007_3	I20411MO	TI-9VZ	10	10	2023

LONGITUD_PRV	CAPACIDAD_PRV	VOL_INV_PRV	AYUDAS_PRV	FINANCIACION_PRV	VPI_RETRIBUIBLE_PRV	ESTADO
1.9	0	126755.67	0	0	137522.88	2 NO
1.7	0	147320.66	0	0	159822.14	2 NO
3.2	0	178964.08	0	0	194510.79	2 NO

Table 6: High Voltage Distribution Lines Plan from Iberdrola's Investment Plans

Note: *This example only includes the first three high-voltage distribution lines included in Iberdrola's plan. This list is ~30 pages long in the original document.*

5.2.6 Low Voltage Distribution Lines

The section on low voltage distribution lines provides information about investments in low voltage infrastructure. It details projects aimed at improving the reliability and capacity of the low voltage network. It includes (BOE22):

- COD_PROYECTO (Project Code): Unique code for the project, to remain unchanged until completion and commissioning.
- FINALIDAD (Purpose): Purpose type code.
  - AB: Connections to the barrier
  - ND: New Demand
  - AN: Adaptation to non-state regulations
  - RE: Renovation of equipment
  - GR: Increase in generation access capacity
  - RR: Rest
- IDENTIFICADOR_PY (Project Identifier): Unique identifier of the projected installation, to remain unchanged until commissioning.
- CINI_PRV (CINI Code): Standardized Identification Codes of installations according to the Circular 8/2021.
- COD_TIPO_INST (Installation Type Code): Code for the type of installation based on Order ITC/260/2015 and Circular 8/2021.
- CODIGO_CCAA_1 (Autonomous Community Code 1): INE code of the autonomous community where the line runs.
- CODIGO_CCAA_2 (Autonomous Community Code 2): INE code of the second autonomous community if the line crosses more than one region.
- ANIO_PREV_APS (Planned Year of Service): Year when the projected installation is planned to be commissioned.
- LONGITUD_PRV (Planned Length): Total length of the line in kilometers.
- CAPACIDAD_PRV (Planned Capacity): Total kVA of the line.
- VOL_INV_PREV (Planned Investment Volume): Total planned investment volume for the projected installation, including aids and transfers.

- AYUDAS_PRV (Planned Aids): Aids planned for the project in euros.
- FINANCIACION_PRV (Planned Financing): Volume of planned third-party financing for the project in euros.
- VPI_RETRIBUIBLE_PRV (Planned Eligible Investment Volume): Total planned investment volume for the project, eligible for remuneration under the retribution rate system.
- ESTADO (Status): Project status.
  - 0: No modifications
  - 1: With modifications
  - 2: New project
- ACTUACION_ELEGIBLE_PRTR (Eligible PRTR Action): Indicates if the action is eligible for subsidies under the PRTR funds.
  - PRTR: Candidate for eligibility
  - No: Not eligible

Example from Iberdrola (IBER22)

COD_PROYECTO	FINALIDAD	IDENTIFICADOR_PY	CINI_PRV	COD_TIPO_INST	CODIGO_CCAA_1	CODIGO_CCAA_2	ANIO_PREV_APS
00208987-101046543	ND	600000683	I20511EB	TI-11Y	10	10	2023
00209160-101047338	ND	904613003	I20511CB	TI-11X	10	10	2023
00185478-ICT-CV	ND	ICT-CV-L34	I20511DB	TI-11Y	10	10	2023

LONGITUD_PRV	CAPACIDAD_PRV	VOL_INV_PREV	AYUDAS_PRV	FINANCIACION_PRV	VPI_RETRIBUIBLE_PRV	ESTADO
0.05	0	9961.58	0	0	10896.91	2
0.05	0	10961.58	0	0	11891.77	2
0.173	0	280601.06	0	280601.06	0	2

Table 7: Low Voltage Distribution Lines Plan from Iberdrola's Investment Plans

Note: *This example only includes the first three low-voltage distribution lines included in Iberdrola's plan. This list is a couple of pages long in the original document.*

5.2.7 Other Assets Not Included in Physical Units

This section covers other assets necessary for the distribution activity that are not included in the physical units of the electricity assets. It ensures all necessary investments are captured and justified (BOE22).

Explanation of the Summary Table (BOE22):

- COD_PROYECTO (Project Code): Unique code for the project related to necessary assets for distribution activities, to remain unchanged until the project is completed and the assets are effectively in service.
- FINALIDAD (Purpose): Purpose type code.
  - AB: Connections to the barrier
  - ND: New Demand
  - AN: Adaptation to non-state regulations
  - RE: Renovation of equipment
  - GR: Increase in generation access capacity
  - RR: Rest
- IDENTIFICADOR_PY (Project Identifier): Unique identifier for the projected asset installation, to remain unchanged until the asset is effectively in service.
- CINI_PRV (CINI Code): Standardized Identification Codes of installations according to Circular 8/2021.
- CODIGO_CCAA (Autonomous Community Code): INE code of the autonomous community where the asset is located.
- ANIO_PREV_ES (Planned Year of Service): Year when the projected asset is planned to be commissioned.
- VOL_INV_PREV (Planned Investment Volume): Total planned investment volume for the projected asset, including aids and transfers, in euros.
- AYUDAS_PRV (Planned Aids): Aids planned for the projected asset in euros.
- FINANCIACION_PRV (Planned Financing): Volume of planned third-party financing for the projected asset in euros.

- VPI_RETRIBUIBLE_PRV (Planned Eligible Investment Volume): Total planned investment volume for the projected asset, eligible for remuneration under the retribution rate system.
- ESTADO (Status):
    - 0: Element without modifications.
    - 1: Element with modifications.
    - 2: New element.
- ACTUACION_ELEGIBLE_PRTR (Eligible PRTR Action): Indicates if the action is eligible for subsidies under the PRTR funds.
    - PRTR: Candidate for eligibility
    - No: Not eligible

No example available from Iberdrola Investment Plans

5.2.8 Substations Equipped with Circuit Breaker

The section on substations equipped with circuit breakers provides detailed information about each substation project aimed at enhancing the reliability and capacity of the distribution network. This section ensures all necessary investments in substations are captured and justified (BOE22).

