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A Discussion Paper on Ireland's Grid Development Strategy

Appendix 3

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Appendix 3

National and Regional Evaluation of the Economic Benefits of Investment in Ireland's Elecricity Transmission Network

Indecon

National and Regional Evaluation of the Economic Benefits of Investment in Ireland's Electricity Transmission Network

Report for EirGrid

Prepared by

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Executive summary

Introduction

This independent report is undertaken by Indecon International Economists for EirGrid. The report concerns a research assessment of the economic benefits associated with the expenditure impacts of investment in Ireland's electricity transmission network. The report also considers the scenarios available to achieve the key objective of providing adequate high-voltage electricity transmission grid infrastructure. Indecon recognises there are broader community and environmental issues which are relevant and this report is confined to economic aspects.

The context for the study is that EirGrid has identified a number of new scenarios to meet the future electricity transmission grid requirements of the Irish economy. Indecon fully supports the validity of EirGrid reviewing the scale of investment and the specific scenarios to meet requirements in the light of changes in economic need and revised policy priorities. This is particularly important given the fundamental revisions to Ireland's economic growth forecasts. There have also been changes in technological developments and in energy efficiency.

From an economic perspective Indecon believes the key challenges for EirGrid are to ensure sufficient high-voltage grid infrastructure to meet the requirements of the economy and to plan this infrastructure spending in the most cost effective manner.

Indecon believes that if there is over-investment in the electricity transmission network, beyond the needs of the economy then this would represent a clear waste of scarce economic resources and would result in higher electricity costs than necessary. This could result in uncompetitive electricity prices and would damage the ability of firms in Ireland to succeed in export markets and the attractiveness of Ireland as a location for overseas investment. As a result, excessive infrastructural spending would damage economic and employment prospects. However, insufficient electricity infrastructure would have very negative economic impacts and would stunt economic growth.

Reflecting policy priorities and the changes in the structure and prospects of the Irish economy, EirGrid has appropriately identified a number of new scenarios for electricity transmission network investment, which on a like-for-like basis relative to previous plans, show significant cost savings.

Indecon would also highlight that in addition to ensuring the lowest cost effective solution to Ireland's electricity transmission network requirements, it is essential that EirGrid's investment programme meets the policy requirement to spread economic growth on a regional basis.

In this report we consider some of the economic and regional aspects of grid investment and also assess the direct economic benefit of expenditure on the grid. We also outline some issues for consideration designed to ensure sufficient infrastructure at the lowest cost to the economy.

Background, Context and Policy Objectives

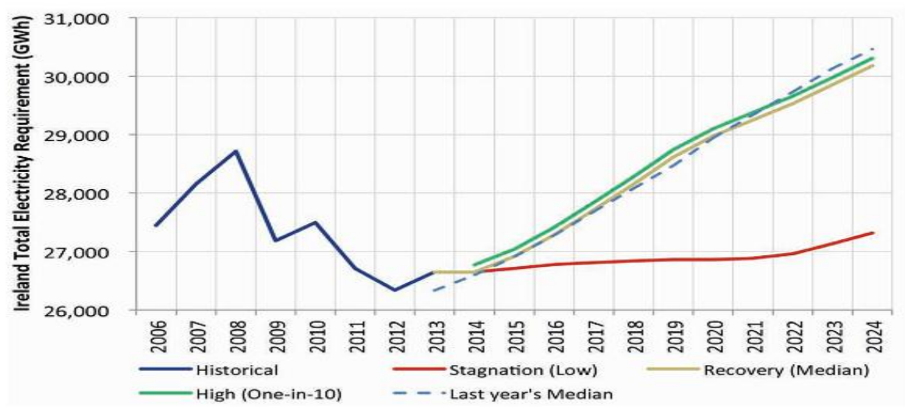
EirGrid began planning for the next generation of transmission grid investment over seven years ago. The original grid investment programme cost estimate was scaled back from €4 billion to €3.2 billion in 2011. The final cost of the programme will depend on the technologies selected for individual projects but it is anticipated that it will be in the range of €2.7 billion to €3.9 billion. All of these programme scenarios, however, involve cost adjustments due to a number of reasons including:

- Expected reduction in demand-related expenditure;
- Better use of new technologies;
- Lower than anticipated costs for some technologies such as circuit upgrading technologies;

- Scaling back and optimisation of some intended projects to be aligned with a rigorous assessment of future requirements over the relevant period; and
- Technology selected for individual projects.

Transmission capacity needs are fundamentally linked to electricity demand growth. The chart below provides a range of likely future electricity demand scenarios. The median scenario indicates the most likely growth in electricity demand between 2014 and 2024. By 2024, the likely total annual electricity consumption is forecast to be just above 30,000 TER (GWh), which represents around a 14% increase on the 2013 value. This represents annual average growth of around 1.3% which is considerably lower than the average growth rates prior to 2007.

Republic of Ireland annual electricity demand forecast- 2013-2024



Source: EirGrid/SONI "All Island Generation Capacity Statement 2015-2024"

Three scenarios have been developed to meet Ireland's high-voltage grid infrastructure requirements and involve costs of between €2.7 billion to €3.9 billion. Scenario A costs are estimated to be €2.9 billion, Scenario B €3.9 billion and Scenario C €2.7 billion. The key variables are discussed in EirGrid reports but from an economic perspective we examine the expenditure impacts of all three. We refer to Scenario A as mid-cost scenario, Scenario B as high-cost and Scenario C as low-cost. Some general elements of these scenarios are presented below. In addition to the economic issues the impact on visual amenity and other factors should be considered.

Summary of proposed for Grid Development – Other Economic Impacts

	Scenario A – Mid Cost	Scenario B – High Cost	Scenario C – Low Cost
Supports Regional Development	✓	✓	✓
Provides adequate capacity	✓	✓	✓
Minimises Cost to Electricity Users	-	×	✓

Source: Indecon analysis

Assessment of the Direct Impact of Grid Investment Programme

In our analysis we consider both the direct and indirect economic impacts of the expenditure and we firstly consider the direct impacts. A number of key points with regard to the direct economic impacts of the grid investment are as follows:

- Grid investment will generate significant levels of spend in the domestic economy through the expenditure on Irish labour and Irish-produced materials and services.
- Estimating the expenditure impacts of this investment requires a quantitative model of the programme of investment expenditure. This model developed by Indecon is designed as one input to the assessment of how grid investment expenditure will contribute to national output/GDP and employment.
- We estimate that undertaking grid investment as per Scenario A contributes around €1.97 billion to national output in gross expenditure impacts. In present value terms, this equates to around €1.5 billion. This gross expenditure benefit should be considered in evaluating the overall costs of the investment and the key user and other benefits.
- In terms of employment, this investment would lead to significant direct employment benefits of around 22,234 FTE man years which equals around 1,482 annual jobs supported.
- In all of the scenarios identified by EirGrid the expenditure benefits need to be weighed against the opportunity costs of the resources and the wider benefits for the Irish economy of the provision of sufficient grid infrastructure.

Direct contribution of each grid investment scenario total expenditure to national output/GDP and Employment – Scenario A	
Total National Spending – €million (undiscounted)	1,968
Total National Spending – €million (discounted)	1,498
Total National Employment– FTE Man Years	22,234
Total National Employment– Average annual jobs	1,482

Source: Indecon analysis of EirGrid Expenditure data

- In present value terms, we estimate that the expenditure in Scenario B contributes around €3.0 billion to national output in gross expenditure impacts. This equals €2.15 billion in present value terms.
- This level of expenditure on electricity grid investment supports an estimated 1,982 annual jobs.

Direct contribution of each grid investment scenario total expenditure to national output/GDP and Employment – Scenario B	
Total National Spending – €million (undiscounted)	2,994
Total National Spending – €million (discounted)	2,146
Total National Employment– FTE Man Years	29,734
Total National Employment– Average annual jobs	1,982

Source: Indecon analysis of EirGrid Expenditure data

- An analysis of the expenditure impacts of Scenario C leads to an expenditure related contribution of around €1.81 billion to national output.
- The employment supported by this investment expenditure is estimated to be around 1,365 per annum.

Direct contribution of each grid investment scenario total expenditure to national output/GDP and Employment – Scenario C	
Total National Spending – €million (undiscounted)	1,814
Total National Spending – €million (discounted)	1,407
Total National Employment– FTE Man Years	20,476
Total National Employment– Average annual jobs	1,365

Source: Indecon analysis of EirGrid Expenditure data

Assessment of Economy-wide impacts of grid investment

- When account is taken of indirect impacts as well as the direct impacts referred to above, grid investment is likely to have significant impacts in terms of national expenditure and employment.
- We estimate that grid investment in the proposed Scenario A would contribute a gross €1.62 billion to the wider Irish economy over the lifetime of the project. In present value terms, this translates to €1.2 billion.
- This level and type of investment is estimated using input-output analysis to support around 2,825 in average annual jobs when account is taken of the direct, indirect and induced impacts.

Gross economy-wide impacts of grid investment expenditures on Irish economy – Contributions to National Output and Employment – Scenario A	
	Total
Total Direct, indirect and induced benefits less labour spending – discounted (€million)	1,226.4
Direct, Indirect and induced FTE Man years	42,371
Average Annual jobs equivalent	2,825

Source: Indecon analysis

- Scenario B is estimated to contribute around €1.94 billion in present value terms to the economy in gross expenditure impacts.
- Including direct, indirect and induced employment impacts gives an annual average of jobs supported of 3,774.

Gross economy-wide impacts of grid investment expenditures on Irish economy – Contributions to National Output and Employment – Scenario B	
	Total
Total Direct, Indirect and induced Benefits less labour spending – discounted (€million)	1,939.6
Direct, Indirect and induced FTE Man years	56,603
Average Annual jobs equivalent	3,774
Source: Indecon analysis	

- Scenario C grid investment would lead to around €1.15 billion in gross expenditure related economic benefits (less labour spending) to the economy.
- In terms of wider economy benefits, this investment is likely to support around 2,603 jobs on an annual basis.

Gross economy-wide impacts of grid investment expenditures on Irish economy – Contributions to National Output and Employment – Scenario C	
	Total
Total Direct, Indirect and induced Benefits less labour spending – discounted (€million)	1,147.7
Direct, Indirect and induced FTE Man years	39,046
Average Annual jobs equivalent	2,603
Source: Indecon analysis	

In the next table we compare the key economic impacts across the different scenarios. The estimates in the table demonstrate that while all of the scenarios have significant cost as well as expenditure and employment benefits on the Irish economy, a key issue is the impact of these investments regarding the direct benefits of infrastructure provision.

All of the scenarios will have positive gross employment impacts arising from the expenditures. The gross employment impacts of the expenditures should not, however, be misinterpreted as suggesting that this equates to net employment impacts. The latter would need an adjustment to take account of the opportunity cost of labour. We estimate the opportunity cost of labour to be between 80 – 100%, indicating the percentage of persons who would be employed as a result of the investment expenditure that would have been employed otherwise in other activity. The more significant employment impacts would depend on how the provision, or lack of provision, of adequate electricity grid infrastructure impacts on jobs in the traded sector of the economy. Some indication of this can be seen by considering the costs of disruption in electricity supply but this is only a short-term impact. The effect on the ability of enterprises to expand and to facilitate new investment is a more significant impact. These factors represent the most important potential long-term benefits of grid investment. Research on the views of enterprises in Ireland on the importance of an adequate electricity grid on investment represents one indication of the significance of this issue. Also relevant are the implications of the proposed investment for cost competitiveness and electricity prices. This demonstrates the economic importance of ensuring infrastructure needs are met at the lowest feasible cost.

Summary of proposed scenarios for grid development			
	Scenario A	Scenario B -	Scenario C
NPV (Net Present Value) of the Gross Expenditure Benefits	2,229	2,864	2,097
NPV of the Costs	1,229	1,942	1,150
Difference	1,000	922	947
Economy-wide Employment (Man Years) supported	42,371	56,603	39,046
Economic Benefits of Infrastructure provision	(See below)	(See below)	(See below)
Source: Indecon analysis			

Economic Benefits of Grid Infrastructure on Investment and Economic Output

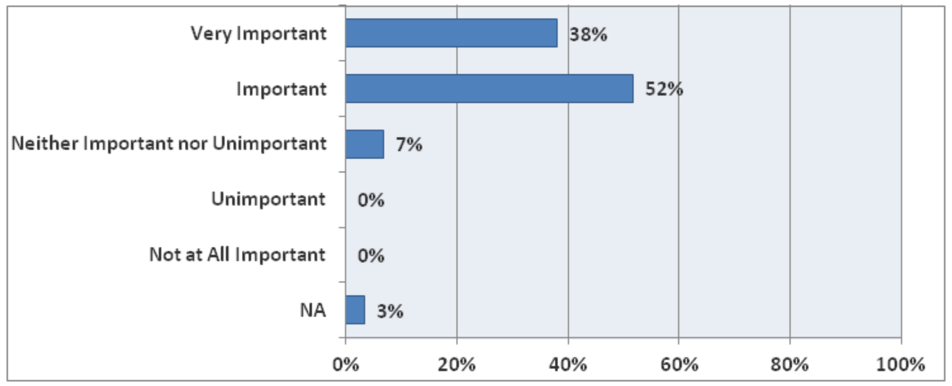
The economic benefits of providing grid infrastructure can also be considered in the context of the economic cost of an electricity outage to users. Indecon estimates that this is likely to be significant. We estimate that for a one hour outage, a conservative estimate of the economic cost is likely to be over €24 million and if wider economy costs are included is estimated to be around €45 million.

In addition to the economic costs of an electricity outage, of more fundamental significance is the impact on investment if sufficient infrastructure were not available. Such a scenario would impact on the ability of existing firms to expand and the ability to attract new investment into Ireland.

Grid investment is an essential component in meeting the requirements of industry connection to the transmission system. This is particularly relevant for firms in the internationally traded sector.

Indecon's analysis shows that 90% of firms surveyed believe that investment in the electricity transmission network is important or very important for Ireland's ability to attract additional foreign direct investment (FDI).