Explanation of the Summary Table (BOE22):

- COD_PROYECTO (Project Code): Unique code for the project, to remain unchanged until completion and commissioning.
- FINALIDAD (Purpose): Purpose type code.
    - AB: Connections to the barrier
    - ND: New Demand
    - AN: Adaptation to non-state regulations
    - RE: Renovation of equipment
    - GR: Increase in generation access capacity
    - RR: Rest

- IDENTIFICADOR_PY (Project Identifier): Unique identifier of the projected installation, to remain unchanged until commissioning.
- CINI_PRV (CINI Code): Standardized Identification Codes of installations according to Circular 8/2021.
- COD_TIPO_INST (Installation Type Code): Code for the type of installation based on Order ITC/260/2015 and Circular 8/2021.
- CODIGO_CCAA (Autonomous Community Code): INE code of the autonomous community where the substation is located.
- ANIO_PREV_APS (Planned Year of Service): Year when the projected installation is planned to be commissioned.
- VOL_INV_PREV (Planned Investment Volume): Total planned investment volume for the projected installation, including aids and transfers, not including FRRI.
- AYUDAS_PRV (Planned Aids): Aids planned for the project in euros, not including FRRI.
- FINANCIACION_PRV (Planned Financing): Volume of planned third-party financing for the project in euros, not including FRRI.
- VPI_RETRIBUIBLE_PRV (Planned Eligible Investment Volume): Total planned investment volume for the project, eligible for remuneration under the retribution rate system, including FRRI.
- ESTADO (Status): Project status.
    - 0: No modifications
    - 1: With modifications
    - 2: New project
- ACTUACION_ELEGIBLE_PRTR (Eligible PRTR Action): Indicates if the action is eligible for subsidies under the PRTR funds.
    - PRTR: Candidate for eligibility
    - No: Not eligible

Example from Iberdrola (IBER22)

COD_PROYECTO	FINALIDAD	IDENTIFICADOR_PY	CINI_PRV	COD_TIPO_INST	CODIGO_CCAA
00002066-100613189	GR	322301_1	I28C2A2O	TI-102V	10
00072804-100780693	ND	327701_1	I28C2A2O	TI-102V	10
00072804-100780693	ND	327701_2	I28C2A2O	TI-102V	10

ANIO_PREV_APS	VOL_INV_PREV	AYUDAS_PRV	FINANCIACION_PRV	VPI_RETRIBUIBLE_PRV	ESTADO
2023	182652.06	0	41281.56	153367.06	2
2023	19192.9	0	11440.81	8409.92	2
2023	19192.9	0	11440.81	8409.92	2

Table 8: Substations Equipped with Circuit Breaker Plan from Iberdrola's Investment Plans

Note: *This example only includes the first three substations equipped with circuit breaker included in Iberdrola's plan. This list is a ~20 pages long in the original document.*

5.2.9 Planned Machines

The section on planned machines details each project involving the installation of new machines, such as transformers or other essential equipment, aimed at enhancing the network's capacity and efficiency. This section ensures all machine-related investments are thoroughly documented and justified (BOE22).

Explanation of the Summary Table (BOE22):

- COD_PROYECTO (Project Code): Unique project code, must remain unchanged until the project is completed and the installations are in service.
- FINALIDAD (Purpose): Purpose type code.
  - AB: Connections to the barrier
  - ND: New Demand

- AN: Adaptation to non-state regulations
- RE: Renovation of equipment
- GR: Increase in generation access capacity
- RR: Rest

- IDENTIFICADOR_PY (Project Identifier): Unique identifier of the projected installation, must remain unchanged until commissioning.
- CINI_PRV (CINI Code): Standardized Identification Codes of installations. Table 3 of Annex II of Circular 8/2021, December 1.
- COD_TIPO_INST (Installation Type Code): Code for the type of installation based on Order ITC/260/2015, December 11, or the new codes established in Circular 8/2021, December 1.
- CODIGO_CCAA (Autonomous Community Code): INE code of the autonomous community where the substation is located.
- ANIO_PREV_APS (Planned Year of Service): Year planned for commissioning of the projected installation.
- CAPACIDAD_PRV (Capacity): Capacity in MVA
- VOL_INV_PREV (Planned Investment Volume): Total planned investment volume for the projected installation, including aids and transfers, in euros. This amount does not include the Factor de Retardo Retributivo de la Inversión (FRRI).
- AYUDAS_PRV (Planned Aids): Planned aids for the projected installation, in euros, excluding FRRI. It includes aids for all planned actions, including those eligible for PRTR funds.
- FINANCIACION_PRV (Planned Financing): Volume of planned third-party financing for the project, in euros, excluding FRRI. It includes financing for all planned actions, including those eligible for PRTR funds
- VPI_RETRIBUIBLE_PRV (Planned Eligible Investment Volume): Total planned investment volume for the project, eligible for remuneration under the retribution rate system, including FRRI.
- ESTADO (Status): Project status.
    - 0: No modifications
    - 1: With modifications

  - 2: New project
- ACTUACION_ELEGIBLE_PRTR (Eligible PRTR Action): Indicates if the action is eligible for subsidies under PRTR funds.
  - PRTR: Candidate for eligibility
  - No: Not eligible

Example from Iberdrola (IBER22)

COD_PROYECTO	FINALIDAD	IDENTIFICADOR_PY	CINI_PRV	COD_TIPO_INST	CODIGO_CCAA
00001726-100470554	GR	3507_1	I27121NO	TI-159UA	10
00001729-100429749	ND	3585_1	I27341FO	TI-164V	10
00001729-100429749	ND	3585_2	I27341GO	TI-164V	10

ANIO_PREV_APS	VOL_INV_PREV	AYUDAS_PRV	FINANCIACION_PRV	VPI_RETRIBUIBLE_PRV	ESTADO
2023	225	1899026	0	2060175.45	2
2023	20	334752.08	0	334752.08	2
2023	25	418439.53	0	414272.26	2

Table 9: Machines Plan from Iberdrola's Investment Plans

Note: *This example only includes the first three machines included in Iberdrola's plan. This list is ~10 pages long in the original document.*

5.2.10 Planned Dispatches

The section on planned dispatches details each project involving the installation of new dispatches, aimed at improving the control and management of the distribution network. This section ensures that all dispatch-related investments are thoroughly documented and justified (BOE22).

Explanation of the Summary Table (BOE22):

- COD_PROYECTO (Project Code): Unique code for the project, to remain unchanged until completion and commissioning.
- FINALIDAD (Purpose): Purpose type code.
    - AB: Connections to the barrier
    - ND: New Demand
    - AN: Adaptation to non-state regulations
    - RE: Renovation of equipment
    - GR: Increase in generation access capacity
    - RR: Rest
- IDENTIFICADOR_PY (Project Identifier): Unique identifier of the projected installation, to remain unchanged until commissioning.
- CINI_PRV (CINI Code): Standardized Identification Codes of installations according to the Circular 8/2021.
- CODIGO_CCAA (Autonomous Community Code): INE code of the autonomous community where the dispatch is located.
- ANIO_PREV_APS (Planned Year of Service): Year when the projected installation is planned to be commissioned.
- VOL_INV_PREV (Planned Investment Volume): Total planned investment volume for the projected installation, including aids and transfers.
- AYUDAS_PRV (Planned Aids): Aids planned for the project in euros.
- FINANCIACION_PRV (Planned Financing): Volume of planned third-party financing for the project in euros.
- VPI_RETRIBUIBLE_PRV (Planned Eligible Investment Volume): Total planned investment volume for the project, eligible for remuneration under the retribution rate system.
- ESTADO (Status): Project status.
    - 0: No modifications
    - 1: With modifications
    - 2: New project
- ACTUACION_ELEGIBLE_PRTR (Eligible PRTR Action): Indicates if the action is eligible for subsidies under the PRTR funds.