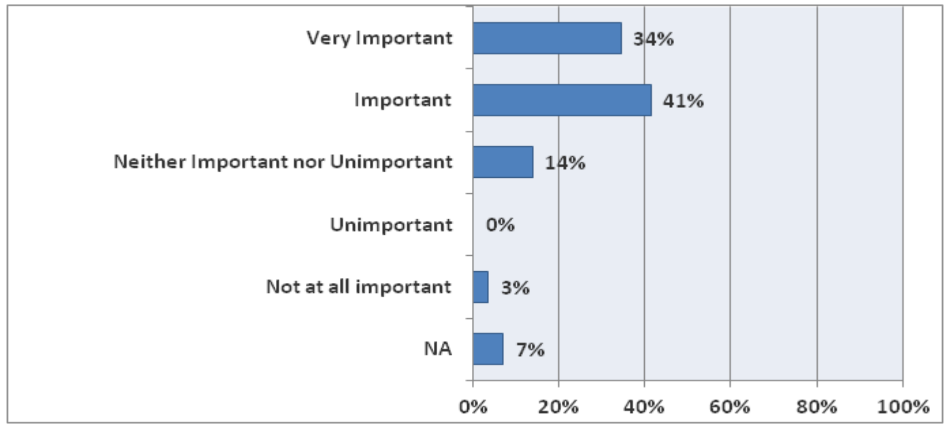
Views on importance of electricity transmission network on ability to attract additional foreign investment to Ireland



Source: Indecon survey of multinationals and indigenous companies in Ireland

- 75% of companies indicated it was 'important' or 'very important' to decisions to locate new operations or functions in Ireland.

Views on the importance of access to a high quality electricity supply on decisions to locate new operations or functions in Ireland



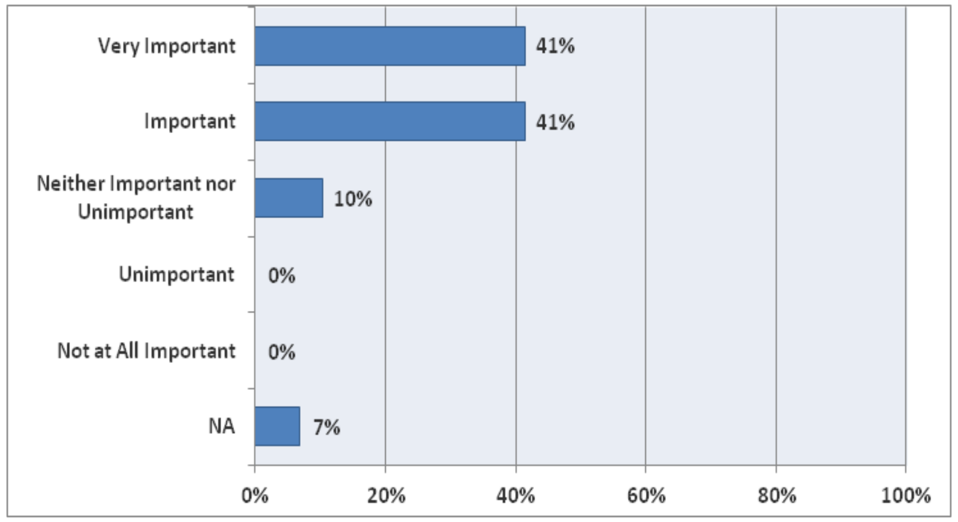
Source: Indecon survey of multinationals and indigenous companies in Ireland

Assessment on the Regional impact of grid investment

Grid investment will lead to different regional impacts in terms of local spending and employment. Of even more importance is whether the scenarios being considered have the potential to facilitate an expansion of economic output in each of the regions. Some of our key findings are as follows:

- It is estimated that grid investment will lead to significant local expenditure. This grid investment will have different regional impacts.
- It is essential there is sufficient grid infrastructure to support regions to attract new investment and to facilitate growth in jobs in existing industry. The importance of regional infrastructure is a crucial factor to achieving the potential of regional development in Ireland.
- National policy is focused on expanding economic output and employment in each of the regions. This will require an expansion of tourism, agriculture and indigenous and foreign-owned firms. While it would be a mistake to see this only in terms of foreign industry, the focus on winning investment for the regions is reflected in the new IDA (Ireland) strategy which is targeting a minimum of 30% - 40% increase in the number of investments for each region outside of Dublin over the period 2015 – 2019.
- Opinions of businesses surveyed on the importance of grid investment in facilitating regional economic development indicate that 82% of respondents believe that investment in the transmission grid is 'important' or 'very important' to facilitate regional development.

Views on the importance of investment in the electricity transmission network to facilitate regional economic development



Source: Indecon survey of multinationals and indigenous companies in Ireland

Adequacy to Meet Regional Needs

In evaluating the scenarios being considered by EirGrid it is critical to consider the ability of each scenario to accommodate the likely future demand in each region. In the table below we outline the capability of the proposed investment programme to accommodate additional demand and compare this to estimated demand in each of the regions. This suggests that there will be available capacity in all of the regions to accommodate significant expansion of demand. There are a number of caveats regarding the table below regarding differences within regions and the interaction between nodes/stations and regions. However, the evidence suggests that all of the plans for regional expansion outside of the Dublin/East region could be accommodated under the various scenarios identified by EirGrid.

Projected Demand by Region and Additional Capacity available

	East	Midlands	West	North East	North West	South East	South West
2014 Demand (MW)	1830	480	370	380	630	380	560
2025 Demand (MW)	2070	530	410	420	700	420	630
Additional Capacity (MW) – High	870	657	658	700	441	378	775
Additional Capacity (MW) - Median	735	469	433	425	295	284	532
Additional Capacity (MW) – Low	600	280	210	150	150	190	290

Source: EirGrid

Issues for Consideration

A number of issues have been identified by Indecon during our research which Indecon believes merit consideration in order to maximise the use of scarce resources at the lowest cost to the economy. These are summarised as follows and discussed later in the report and include possible measures to increase the attractiveness of regional locations for investment.

- Examine regional economic outlook and map against infrastructure gaps
- Consider adjustments to transmission pricing policy to facilitate lower pricing in regions
- Evaluate the current and likely future economic costs and benefits of energy policy concerning renewables and wind and its impact on grid infrastructure requirements

Overall Conclusions

This independent report suggests that grid investment will lead to significant benefits for the Irish economy in terms of increased output and employment arising from the expenditures in Ireland from the grid development strategy. It will also support regional development. The development strategies will also involve significant costs which must be evaluated against the benefits of facilitating an expansion of the Irish economy both nationally and at a regional level. Ensuring this is achieved at the lowest cost taking into account all relevant factors is a key challenge.

Acknowledgements

Indecon would like to thank a number of individuals and organisations for their inputs and assistance in completing this assessment. We are very grateful for inputs from our survey work with indigenous and overseas firms in Ireland on their views on the benefits of grid infrastructure. We would also particularly like to acknowledge the valuable inputs and assistance of management and staff at EirGrid, including Michael Walsh, Rosemary Steen, Timothy Hurley, Mark Norton and Fintan Slye. In addition, we would like to thank the Board of EirGrid for their insightful comments. The usual disclaimer applies, and responsibility for the analysis and findings in this independent research remain the sole responsibility of Indecon.