- PRTR: Candidate for eligibility
- No: Not eligible

Example from Iberdrola (IBER22)

COD_PROYECTO	FINALIDAD	IDENTIFICADOR_PY	CINI_PRV	CODIGO_CCAA	ANIO_PREV_APS	VOL_INV_PREV	AYUDAS_PRV	VPI_RETRIBUIBLE_PRV	ESTADO
0005852-CT-IND-432110	ND	432110028	I2362200	10	2023	8332.5	0	9039.59	2
0005853-CT-IND-432110	ND	432110029	I2362200	10	2023	8332.5	0	9039.59	2
00074905-MUSEROS P-2	RE	3630_1	I2362100	10	2023	205873.04	0	223343.22	2

Table 10: Planned Dispatches Plan from Iberdrola's Investment Plans

Note: *This example only includes the first three planned dispatches included in Iberdrola's plan. This list is ~70 pages long in the original document.*

5.2.11 Reliability Improvement Elements

The section on reliability improvement elements focuses on planned investments aimed at enhancing the reliability of the electricity distribution network. This section ensures that all reliability-related investments are clearly documented and justified (BOE22).

Explanation of the Summary Table (BOE22):

- COD_PROYECTO (Project Code): Unique code for the project, to remain unchanged until completion and commissioning.
- FINALIDAD (Purpose): Purpose type code.
  - AB: Connections to the barrier
  - ND: New Demand
  - AN: Adaptation to non-state regulations
  - RE: Renovation of equipment
  - GR: Increase in generation access capacity
  - RR: Rest

- IDENTIFICADOR_PY (Project Identifier): Unique identifier of the projected installation, to remain unchanged until commissioning.
- CINI_PRV (CINI Code): Standardized Identification Codes of installations according to the Circular 8/2021.
- COD_TIPO_INST (Installation Type Code): Code for the type of installation based on Order ITC/2660/2015 and Circular 8/2021.
- CODIGO_CCAA (Autonomous Community Code): INE code of the autonomous community where the projected asset is located.
- ANIO_PREV_APS (Planned Year of Service): Year when the projected installation is planned to be commissioned.
- VOL_INV_PREV (Planned Investment Volume): Total planned investment volume for the projected installation, including aids and transfers.
- AYUDAS_PRV (Planned Aids): Aids planned for the project in euros.
- FINANCIACION_PRV (Planned Financing): Volume of planned third-party financing for the project in euros.
- VPI_RETRIBUIBLE_PRV (Planned Eligible Investment Volume): Total planned investment volume for the project, eligible for remuneration under the retribution rate system.
- ESTADO (Status): Project status.
    - 0: No modifications
    - 1: With modifications
    - 2: New project
- ACTUACION_ELEGIBLE_PRTR (Eligible PRTR Action): Indicates if the action is eligible for subsidies under the PRTR funds.
    - PRTR: Candidate for eligibility
    - No: Not eligible5.2.12 Planned Transformation Centers

Example from Iberdrola (IBER22)

COD_PROYECTO	FINALIDAD	IDENTIFICADOR_PY	CINI_PRV	COD_TIPO_INST	CODIGO_CCAA
00213724-PD2330-1120	ND	35077701_1	I2640723	TI-187A	10
00213726-PD2330-1124	ND	35077701_2	I2640723	TI-187A	10
00213725-PD2330-1121	ND	35077801_1	I2640723	TI-187A	10

ANIO_PREV_APS	VOL_INV_PREV	AYUDAS_PRV	FINANCIACION_PRV	VPI_RETRIBUIBLE_PRV	ESTADO
2023	10200	0	0	11065.56	2
2023	10200	0	0	11065.56	2
2023	10200	0	0	11065.56	2

Table 11: Reliability Improvement Elements Plan from Iberdrola's Investment Plans

Note: *This example only includes the first three reliability improvement elements included in Iberdrola's plan. This list is a ~30 pages long in the original document.*

5.2.12 Transformation Centers

The section on planned transformation centers details the investments planned for installing and upgrading transformation centers within the electricity distribution network. This section is crucial for ensuring that all transformation-related investments are clearly documented and justified (BOE22).

Explanation of the Summary Table (BOE22):

- COD_PROYECTO (Project Code): Unique code for the project, to remain unchanged until completion and commissioning.
- FINALIDAD (Purpose): Purpose type code.
  - AB: Connections to the barrier
  - ND: New Demand
  - AN: Adaptation to non-state regulations
  - RE: Renovation of equipment
  - GR: Increase in generation access capacity
  - RR: Rest
- IDENTIFICADOR_PY (Project Identifier): Unique identifier of the projected installation, to remain unchanged until commissioning.

- CINI_PRV (CINI Code): Standardized Identification Codes of installations according to the Circular 8/2021.
- COD_TIPO_INST (Installation Type Code): Code for the type of installation based on Order ITC/2660/2015 and Circular 8/2021.
- CODIGO_CCAA (Autonomous Community Code): INE code of the autonomous community where the transformation center is located.
- ANIO_PREV_APS (Planned Year of Service): Year when the projected installation is planned to be commissioned.
- VOL_INV_PREV (Planned Investment Volume): Total planned investment volume for the projected installation, including aids and transfers.
- AYUDAS_PRV (Planned Aids): Aids planned for the project in euros.
- FINANCIACION_PRV (Planned Financing): Volume of planned third-party financing for the project in euros.
- VPI_RETRIBUIBLE_PRV (Planned Eligible Investment Volume): Total planned investment volume for the project, eligible for remuneration under the retribution rate system.
- ESTADO (Status): Project status.
    - 0: No modifications
    - 1: With modifications
    - 2: New project
- ACTUACION_ELEGIBLE_PRTR (Eligible PRTR Action): Indicates if the action is eligible for subsidies under the PRTR funds.
    - PRTR: Candidate for eligibility
    - No: Not eligible

Example from Iberdrola (IBER22)

COD_PROYECTO	FINALIDAD	IDENTIFICADOR_PY	CINI_PRV	COD_TIPO_INST	CODIGO_CCAA
00062190-CT-IND-101011	RE	1010112	I22454JS	TI-85U	10
00062248-CT-IND-303000	RE	3030001_1	I22453OI	TI-49W	10
00062301-CT-IND-505004	RE	5050046_1	I22454JI	TI-75U	10

ANIO_PREV_APS	VOL_INV_PREV	AYUDAS_PRV	FINANCIACION_PRV	VPI_RETRIBUIBLE_PRV	ESTADO
2023	19944.13	0	0	21636.57	2
2023	19944.13	0	0	21636.57	2
2023	19944.13	0	0	21636.57	2

Table 12: Transformation Centers Plan from Iberdrola's Investment Plans

Note: *This example only includes the first three transformation centers included in Iberdrola's plan. This list is ~40 pages long in the original document.*

Chapter 6

6. Evaluation and Proposals for Improving Investment Justification in Spain

This chapter evaluates the current methodology for justifying investments in Spain's electricity distribution networks. By comparing it with the structured approach used in the UK, particularly the RIIO-ED2 framework and Engineering Justification Papers (EJPs) from SP Energy Networks (SPEN), we aim to identify strengths and weaknesses in the Spanish approach. Based on this comparative analysis, we will propose enhancements to improve the investment justification process in Spain.

The conclusions in this chapter are derived from the analyses in Chapters 4 and 5, combined with the relevant documents from both countries used in those chapters.

6.1 Context and Objectives

The investment justification process is critical for the development and modernisation of electricity distribution networks. In Spain, the process is guided by the National Commission on Markets and Competition (CNMC). Conversely, the UK employs a highly structured approach through the RIIO-ED2 framework, overseen by Office of Gas and Electricity Markets (Ofgem).

This section sets the context for the evaluation and comparison that follows. We will briefly summarise the methodologies outlined in Chapters 4 and 5 and state the specific objectives of this chapter.

6.1.1 Summary of Regulatory Frameworks and Methodologies

In Chapter 4, we examined the UK's RIIO-ED2 framework, focusing on the structured approach guided by Ofgem for justifying investments. The key elements of this methodology include a standardised front cover, a detailed technical governance process, thorough background information, a comprehensive needs case, option evaluation, and a detailed analysis of costs and risks. This approach ensures robust decision-making in investment planning (OFGE21).

Chapter 5 provided an overview of the Spanish approach, highlighting the processes followed by major distributors such as Iberdrola. The investment plans include a main investment document supported by detailed annexes. These plans aim to address the growth in demand, improve network efficiency, enhance resilience, and promote the integration of renewable energy sources (IBER22).

6.1.2 Objectives

The goal is to assess the Spanish approach, compare it with the UK model, and propose actionable recommendations to enhance the Spanish methodology.

The primary objectives of this chapter are:

- Evaluation of the Spanish approach to investment justification: Assess the strengths and weaknesses of the current Spanish methodology.
- Comparison with the UK approach: Compare the Spanish approach with the UK's structured methodology, highlighting key differences and potential areas for improvement.
- Proposals for improvement: Develop recommendations for enhancing the Spanish investment justification process by incorporating best practices from the UK model.
- Expected benefits and implementation feasibility: Discuss the anticipated benefits of the proposed improvements and evaluate their feasibility within the Spanish regulatory and operational context.

With these objectives in mind, the following sections will provide a detailed evaluation of the Spanish approach, draw comparisons with the UK model, and propose a refined methodology tailored for Spain's specific needs and regulatory environment.

6.2 Evaluation of the Spanish Approach to Investment Justification

As exemplified by Iberdrola's "Investment Plan 2023-2025 in the Valencian Community," the Spanish methodology for justifying investments in electricity distribution networks follows a comprehensive yet somewhat fragmented structure. This section evaluates the strengths and weaknesses of this approach, referencing relevant regulatory documents and the structure of the investment plans themselves (IBER22; CNMC22).

6.2.1 Elements to Evaluate in an Investment Plan

When evaluating whether an investment plan for electricity distribution projects is effective, several key elements should be considered:

- Clarity and structure: The plan should have a clear and logical structure, with well-defined sections for different types of investments.
- Detail and specificity: Each project within the plan should be detailed, providing specifics on objectives, costs, expected outcomes, and timelines.
- Alignment with regulatory requirements: The plan should comply with national and regional regulations, ensuring legitimacy and adherence to required standards.
- Financial justification: There should be a thorough financial analysis, including cost-benefit evaluations, funding sources, and economic impacts.
- Strategic objectives: The plan should align with broader strategic goals, such as improving network efficiency, integrating renewable energy, and enhancing resilience.
- Transparency and accountability: The process for developing and approving the plan should be transparent, with clear accountability for the implementation and outcomes.

6.2.2 Spanish Investment Plan Structure and Content

The Spanish investment plans, as detailed in Iberdrola's documentation and the CNMC report, generally follow a structured format but present certain limitations (IBER22; CNMC22).

Main Investment Document

- Introduction: The introduction sets the context but can be somewhat generic, often lacking a detailed linkage with the specific projects (IBER22).
- Objectives: Objectives are clearly defined but tend to be broad. There is often a gap in connecting these objectives directly to individual projects listed in extensive annexes (IBER22).
- Investments by project type: This section categorises projects broadly. While this helps in summarising the investments, it lacks the granularity needed to understand individual project impacts fully (IBER22).

Detailed Annexes

- Format and data fields: The annexes in TXT format provide comprehensive data fields for each project, including project codes, purposes, and investment volumes (IBER22). However, the presentation can be cumbersome, and navigating through extensive lists to find specific project details is challenging.
- Project specificity: While the annexes list numerous projects, each line provides minimal information, often limited to basic identifiers and financial figures without detailed descriptions of expected outcomes or implementation strategies (IBER22).

6.2.3 Strengths and Weaknesses of the Spanish Approach

Strengths of the Spanish Approach

- Comprehensive coverage: The plans include a wide range of projects, addressing various aspects of network development, from high voltage lines to smart grids and renewable integration (IBER22).
- Regulatory compliance: The plans adhere to established regulatory frameworks, ensuring that they meet national and regional requirements (CNMC22).
- Categorisation of investments: Grouping projects by type provides a high-level overview of investment distribution, helping stakeholders understand the focus areas (IBER22).

Weaknesses of the Spanish Approach

- Fragmented presentation: The main document and detailed annexes are often disjointed, making it difficult to see how specific projects contribute to the overall objectives (IBER22).
- Lack of detailed project descriptions: The investment plans provide limited detail on individual projects, which hampers a thorough evaluation of their necessity, expected impact, and implementation feasibility (IBER22).
- Overemphasis on financial figures: The focus on financial metrics without sufficient contextual information about project goals and benefits can obscure the strategic value of the investments (IBER22).
- Inadequate linkage between objectives and projects: There is often a disconnect between the high-level objectives stated in the main document and the specific projects listed in the annexes. This makes it challenging to assess whether the projects are effectively addressing the stated goals (IBER22).