1 Introduction

This independent report is undertaken by Indecon International Economists for EirGrid. The report concerns a research assessment of the economic benefits associated with the expenditure impacts of investment in Ireland's electricity development strategy. The report also considers the economic impact of the transmission scenarios available to achieve the key objective of providing adequate electricity grid infrastructure.

The context for the study is that EirGrid has identified a number of scenarios to meet Ireland's future transmission grid requirements. Indecon fully supports the validity of EirGrid reviewing the scale of investment and the specific scenarios to meet requirements in the light of changes in economic need and revised policy priorities. This is particularly important given the fundamental revisions to Ireland's economic growth forecasts. There have also been changes in technological developments and in energy efficiency.

From an economic perspective Indecon believes the key challenges for EirGrid are to ensure sufficient grid infrastructure to meet the requirements of the economy, and how to ensure this is delivered in the most cost effective manner.

Indecon would also highlight that in addition to ensuring the most cost effective solution to Ireland's electricity grid requirements, it is essential that the infrastructural strategy meets the policy requirement to spread economic growth on a regional basis.

In this report we consider some of the economic and regional aspects of grid investment and also assess the direct economic benefit of expenditure on the grid. We also outline some issues for consideration designed to ensure sufficient infrastructure is provided but at a lower cost to the economy.

1.1 Background, Context and Policy Objectives

The original 2008 grid development strategy cost estimate was scaled back from €4 billion to €3.2 billion in 2011. The final cost of the programme will depend on the technologies selected for individual projects but it is anticipated that it will be in the range of €2.7 billion to €3.9 billion. All of these programme scenarios, however, involve cost adjustments.

Based on the technology options for projects described in EirGrid's reports three scenarios have been developed that cover the potential investment requirements to meet Ireland's grid infrastructure requirements. We examine the expenditure impacts of all three Scenarios from an economic perspective. We refer to Scenario A as mid-cost which involves costs of €2.9 billion which is most closely aligned with the technology assumptions in the original Grid 25 strategy. Scenario B involves costs of €3.9 billion which we refer to as high cost scenario and Scenario C has estimated capital costs of €2.7 billion which we refer to as the low cost scenario.

1.2 Objectives of study

The primary objective of this study is to examine the gross expenditure benefits associated with the grid strategy. This study also examines the importance of grid infrastructure in terms of regional development and the attraction of foreign investment along with the creation of employment. We also undertake a preliminary assessment of the three investment scenarios and review whether these are likely to meet regional demand requirements. A number of recommendations designed to ensure grid requirements are met at lowest cost to the economy is presented.

1.3 Methodological approach

The methodology applied in this report involves application of international best practice regarding estimating economic impacts of large-scale investments. It should be noted that this analysis is not a cost-benefit analysis and focuses on the expenditure benefits of each investment scenario. The direct user benefits and the impact of ensuring adequate grid infrastructure as well as the costs of the investment are separately considered on a project by project basis by EirGrid.

1.4 Structure of report

The remainder of the report is structured as follows:

- Section 2 outlines EirGrid's scenarios for grid investments;
- Section 3 evaluates the direct expenditure of the grid investment scenarios and the economic benefits from such expenditure;
- Section 4 considers the economy-wide indirect and induced benefits from grid investment expenditure including an analysis of the various scenarios that could be chosen to meet the objectives of grid development;
- Section 5 examines the regional impacts of grid investment on local expenditures and employment. This section also considers regional development and how grid development is important in sustaining regional job creation;
- Section 6 considers the impact of grid development on attracting foreign direct investment; and
- Section 7 summarises the key conclusions.

2 EirGrid's Scenarios for Grid Investment

2.1 Introduction

Grid investment will impact the economy in two primary ways: by improving the capacity and efficiency of the national electricity transmission network, and by the investment expenditure impact on the economy that is required to implement such upgrades. This report focuses on the economic impacts of this investment expenditure and how it relates to national expenditure and employment.

2.2 Changing context of the Grid Investment Programme

The original grid investment programme had an initial estimated capital cost of around €4 billion and was scaled back to €3.2 billion in 2011. The final cost of the programme will depend on the technologies selected for individual projects but is anticipated it will be in the range of €2.7 billion to €3.9 billion. All of these scenarios however involve cost adjustments due to the following reasons:

- Expected reduction in demand-related expenditure;
- Better use of new technologies;
- Lower than anticipated costs for some technologies such as circuit upgrading technologies;
- Scaling back and optimisation of some intended projects; and
- Technology selected for individual project.

The key considerations underlying the revised scenarios for grid investment include the following:

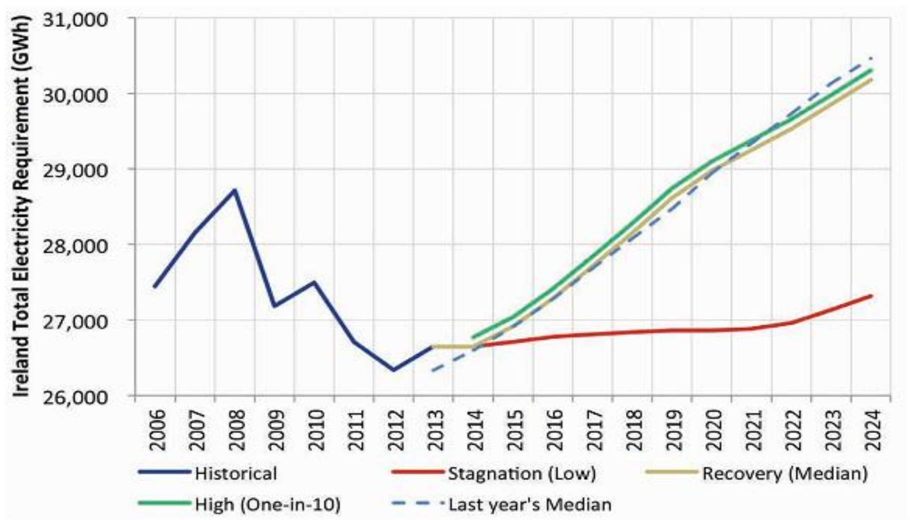
- Fundamental revision of forecasts for future economic growth;
- Technological developments and improvements in energy efficiency; and
- Changes in Policy including the New 5 Year Regional Government Strategy.

It is important to note that forecasted electricity demand has changed considerably since 2008. This is related to developments in the Irish economy but also relates to an improvement in the energy efficiency of the Irish economy.

2.3 Demand Projections

An important aspect of any investment project is to establish the need or the demand for the proposed infrastructure. The most recent projections for electricity demand in Ireland are shown in Figure 2.1. This chart provides a range of likely future electricity demand scenarios with the median scenario indicating the likely growth in electricity demand between 2014 and 2024. By 2024, the likely electricity demand is forecast to be just over 30,000 TER (GWh) which represents around a 14% increase on the 2013 value. It must be noted that the link between economic growth and electricity demand has decreased in recent years due to changes in the energy efficiency / intensity of the economy. This is related to an improvement in the energy efficiency and also structural changes in the composition of the economy.