6.2.4 Critical Assessment

The Spanish approach to justifying investments in electricity distribution networks is commendable in its efforts to cover a broad range of projects and comply with regulatory standards (CNMC22; IBER22). However, the fragmented nature of the documentation and the lack of detailed project information significantly weaken its effectiveness.

Fragmented Documentation

The primary issue lies in the presentation and granularity of information. Having a main document that sets objectives and provides broad financial figures, paired with annexes that list projects in a terse format, creates a scenario where it is challenging to trace the alignment of specific projects with strategic goals. This approach could benefit from a more integrated format where each project's contribution to overall objectives is clearly articulated, supported by detailed descriptions, timelines, and expected outcomes.

Lack of Detailed Project Information

Another significant shortcoming is the lack of detailed information for each project. The documentation lists projects without providing comprehensive breakdowns of costs, timelines, and specific objectives each project aims to achieve (IBER22). Without this level of detail, stakeholders are left with an incomplete picture, making it difficult to assess the viability and strategic importance of the projects.

Overemphasis on Financial Figures

Although financial metrics are crucial, the current documentation often lacks balance with qualitative assessments. The focus is heavily on economic data, such as total investment volumes and planned aids, while providing limited context on the projects' strategic value or expected benefits (CNMC22). This overemphasis can obscure the broader strategic value of the investments, as there is insufficient explanation of the strategic impact or specific benefits of each project.

Insufficient Integration with Strategic Goals

There is a notable difficulty in linking individual projects to the broader strategic goals outlined in the main document. While the Spanish methodology provides a high-level overview of objectives, it fails to explicitly connect these objectives with specific projects (CNMC22). This disconnection hinders the ability to evaluate whether the investments are effectively addressing the strategic priorities of the electricity distribution network.

Inadequate Financial Justification

The financial analysis in the Spanish plans often lacks depth. A thorough financial justification should include cost-benefit evaluations, a clear identification of funding sources, and an analysis of the economic impacts of the investments (CNMC22). Presenting broad financial figures without these critical aspects undermines the robustness of the financial justification.

Lack of Transparency and Accountability

Transparency in the decision-making process is crucial for the credibility and effectiveness of the investment justification process. The current Spanish approach could improve by providing more explicit documentation on how decisions are made, the criteria used for prioritising projects, and the expected outcomes. Clearer documentation would also enhance accountability, ensuring that all stakeholders understand the rationale behind investment decisions.

6.3 Comparison with the UK Approach

The UK approach to investment justification in electricity distribution networks, exemplified by SP Energy Networks' Engineering Justification Papers (EJPs) under the RIIO-ED2 framework, provides a structured and detailed methodology that contrasts sharply with the Spanish approach. This comparison is derived from the detailed analysis presented in Chapters 4 and 5, where we examined the methodologies and regulatory frameworks of both countries. This section highlights the differences and potential areas for improvement in the Spanish system.

6.3.1 Clarity and Structure

The UK investment justification documents follow a highly standardised and structured format. This format includes a front cover summarising key project details, such as the project title, reference number, and summary of the need for the investment. It also includes detailed sections on technical governance, background information, needs case, option evaluation, and risk assessment (OFGE21). This clarity and structure ensure that the investment plans are easy to follow and review, facilitating a thorough understanding of each project's rationale and expected outcomes.

In contrast, the Spanish investment plans, while comprehensive, suffer from fragmentation. The main document outlines broad objectives and financial figures, while the annexes list individual projects in a terse format. This structure makes it challenging to trace the alignment of specific projects with strategic goals. The lack of an integrated format means that reviewers must piece together information from multiple documents to get a complete picture of the project's purpose and impact (IBER22; CNMC22).

6.3.2 Detail and Specificity

UK EJPs provide detailed descriptions for each project, including objectives, costs, expected outcomes, timelines, and a thorough needs case. Each project is justified with a detailed cost-benefit analysis, risk assessment, and sensitivity analysis, ensuring that all aspects of the project are well-documented and justified (SPEN21). This level of detail allows stakeholders to understand precisely what each project aims to achieve, how it will be implemented, and what risks are involved.

The Spanish approach, however, often lacks this level of detail. While the main document provides an overview, the individual projects listed in the annexes typically include minimal information, often limited to basic identifiers and financial figures without detailed descriptions of expected outcomes or implementation strategies (IBER22). This lack of specificity can make it difficult to assess the true value and feasibility of each project, as well as to monitor progress and measure success.

6.3.3 Financial Justification

The financial justification in the UK approach includes detailed cost-benefit evaluations, funding sources, and economic impacts. The financial analysis is integrated with qualitative assessments, providing a holistic view of each project's strategic importance and potential impact. This approach ensures that investments are not only financially viable but also strategically aligned with broader network goals (SPEN21).

In Spain, the investment plans emphasise financial metrics such as total investment volumes and planned aids. However, there is often an overemphasis on financial figures without sufficient contextual information about the project's goals and benefits. For instance, the plans present extensive financial data (e.g., investment volumes, subsidies, and financing details) but do not explain the strategic impact or specific benefits of each project in detail. This can obscure the strategic value of the investments and hinder a comprehensive evaluation of their effectiveness (IBER22).

6.3.4 Alignment with Strategic Objectives

UK investment plans are closely aligned with broader strategic objectives such as improving network efficiency, integrating renewable energy, and enhancing resilience. Each project's contribution to these objectives is clearly articulated, supported by detailed descriptions, timelines, and expected outcomes. This alignment ensures that all investments are strategically justified and contribute to the overarching goals of the electricity distribution network (OFGE21).

In the Spanish plans, while the objectives are clearly defined, there is often a gap in connecting these objectives directly to individual projects. The fragmented nature of the documentation makes it challenging to assess whether the projects are effectively addressing the stated goals. For example, the objectives may include enhancing network resilience or integrating renewable energy, but the detailed annexes do not consistently show how each project contributes to these objectives. This disconnect can make it difficult to ensure that investments are strategically targeted and aligned with long-term network goals (IBER22).

6.3.5 Transparency and Accountability

The UK approach ensures transparency and accountability through clear documentation and a rigorous technical governance process. Each project undergoes multiple stages of review and approval, ensuring that all aspects are thoroughly evaluated and documented. This process includes stakeholder consultations, independent reviews, and regular progress reports, which help maintain accountability and transparency throughout the investment lifecycle (SPEN21).

The Spanish methodology, though compliant with regulatory requirements, could benefit from enhanced transparency and accountability. The fragmented presentation and lack of detailed project descriptions can make it difficult to trace decision-making processes and hold stakeholders accountable. For example, while the plans provide extensive financial data, they often lack detailed justifications for individual projects and clear documentation of decision-making criteria. Enhancing transparency and accountability would involve providing more detailed project descriptions, clearer links between objectives and projects, and more thorough documentation of the decision-making process (IBER22; CNMC22).