Figure 2.1 : Forecasted electricity demand in Ireland- 2013-2024

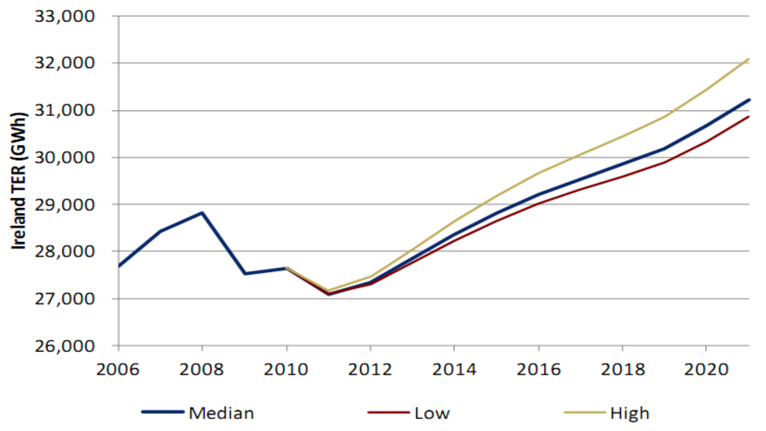


Source: EirGrid/SONI "All Island Generation Capacity Statement 2015-2024"

The figure above also highlights that electricity demand may be lower if the Irish economy grows more slowly than anticipated. Under this scenario, electricity demand will be 8% lower by 2023 compared to the median growth scenario.

In the context of the original plans for the Grid Transmission Development Strategy, forecasts of future electricity demand have reduced significantly since 2011. The extent of change in demand is evident in Figure 2.2. The median demand forecast is now around 29,000 TER (GWh) by 2020. This compares with the previous comparable estimate of 30,500 TER (GWh).

Figure 2.2 : Previous Forecasted electricity demand in Ireland- 2006-2021



Source: EirGrid/SONI "All Island Generation Capacity Statement 2012-2021"

Peak Demand

It is also necessary to consider peak demand when forecasting electricity demand. The most recent analysis of peak demand in Ireland is shown in Table 2.1 and shows the likely future growth in peak demand over the next ten years. This highlights expected growth in demand and it is of critical national importance that further investment is made in the electricity capacity in order to be able to accommodate peak demand requirements.

Table 2.1: Peak Demand Projections (2014-2024) – Transmission Peak (MW)

Year	Ireland (Peak Demand)	% change	NI (Peak demand)	% change	All Island Peak Demand	% change
2014	4,818		1,694		6,492	
2015	4,831	0.3%	1,694	0.0%	6,505	0.2%
2016	4,856	0.5%	1,696	0.1%	6,532	0.4%
2017	4,881	0.5%	1,700	0.2%	6,561	0.4%
2018	4,898	0.3%	1,707	0.4%	6,585	0.4%
2019	4,919	0.4%	1,716	0.5%	6,614	0.4%
2020	4,939	0.4%	1,727	0.6%	6,646	0.5%
2021	4,959	0.4%	1,739	0.7%	6,678	0.5%
2022	4,999	0.8%	1,750	0.6%	6,729	0.8%
2023	5,045	0.9%	1,762	0.7%	6,788	0.9%
2024	5,093	1.0%	1,774	0.7%	6,847	0.9%

Source: EirGrid/SONI "All Island Generation Capacity Statement 2015-2024"

2.4 Description of scenarios under consideration to achieve the objectives of the Grid Development Strategy

The estimated capital costs of the three scenarios for addressing grid requirements of the Irish economy are summarised in Table 2.2.

Table 2.2: Key statistics with the proposed Grid Investment Scenarios

	Scenario A	Scenario B	Scenario C
Capital Cost (€Billion)	2.9	3.9	2.7

Source: EirGrid

A summary of some of the other characteristics of the scenarios are presented below.

This highlights the fact that the costs of the investment needs to be compared to the likely benefits and reinforces the importance of ensuring cost effective solutions. It is also important to consider other issues such as visual amenity which are outside the scope of this economic report.

Table 2.3: Summary of proposed for Grid Development – Other Economic Impacts

	Scenario A	Scenario B	Scenario
Supports Regional Development	✓	✓	✓
Provides adequate capacity	✓	✓	✓
Minimises Cost to Electricity Users	-	×	✓

Source: Indecon analysis

2.5 Summary of findings

In this section, we reviewed the changing context on which the update of the grid development strategy is based. The key findings of this section can be summarised as follows:

- The final cost of the programme will depend on the technologies selected for individual projects but it is anticipated that it will be in the range of €2.7 billion to €3.9 billion. All of these scenarios however involve cost adjustments.

  This reduction in the capital costs is related to a reduction in demand-related expenditure, better use of new technologies, lower than anticipated costs for some technologies and scaling back of some intended projects.
- The key considerations underlying the revised scenarios for grid investment include the following: fundamental revision of forecasts for future economic growth; technological developments and improvements in energy efficiency; and changes in policy including the new Five-Year Regional Government Strategy.
- The main driver of the investment programme is to meet the electricity demand requirements of the economy. By 2024, the likely electricity demand is forecast to be just

above 30,000 TER (GWh) which represents around a 14% increase on the 2013 value. This represents annual average growth of around 1.3% which is considerably lower than the average growth rates prior to 2007. It must be noted that the link between economic growth and electricity demand has decreased in recent years due to a decrease in the energy intensity of the economy. This is related to an improvement in energy efficiency and also structural changes in the composition of the economy.

- All of the three scenarios identified by EirGrid are seen as providing sufficient capacity to meet both national and regional needs. However, they have different capital costs and have other differing characteristics which need to be evaluated.

3 Assessment of direct impacts of Transmission Grid Development Strategy

3.1 Introduction

In this section, we examine the direct expenditure impacts of the different grid investment expenditure scenarios. The analysis is based on a quantified economic impact model which examines different economic impacts at a national and regional level associated with different levels and types of expenditure.

The analysis examines the direct impacts of the expenditure of the different grid investment scenarios from 2011-2025. Each scenario consists of a large number of individual projects that will develop and upgrade the electricity transmission network.

3.2 Economic model used to assess expenditure benefits

Estimating the expenditure benefits of grid investment requires a quantitative model of the programme of investment. This model, developed by Indecon, is designed to assess the amount of grid investment expenditure that will contribute to national output/GDP and employment.

The model maps the spending breakdowns of the grid investment undertaken by EirGrid by project type, type of expenditure, class of expenditure to locations, and discounted future cash flows, which will occur over the period to 2025. The model can be used to assess the division of spending by county across grid investments; this allows estimation of the regional impacts. In addition, the model has been designed to identify labour spending both at regional and national levels in order to analyse the employment impacts of grid investment.

The model has been used to estimate different variants of grid investment (Scenarios A, B, C) which have different compositions of project types.