6.3.6 Conclusion of the Comparison with the UK Approach

In summary, the UK approach to investment justification in electricity distribution networks offers a more structured, detailed, and transparent methodology compared to the Spanish system. By adopting some of the best practices from the UK model, Spain could enhance the effectiveness of its investment justification process, ensuring that investments are well-documented, strategically aligned, and transparently reviewed. This would involve integrating detailed project descriptions with clear links to strategic objectives, balancing financial data with qualitative insights, and enhancing transparency and accountability in the decision-making process.

6.4 Adaptation of Best Practices from the UK

In this section, we aim to identify and detail the best practices from the UK under the RIIO-ED2 framework that could enhance the investment justification process in Spain. The goal is to explain how these practices can be adapted to the Spanish context to improve the clarity of the investment plans.

6.4.1 Introduction and Justification

Adapting UK best practices starts with ensuring the introduction of the investment plans provides a clear justification for each project:

- ***Contextual Overview***

  The introduction should give a detailed overview of the regulatory framework, strategic objectives, and economic context, setting the stage for understanding the necessity and relevance of the planned investments.

- ***Project Justification***

  Each project should be justified in terms of its alignment with strategic goals such as enhancing network efficiency, integrating renewable energy, and improving resilience. Include a summary of the project's objectives, expected outcomes, and strategic importance.

Example Adaptation

Incorporate a section in the introduction of the Spanish investment plans that parallels the "Needs Case" section in the UK's EJPs. This section should detail why each project is necessary, how it aligns with strategic objectives, and what benefits it will bring to the network.

6.4.2 Detailed Project Descriptions

To address the lack of specificity and granularity in the Spanish plans, include detailed descriptions for each project:

- ***Project Objectives and Scope***

  Clearly define the goals and scope of each project, including specific targets and performance metrics.

- ***Cost Breakdown and Financial Analysis***

  Provide a detailed breakdown of costs, including capital expenditure, operational expenditure, and expected financial returns. Accompany this with a cost-benefit analysis.

- ***Implementation Timeline***

  Outline the timeline for project implementation, including key milestones and completion dates.

- ***Risk Assessment***

  Conduct a thorough risk assessment, identifying potential risks, mitigation strategies, and contingency plans.

Example Adaptation

Develop a standardised template for detailed project descriptions, similar to the UK's EJP format. This template should be mandatory for all projects listed in the Spanish investment plans, ensuring consistency and comprehensiveness.

6.4.3 Enhanced Financial Justification

Incorporate comprehensive financial justifications into the Spanish investment plans by:

- ***Cost-Benefit Analysis***

  Each project should include a detailed cost-benefit analysis, considering both financial and non-financial benefits. This analysis should justify the investment by demonstrating its value proposition.

- ***Funding Sources and Economic Impact***

  Clearly outline the funding sources for each project, including any subsidies, grants, or external financing. Additionally, assess the economic impact of the project on the local and national economy.

Example Adaptation

Introduce a financial justification section in the investment plans that mirrors the financial analysis in the UK's EJPs. This section should provide a detailed cost-benefit analysis, funding sources, and economic impact assessment for each project.

6.4.4 Strategic Alignment and Integration

Ensure that each project aligns with broader strategic goals by:

- ***Strategic Mapping***

  Map each project to specific strategic objectives, showing how it contributes to goals such as network efficiency, renewable integration, and resilience.

- ***Performance Metrics***

  Define performance metrics for each project, linking them to strategic objectives. Use these metrics to monitor and evaluate the success of the project.

Example Adaptation

Create a strategic alignment section in the investment plans, integrating elements of the "Needs Case" and "Strategic Fit" sections in the UK's EJPs. This section should map each project to strategic objectives and include performance metrics to track progress.

6.4.5 Enhanced Transparency and Accountability

Improve transparency and accountability by:

- ***Clear Documentation***

Ensure all decisions and justifications are clearly documented, providing a transparent record of the investment planning process.

- ***Stakeholder Engagement***

Engage with stakeholders throughout the investment planning process, including consultations, feedback sessions, and public disclosures.

- ***Optioneering***

  Include an analysis of different options considered for the project, discussing the rationale for the chosen option and why it is deemed the best solution.

- ***Regular Reporting***

  Implement regular reporting on project progress, including financial performance, milestones achieved, and any deviations from the plan.

Example Adaptation

Adopt a governance framework similar to the UK's, which includes stakeholder engagement, regular reporting, and clear documentation of decision-making processes. Additionally, add an optioneering section to explain the rationale behind choosing the project.

6.5 Proposed Methodology for Investment Justification in Spain

Building on the adapted best practices from the UK, this section proposes a detailed methodology for justifying investments in Spain's electricity distribution networks. The proposed methodology is tailored to align with Spanish regulations and market conditions, ensuring that investment plans are clear, comprehensive, and strategically aligned with national and regional objectives.

6.5.1 Document Structure and Clarity

The investment plans should consist of a main investment document and project-specific documents. The main document will outline strategic objectives, regulatory context, and overall financial figures, while project-specific documents will provide detailed information on each project. This standardised format will maintain consistency and facilitate review.

Main Document

This document should serve as an overarching guide, summarising the strategic goals, regulatory framework, and overall financial strategy. It should include sections on the regulatory context, strategic objectives, and a summary of all planned investments.

Project-Specific Documents

Each project should have a dedicated document following a standard template. This template should include sections for project justification, detailed cost analysis, implementation timeline, risk assessment, and performance metrics.

6.5.2 Detailed Project Analysis

- ***Project Justification***

  Clearly explain why the project is necessary and how it aligns with strategic goals. This should include any regulatory requirements, technical challenges, or strategic goals it addresses.

- ***Cost Analysis***

  Provide a detailed breakdown of costs, including capital expenditure, operational expenditure, and expected financial returns. Conduct a cost-benefit analysis that quantifies both financial and non-financial benefits.

- ***Implementation Plan***

  Outline the project timeline, key milestones, and responsible parties. Highlight critical paths and potential bottlenecks, and include risk management strategies.

- ***Performance Metrics***

  Define metrics to measure the project's success and ensure alignment with strategic objectives. These metrics should be specific, measurable, achievable, relevant, and time-bound.

6.5.3 Financial and Economic Evaluation

- ***Cost-Benefit Analysis***

  Each project should include a thorough cost-benefit analysis, considering both direct and indirect benefits. This analysis should justify the investment by demonstrating its value proposition.

- ***Funding Sources***

  Clearly identify funding sources and financial arrangements. This includes internal budgets, government grants, and private investments.

- ***Economic Impact Assessment***

  Evaluate the broader economic impact of the project on the community and the national economy. Assess how the project will affect local employment, economic growth, and regional development, including both positive impacts (e.g., job creation) and any potential negative impacts (e.g., disruption during construction).

6.5.4 Strategic Alignment

- ***Mapping Projects to Objectives***

  Show how each project contributes to strategic goals like efficiency, resilience, and renewable integration. Create a matrix that links each project to one or more strategic objectives to demonstrate support for the overall strategy.

- ***Performance Metrics***

Develop specific metrics to track project performance. Use these metrics to monitor progress and adjust strategies as needed.

6.5.5 Transparency and Accountability

- ***Clear Documentation***

  Document all decision-making processes and justifications, ensuring that all decisions are well-documented, including the rationale, alternatives considered, and the final decision. This helps provide a transparent record for audits and reviews.

- ***Stakeholder Engagement***

  Regularly engage with stakeholders to gather feedback and ensure transparency. Hold regular meetings with stakeholders, including regulators, community groups, and industry partners, to present plans, gather input, and address concerns.

- ***Regular Reporting***

  Implement regular progress reports to track project performance and address any issues promptly. Develop a reporting framework that includes monthly or quarterly updates on project status, financial performance, and any issues encountered.

By incorporating these detailed adaptations and developing a robust methodology tailored for Spain, investment plans will be clear, comprehensive, and aligned with strategic objectives. This will enhance the transparency, accountability, and effectiveness of the investment justification process in the Spanish electricity distribution network.

6.6 Expected Benefits of Implementing the New Approach

The methodology proposed, adapted from best practices in the UK, is expected to bring significant benefits to the investment justification process in Spain's electricity distribution networks. These benefits include improved transparency, efficiency, strategic alignment, financial robustness, and stakeholder confidence.

Enhanced Clarity and Structure

Implementing a more detailed and structured methodology ensures that investment plans are clear and logically organized. This makes it easier for stakeholders to navigate and understand the rationale behind each investment, improving overall transparency and trust in the decision-making process.

Improved Financial Justification

The new approach incorporates detailed cost-benefit analyses and clear funding sources to ensure that investments are financially sound and strategically valuable. This helps make more informed decisions and demonstrates the economic viability of each project.

Better Strategic Alignment

To ensure that investments contribute to long-term objectives, it's important to align each project with broader strategic goals, such as improving network efficiency, integrating renewable energy, and enhancing resilience. This strategic alignment helps prioritize projects that provide the greatest benefit to the network and its users.

Greater Transparency and Accountability

Improved transparency in the decision-making process, achieved through clear documentation and stakeholder engagement, enhances accountability. Regular reporting on project progress and performance metrics ensures that all stakeholders are well-informed and can hold the responsible parties accountable for meeting the stated objectives.

Increased Project Specificity

Providing detailed descriptions for each project, including objectives, costs, timelines, and risk assessments, ensures that each investment is thoroughly justified and planned. This level of detail helps in assessing the feasibility and expected impact of each project, leading to more effective investment decisions.

Enhanced Stakeholder Confidence

Clear and transparent investment plans, well-documented and presented, inspire confidence among stakeholders, including regulators, investors, and the public. This confidence is vital for securing support and funding for projects.

Optimised Resource Allocation

A structured and detailed approach to investment justification is essential for optimizing the allocation of resources. Clearly identifying the costs, benefits, and strategic importance of each project helps allocate resources more efficiently, ensuring that critical and beneficial projects receive the necessary funding and attention.

By implementing these enhancements, the Spanish investment justification process can be significantly improved. This will ensure that plans are comprehensive, detailed, and strategically aligned with national goals.

6.7 Considerations and Implementation Feasibility

Implementing the proposed methodology in Spain involves several considerations and potential challenges. Understanding these and planning for them is crucial for a smooth transition and successful adoption. Below, we discuss the key considerations and offer solutions to address the challenges.

Regulatory Compliance

- Consideration: Ensuring that the new methodology complies with existing Spanish regulations is essential. There may be discrepancies between the proposed framework and current regulatory requirements.
- Solution: Collaborate closely with regulatory bodies such as CNMC to align the new methodology with Spanish regulations. Regular consultations and workshops can help in refining the methodology to meet regulatory standards.

Stakeholder Engagement

- Consideration: Engaging all relevant stakeholders, including electricity distribution companies, regulatory bodies, and the public, is critical for gaining support and ensuring successful implementation.
- Solution: Implement a comprehensive stakeholder engagement strategy. This can include regular meetings, public consultations, and transparent communication channels to gather feedback and build consensus.

Resource Allocation

- Consideration: The proposed methodology requires detailed project descriptions, financial analyses, and strategic alignment, which may demand additional resources and expertise.
- Solution: Provide training and capacity-building programs for the teams involved in preparing investment plans. This can help in developing the necessary skills and knowledge to adopt the new methodology effectively.

Transition Period

- Consideration: The shift to a more detailed and structured methodology represents a significant change from the current approach. A sudden transition may lead to challenges in compliance and adaptation.

- Solution: Implement the new methodology in phases. Start with a pilot program involving a few selected projects to test and refine the approach. Gradually expand the implementation to include all investment plans, allowing time for adjustments and improvements.

Data Management

- Consideration: Collecting and managing the detailed data required for the new methodology can be challenging, especially for large projects with extensive information.
- Solution: Invest in robust data management systems and software tools that can handle the increased volume and complexity of data. This will facilitate efficient data collection, storage, and analysis.

Cost Implications

- Consideration: The detailed financial analyses and additional documentation required by the new methodology may increase the cost of preparing investment plans.
- Solution: Conduct a cost-benefit analysis to justify the initial investment in the new methodology. Highlight the long-term benefits, such as improved decision-making, enhanced transparency, and better strategic alignment, which can outweigh the initial costs.

Monitoring and Evaluation

- Consideration: Establishing effective mechanisms for monitoring and evaluating the implementation of the new methodology is crucial to ensure its success.
- Solution: Develop a comprehensive monitoring and evaluation framework that includes regular progress reports, performance metrics, and feedback loops. This will help in identifying any issues early and making necessary adjustments.

By addressing these considerations and implementing the proposed methodology in a phased manner, the transition can be managed effectively. The new approach promises significant improvements in the clarity, detail, and strategic alignment of investment plans, ultimately enhancing the efficiency and effectiveness of electricity distribution network investments in Spain.

Chapter 7

7. Conclusions

7.1 Key Insights

This study offers a thorough comparative analysis of investment plans for electricity distribution networks in the UK and Spain. It highlights the strengths of the UK's RIIO model, which emphasises detailed project documentation, robust financial justification, and clear strategic alignment. In contrast, the Spanish approach, as seen in Iberdrola's plans, often lacks detail, which can impede optimal decision-making and strategic planning.