The model inputs make use of four sets of key parameters:

1. Time parameters: timeline of project types, cash flow schedule of project types; this is important to establish the net present value of the investment. It is also important in terms of identifying when additional infrastructure is completed.
2. Project and expenditure location parameters: distance-split of projects spanning more than one area, percentage of spending that occurs in the same area as project location and split by project type; this allows us to estimate the regional impacts of the different grid investments. It must also be noted that a number of grid investments span multiple regions and thus it is important to isolate the individual regional impacts.
3. Project expenditure type breakdown parameters[1]: labour spending by project type, material spending by project type, 'other[2]' spending by project type, overhead spending by project type and labour spending by project stage.
4. Discount parameters: the discount rate used (5% discount rate used). This is consistent with the Department of Public Expenditure recommended 5% discount rate which replaces the previous advised discount rate of 4%.

[1] These parameters are important in isolating the different impacts associated with the different types of projects.

[2] Other spend is further broken down into civil works, labour and other

The model calculates the present value of national spending undertaken as part of the grid development strategy. In addition, the model offers the present value of total local expenditure.

This expenditure is classified as spending that involves the purchase of Irish and non-Irish goods and services. For example, the construction of a new substation in Tarbert will require a certain proportion of local goods and services, national goods and services, and imported goods and services. Finally, the model gives the present value of labour expenditure under the proposed grid investment and maps this spending to regional level. Therefore, both total expenditure and labour expenditure are mapped to regions. It should be noted that these results represent gross expenditure and do not take account of the opportunity costs of resources. All resources have opportunity costs and these need to be taken into account in the cost-benefit appraisal of individual projects. The purpose of this section of our research is, however, confined to examining the impact on the economy of the expenditures incurred.

3.3 Methodological approach

The key economic impacts that we examine in the model are the gross effect of the investment on national output/GDP and the impact of the national expenditure on national and local employment.

3.3.1 The direct contribution of grid investment expenditure to national output/GDP

To estimate the contribution of grid investment expenditure to national output/GDP, the following methodology was used:

- Each spending project was classified by five types (uprate, substation, overhead line, cable and miscellaneous).
- For each project type, proportions of spending on Time, Materials, Other and Overheads were assumed based on prior research.[3]
- For each project type, the percentage of the spending on imports was calculated.
- The total amount of grid investment expenditure that will contribute to GDP/national output is the sum over all projects of the total national (non-imported) expenditure.

Total national spending by year for electricity grid investment for Scenario A is shown in Table 3.1. These figures represent the sum of expenditure for the individual projects for each year, discounted to the present.

Table 3.1: National grid investment discounted spending for each scenario by year – Scenario A (€ million)

2011-2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
722.9	115.8	104.6	98.2	105.5	114.8	90.6	73.7	63.9	4.2	4.1

Source: Indecon analysis of EirGrid data

[3] Station, Overhead Line and Cable are based on the CER decision document published in 2009 (Standard Transmission Charges & Timelines, CER/09/077; assumptions on uprate and misc. projects were developed by EirGrid

Scenario B involves a different profile of national spending post 2016. This spending is shown on an annual basis in Table 3.2. After 2015, the spending peaks in 2021.

Table 3.2: National grid investment discounted spending for each scenario by year – Scenario B (€ million)

2011-2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
722.9	115.8	125.3	133.8	142.8	197.1	347.8	152.1	130.9	18.2	9.7

Source: Indecon analysis of EirGrid data

Finally, we examine the national spending profile of Scenario C. The annual national spending profile associated with this scenario is shown in the table below. It is important to note that this national spending excludes spending on imports.

Table 3.3: National grid investment discounted spending for each scenario by year – Scenario C (€ million)

2011-2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
722.9	115.8	104.6	98.2	105.5	95.0	65.5	49.8	41.1	4.2	4.1

Source: Indecon analysis of EirGrid data

3.3.2 The direct contribution of grid investment expenditure to national employment

The methodology employed to estimate the direct contribution of grid investment expenditure to employment is similar to the methodology outlined for estimating the contribution to national output, with the following changes:

- Instead of using proportions of spend on time, materials, etc., the model isolates spending on labour.
- Using the assumption made on the percentage of labour that is imported, the model produces a figure on the amount spent on national labour from grid investments.
- The estimated domestic labour spend is then used to estimate the number of FTE (Full Time Equivalent) jobs due to grid investment.
- The estimates of labour expenditure are typically driven by the assumption of the share of time of total expenditure. All time costs directly translate into labour costs.
- We also include the labour portion included in the 'other' category. This varies considerably by project type. A significant portion of the 'other' category relates to civil works. Using Indecon's model of the Irish economy, we are able to estimate the labour expenditure associated with each €1 million of civil works.
- This is particularly important for Scenario B where a significant portion of the 'other' category is likely to be accounted by civil works.

In the table, U relates to uprate projects; S relates to station projects; C equals cable projects; L refers to line projects; and O refers to other miscellaneous projects.

The breakdown of labour expenditure for Scenario A by the different project types is shown in the table below.

Table 3.4: National grid investment Discounted labour spending by year and project type – Scenario A

€Million	2011-2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
U Labour spend	63.2	7.9	4.3	3.1	2.4	0.9	0.1	0.1	0.0	0.0	0.0
O Labour spend	28.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C Labour spend	14.5	1.1	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0
L labour spend	139.4	31.9	32.2	31.9	42.5	50.0	37.6	31.8	28.0	1.9	1.8
S labour spend	97.9	13.2	13.0	10.5	4.1	0.6	0.5	0.5	0.1	0.0	0.0

Source: Indecon analysis of EirGrid data

The number of FTE jobs for one year for Scenario A is given in Table 3.5. The direct contribution of this expenditure to national employment is 20,147 man years i.e. with one year tenure.

Table 3.5: Direct contribution of grid investment total expenditure to national employment – undiscounted values – Scenario A

	€Million	FTE Man Years	Average annual jobs equivalent
Stage 1 National Spending	160.5	2,749	183
Stage 2 National Spending	749.0	19,485	1,299
Total National	**909.5**	**22,234**	**1,482**

Source: Indecon analysis of EirGrid Expenditure data

We also examine the profile of the present value of labour expenditure by type of project for Scenario B. This analysis is shown in Table 3.6 and highlights the significant difference in labour expenditure.

Table 3.6: National grid investment discounted labour spending – Scenario B

€Million	2011-2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
U Labour spend	63.2	7.9	4.3	3.1	2.4	0.9	0.1	0.1	0.0	0.0	0.0
O Labour spend	28.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C Labour spend	14.5	5.9	13.3	16.8	19.2	16.5	63.1	9.1	5.9	4.2	1.5
L labour spend	139.4	27.1	21.3	19.2	25.4	56.0	54.4	49.8	46.8	0.6	1.8
S labour spend	97.9	13.2	13.0	10.5	4.1	0.6	0.5	0.5	0.1	0.0	0.0

Source: Indecon analysis of EirGrid data

The implications of this level of investment in terms of employment are shown in Table 3.7. In terms of FTE man years, this level and type of investment is estimated to lead a direct impact of 29,734 jobs. Assuming that each jobs lasts for the full investment period (i.e. 15 years) indicates that this level of investment supports around 1,982 jobs on an annual basis.

Table 3.7: Direct contribution of grid investment total expenditure to national employment – undiscounted values – Scenario B

	€Million	FTE Man Years	Average annual jobs equivalent
Stage 1 National Spending	184.8	3,166	211
Stage 2 National Spending	1,021.3	26,568	1,771
Total National	**1,206.2**	**29,734**	**1,982**

Source: Indecon analysis of EirGrid Expenditure data

The labour expenditure profile of Scenario C is shown in the table below.

Table 3.8: National grid investment discounted labour spending – Scenario C

€Million	2011-2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
U Labour spend	63.2	7.9	4.3	3.1	2.4	0.9	0.1	0.1	0.0	0.0	0.0
O Labour spend	28.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C Labour spend	14.5	1.1	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0
L labour spend	139.4	31.9	32.2	31.9	42.5	41.3	26.6	21.2	18.0	1.9	1.8
S labour spend	97.9	13.2	13.0	10.5	4.1	0.6	0.5	0.5	0.1	0.0	0.0

Source: Indecon analysis of EirGrid data

The employment impacts of this investment are shown in Table 3.9 and indicate this investment supports around 20,476 jobs in terms of FTE man years. In terms of annual jobs equivalent we estimate this represents approximately 1,365 jobs. This equates to a position if the jobs lasted the full 15 years.

Table 3.9: Direct contribution of grid investment total expenditure to national employment – undiscounted values – Scenario C

	€Million	FTE Man Years	Average annual jobs equivalent
Stage 1 National Spending	160.5	2,749	183
Stage 2 National Spending	681.4	17,727	1,182
Total National	**842.0**	**20,476**	**1,365**

Source: Indecon analysis of EirGrid Expenditure data

3.4 Contribution of Grid investment expenditure to output and employment

In this section, the direct expenditure contribution in terms of national output and employment of the various grid investment expenditure scenarios are shown.

The key direct contributions of electricity grid investment as per Scenario A are shown in Table 3.10 and indicate that Scenario A will contribute around €1.97 billion to national output. In present value terms, we estimate that this investment contributes around €1.5 billion to national output. The employment supported by this scenario is very significant and our analysis indicates that around 1,482 jobs are directly supported on an annual basis.

Table 3.10: Direct contribution of each grid investment scenario total expenditure to national output/GDP and Employment – Scenario A

Total National Spending – €million (undiscounted)	1,968
Total National Spending – €million (discounted)	1,498
Total National Employment– FTE Man Years	22,234
Total National Employment– Average annual jobs	1,482

Source: Indecon analysis of EirGrid Expenditure data

The key direct contributions of the grid investment as per Scenario B are summarised in Table 3.11.

In present value terms, we estimate that undertaking grid investment as per Scenario B contributes around €3.0 billion to national output. This equals €2.15 billion in present value terms. This level and type of electricity grid investment supports an estimated 1,982 annual jobs.

Table 3.11: Direct contribution of expenditure to GDP and Employment – Scenario B

Total National Spending – €million (undiscounted)	2,994
Total National Spending – €million (discounted)	2,146
Total National Employment– FTE Man Years	29,734
Total National Employment– Average annual jobs	1,982

Source: Indecon analysis of EirGrid Expenditure data

Scenario C leads to an expenditure contribution of around €1.81 billion to national output. The employment supported by this investment is estimated around 20,476 FTE man years. This equates to around 1,365 annual jobs. These results are shown in Table 3.12.

Table 3.12: Direct contribution of total expenditure to national output/GDP and Employment – Scenario C	
Total National Spending – €million (undiscounted)	1,814
Total National Spending – €million (discounted)	1,407
Total National Employment– FTE Man Years	20,476
Total National Employment– Average annual jobs	1,365

Source: Indecon analysis of EirGrid Expenditure data

3.5 Conclusions on direct impact of grid investment

In this section, we have examined one impact of the benefits namely the direct economic impact of the grid development strategy. This has been assessed in terms of the different scenarios that are being considered to achieve these objectives. A number of key findings are as follows:

- Grid investment is likely to lead to significant levels of investment in the domestic economy through labour and Irish purchased materials;
- We estimate that undertaking grid investment as per Scenario A represents a gross expenditure of around €1.97 billion to national output. In present value terms, this equates to around €1.5 billion;
- In terms of employment, this investment leads to significant direct employment benefits of around 22,234 FTE man years which translates to 1,482 annual jobs supported;
- In present value terms, Scenario B contributes to around €3.0 billion to national output. This equals €2.15 billion in present value terms;
- This scenario supports an estimated 1,982 annual jobs;
- Scenario C leads to a gross contribution of around €1.81 billion to national output; and
- The employment supported by this investment is estimated to be around 20,476 FTE man years equivalent to approximately 1,365 jobs per annum.

These benefits, as well as the indirect benefits discussed in Chapter 4 need to be compared to the costs involved and the objectives of the investment, namely, to meet the requirements of the economy in particular the importance of ensuring competitive electricity prices.

4 Assessment of indirect and economy-wide impacts

4.1 Introduction

This section considers the gross economy-wide impacts arising from the direct economic impacts of each grid investment scenario considered in the preceding section. These wider impacts can be categorised as such:

- Economy-wide value added/GDP impacts and
- Economy-wide employment impacts.

These multipliers have been updated based on the latest CSO publically available data which was released in 2013.

4.2 Explanation and derivation of multipliers

Type I multipliers enable an estimate of the economy-wide impacts arising from the *direct plus indirect impacts* associated with changes in activity that occur in industries that have no direct links to expenditure due to an increase in demand from the directly affected industry. For example, the employment of 80 people (direct effects) on grid investment may lead to additional employment in the local services sector (indirect effect). The relationship between the direct effects and the indirect effects is determined by the size of the Type I multiplier.

Type II multipliers are an expansion of the Type I multiplier by including *direct, indirect and also induced impacts*. Induced impacts arise through the additional consumption that takes place as a result of the additional employment and incomes created, through the indirect impacts. In other words, Type II multipliers include the household as an additional sector in the economic relationships that make up the input-output framework.

Interpretation of multipliers

We would urge caution in the interpretation and usage of the output and employment multiplier estimates presented in this section, for the following reasons:

These multipliers are derived through input-output analysis and this, by definition, reflects the structure of the economy at a particular point in time. Multipliers are subject to change as the economy develops. We currently use multipliers based on the structure of the economy in 2010. These are based on CSO data published in 2013 and replace the pervious multipliers which were based on the structure of the economy in 2005. Also of relevance is that all expenditures and all sectors of the economy have an impact through multipliers on other parts of the Irish economy.

4.3 Economy-wide expenditure impacts

As previously described in the national impact estimates section, expenditure is split into four categories (by EirGrid/CER) in order to estimate, as accurately as possible, the indirect benefits from grid investment. They are:

- Labour
- Materials
- Other expenditures
- Overheads

In our analysis we consider labour spending in terms of full-time equivalent jobs (FTE). Therefore some of the multiplier impacts below do not include the multiplier impacts of expenditure on labour. Such expenditure of course has an expenditure benefit to the economy. It is therefore also useful to consider multiplier impacts taking into account the overall spend including labour. However it is important not to view the expenditure impacts on labour as an addition to the employment impact estimates and for that reason it is useful to consider the multiplier impacts with, and without, the labour spend.