7.2 Evaluation of Spanish Investment Plans

Spanish investment plans are comprehensive but often miss the granularity required for thorough project justification. While they meet regulatory requirements, they frequently lack detailed financial and technical analyses. This shortfall can impact the effectiveness of investments, especially in integrating renewable energy and advancing smart grid technologies.

7.3 Strengths of the UK Model

The RIIO model in the UK offers several advantages, including detailed project justifications, in-depth financial analyses, and strategic alignment. This model promotes innovation, efficiency, and transparency, making it easier to justify and approve investments. The structured approach ensures that each project is thoroughly evaluated and aligned with long-term strategic goals.

7.4 Recommendations for Spain

- Increase Detail and Specificity: Spanish investment plans should include more detailed project descriptions, financial justifications, and impact assessments to improve clarity and support better decision-making.
- Enhance Financial Justifications: Each project should undergo a thorough financial analysis similar to the UK's approach to ensure that investments are economically justified.
- Adopt a Structured Format: Implementing a standardised format for investment plans would enhance readability and transparency.
- Incorporate Strategic Objectives: Investment plans should clearly align with broader strategic goals, such as integrating renewable energy and improving network efficiency.
- Improve Transparency and Accountability: The process for developing and approving investment plans should be more transparent, with clear accountability for implementation and outcomes.

7.5 Anticipated Benefits and Implementation Feasibility

Adopting these recommendations would lead to improved investment decision-making, better alignment with strategic goals, enhanced regulatory compliance, and increased efficiency and sustainability of the electricity distribution network. These improvements are feasible, given that they build on existing practices and frameworks, although further validation through practical implementation studies may be necessary.

7.6 Final Thoughts

This study underscores the importance of detailed, transparent, and strategically aligned investment plans. By adopting best practices from the UK, Spain can enhance its regulatory framework and investment strategies, ensuring a more efficient, reliable, and sustainable electricity distribution network. This transition, while challenging, promises significant improvements in the overall performance and resilience of the power system.

The recommendations provided aim to bridge the gap between current practices in Spain and the more detailed approaches seen in the UK. Implementing these recommendations will contribute to a robust and future-proof electricity distribution network, supporting Spain's energy transition and sustainability goals.

In conclusion, detailed, transparent, and strategically aligned investment plans are crucial for achieving a resilient and sustainable electricity distribution network. Adopting these practices will pave the way for significant advancements in Spain's energy infrastructure, contributing to the nation's energy and environmental objectives.

Chapter 8 (additional)

8. Alignment with Sustainable Development Goals (SDGs)

8.1 Introduction

The United Nations Sustainable Development Goals (SDGs) are a global action plan aimed at achieving a better and more sustainable future for everyone. Adopted in 2015 as part of the 2030 Agenda, these 17 goals tackle the world's most pressing issues, including poverty, inequality, climate change, environmental degradation, peace, and justice (UNIT15). Within the realm of electricity distribution networks, the SDGs are crucial for steering investments and strategies towards sustainability and resilience in the energy system.

8.2 Relevance of the SDGs in the Electrical Sector

The electrical sector is key to achieving several SDGs, especially those related to affordable and clean energy (SDG 7), industry, innovation, and infrastructure (SDG 9), and climate action (SDG 13). Aligning electrical infrastructure investments with these goals is essential for ensuring a sustainable, efficient, and resilient energy supply.

8.3 Integration of the SDGs in Investment Plans

8.3.1 Affordable and Clean Energy (SDG 7)

SDG 7 focuses on ensuring access to affordable, reliable, sustainable, and modern energy for all. This goal includes:

- Promotion of Renewable Energies: Increasing investments in renewable energy sources like solar, wind, and biomass, and integrating them effectively into the distribution network (UNIT15).
- Improvements in Energy Efficiency: Implementing technologies and practices that reduce energy losses in distribution and optimise electricity usage (UNIT15).

8.3.2 Industry, Innovation, and Infrastructure (SDG 9)

SDG 9 aims to promote resilient infrastructure, inclusive and sustainable industrialisation, and innovation. In the electrical sector, this involves:

- Modernisation of Infrastructure: Developing and upgrading infrastructure to be more sustainable and resilient, including implementing smart grids and advanced monitoring and control systems (SCADA) (UNIT15).
- Encouragement of Innovation: Establishing incentives and support for research and development of new technologies that enhance the efficiency and sustainability of the electrical grid (UNIT15).

8.3.3 Climate Action (SDG 13)

SDG 13 seeks urgent action to combat climate change and its impacts. For electrical distribution, this includes:

- Reduction of CO2 Emissions: Implementing strategies to reduce greenhouse gas emissions from electricity generation and distribution by promoting clean energy sources (UNIT15).
- Climate Resilience: Ensuring electrical infrastructure is resilient to extreme weather events, such as storms and heatwaves, which can affect supply stability (UNIT15).

8.4 Specific Strategies for Achieving the SDGs

8.4.1 Evaluation and Justification of Projects

Each investment project should include a detailed evaluation of how it contributes to the SDGs. This involves:

- Environmental Impact Analysis: Assessing the environmental impact of projects to ensure they reduce the carbon footprint.
- Sustainable Economic Justification: Demonstrating how projects are economically viable and aligned with sustainability goals.

8.4.2 Stakeholder Engagement

Engaging stakeholders is crucial to align projects with community needs and the SDGs. This includes:

- Consultation and Collaboration: Involving local communities, governments, and other stakeholders in the planning and execution of projects.
- Transparency: Maintaining open and transparent communication about project objectives, progress, and outcomes.

8.5 Practical Examples of Implementation

8.5.1 Case Study in the United Kingdom: SP Energy Networks

SP Energy Networks has implemented several projects that exemplify integrating the SDGs into their investment plans. For example, the 33kV Reinforcement Project Maentwrog – Porthmadog. This project includes infrastructure upgrades to improve energy efficiency and integrate renewable energy, contributing to SDG 7 and SDG 13.

8.5.2 Case Study in Spain: i-DE Iberdrola

i-DE Iberdrola has adopted several initiatives to align its investments with the SDGs, in 2023-2025 Investment Plans in the Valencian Community. This plan includes investments in smart technologies and improvements in network efficiency, supporting SDG 9 and SDG 7.

8.6 Conclusion

Integrating the Sustainable Development Goals into investment plans for electrical distribution networks is not only an ethical and environmental imperative but also a key strategy to ensure a sustainable and resilient energy supply. Through adopting innovative practices, infrastructure modernisation, and active stakeholder engagement, significant progress can be made towards a more sustainable and equitable future.

This chapter underscores the importance of aligning investments in the electrical sector with the SDGs, providing a clear and strategic framework for their implementation within the context of electricity distribution networks.

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