The multipliers used in this report are summarised in Table 4.1 and are based on the multiplier impacts associated with the electricity and gas sector derived from the input-output tables. We present the output and Gross Value Added (GVA) multipliers in this table.

Table 4.1: Economy-wide impacts of grid investment expenditure in the Irish economy using Input-output analysis

		Type I		Type II	
Category of spending	Multiplier classification	Output Multiplier	GVA Multiplier	Output Multiplier	GVA Multiplier
Labour	Electricity and Gas	1.30	1.29	1.47	1.46
Materials	Electricity and Gas	1.30	1.29	1.47	1.46
Other	Construction/Electricity and Gas	1.36	1.81	1.58	2.39
Overheads	Electricity and Gas	1.30	1.29	1.47	1.46

Source: Indecon analysis of EirGrid Expenditure data, and CSO Input-output tables.

We present the direct, indirect and induced spending for Scenario A in Table 4.2. These estimates are in undiscounted terms and indicate that total economy-wide impact of grid expenditure is likely to be around €1.62 billion. As noted previously, this excludes the labour expenditure as this will be translated directly into employment.

Table 4.2: Undiscounted gross value of economy-wide impacts of grid investment expenditures on Irish economy - Scenario A

	€Million				
Category of spending	Labour	Materials	Other	Overheads	Total
Direct Spending	909.5	83.0	634.9	340.3	1,967.7
Indirect Benefits	270.9	24.7	225.7	101.3	622.7
Induced Benefits	154.0	14.0	140.5	57.6	366.2
Direct and Indirect	1,180.4	107.7	860.7	441.7	2,590.4
Direct, Indirect and induced Benefits	1,334.4	121.7	1,001.2	499.3	2,956.6
Direct, Indirect and induced Benefits less labour spending		121.7	1,001.2	499.3	1,622.2

Source: Indecon analysis of EirGrid Expenditure data and CSO, Input-output tables.

We present a similar analysis for Scenario B in Table 4.3. The key difference between Scenario A and Scenario B is in terms of the 'other' category. Around 59% of the expenditure under Scenario B is classified as other expenditure. This is made up primarily of civil works. The labour component

of this civil works expenditure is removed from the other category and included in the labour category.

Our analysis indicates that the total economy-wide gross impact of the expenditure needed to complete Scenario B on the Irish economy is likely to be around €2.75 billion.

Table 4.3: Undiscounted gross value of economy-wide impacts of grid investment expenditures on Irish economy - Scenario B

	€Million				
Category of spending	Labour	Materials	Other	Overheads	Total
Direct Spending	1,206.2	120.3	1,145.4	522.4	2,994.2
Indirect Benefits	359.2	35.8	407.2	155.6	957.8
Induced Benefits	204.2	20.4	253.5	88.4	566.5
Direct and Indirect	1,565.4	156.1	1,552.6	677.9	3,952.0
Direct, Indirect and induced Benefits	1,769.6	176.4	1,806.1	766.4	4,518.5
Direct, Indirect and induced Benefits less labour spending		176.4	1,806.1	766.4	2,748.9

Source: Indecon analysis of EirGrid Expenditure data and CSO, Input-output tables.

The final scenario that we consider is Scenario C which has the lowest levels of capital investment. The key undiscounted impacts are shown in Table 4.4. The direct, indirect and induced impact of the investment (less the labour spending) is estimated to be around €1.5 billion.

Table 4.4: Undiscounted gross value of economy-wide impacts of grid investment expenditures on Irish economy - Scenario C

	€Million				
Category of spending	Labour	Materials	Other	Overheads	Total
Direct Spending	842.0	77.2	582.8	312.4	1,814.3
Indirect Benefits	250.8	23.0	207.2	93.0	574.0
Induced Benefits	142.5	13.1	129.0	52.9	337.5
Direct and Indirect	1,092.7	100.2	789.9	405.4	2,388.2
Direct, Indirect and induced Benefits	1,235.2	113.3	918.9	458.3	2,725.7
Direct, Indirect and induced Benefits less labour spending		113.3	918.9	458.3	1,490.4

Source: Indecon analysis of EirGrid Expenditure data and CSO, Input-output tables.

The discount net present value (NPV) analysis of the economy-wide impacts of Scenario A expenditure is shown in Table 4.5.

Table 4.5: Discounted NPV of gross economy-wide impacts of grid investment expenditures on Irish economy – Scenario A

	€Million				
Category of spending	**Labour**	**Materials**	**Other**	**Overheads**	**Total**
Direct Spending	695.9	63.9	478.9	257.2	1,496.0
Indirect Benefits	207.3	19.0	170.3	76.6	473.2
Induced Benefits	117.8	10.8	106.0	43.5	278.2
Direct and Indirect	903.2	83.0	649.2	333.8	1,969.2
Direct, Indirect and induced Benefits	1,021.0	93.8	755.2	377.4	2,247.4
Direct, Indirect and induced Benefits less labour spending		270.5	2,159.7	1,088.6	1,226.4

Source: Indecon analysis of EirGrid Expenditure data and CSO, Input-output tables

Using a 5% discount rate, the present value economy-wide impacts of undertaking investment as per Scenario B are shown in Table 4.6. The 5% discount rates is the recommended Department of Public Expenditure and Reform guideline rate to be used to adjust future values into current net present values.

Table 4.6: Discounted NPV of gross economy-wide impacts of grid investment expenditures on Irish economy – Scenario B

	€Million				
Category of spending	**Labour**	**Materials**	**Other**	**Overheads**	**Total**
Direct Spending	882.0	87.8	801.7	372.6	2,144.1
Indirect Benefits	262.7	26.2	285.0	111.0	684.8
Induced Benefits	149.3	14.9	177.4	63.1	404.7
Direct and Indirect	1,144.7	114.0	1,086.7	483.6	2,829.0
Direct, Indirect and induced Benefits	1,294.0	128.8	1,264.1	546.7	3,233.6
Direct, Indirect and induced Benefits less labour spending		371.6	3,614.9	1,577.0	1,939.6

Source: Indecon analysis of EirGrid Expenditure data and CSO, Input-output tables

The direct, indirect and induced expenditure impacts of electricity grid investment as outlined in Scenario C are shown in Table 4.7. These values are shown in present value terms using a 5% discount rate.

Table 4.7: Discounted NPV of gross economy-wide impacts of grid investment expenditures on Irish economy – Scenario C

	€Million				
Category of spending	**Labour**	**Materials**	**Other**	**Overheads**	**Total**
Direct Spending	655.6	60.5	447.8	240.5	1,404.4
Indirect Benefits	195.2	18.0	159.2	71.6	444.1
Induced Benefits	111.0	10.2	99.1	40.7	261.0
Direct and Indirect	850.8	78.5	607.0	312.2	1,848.5
Direct, Indirect and induced Benefits	961.8	88.7	706.1	352.9	2,109.5
Direct, Indirect and induced Benefits less labour spending		255.9	2,019.1	1,018.0	1,147.7

Source: Indecon analysis of EirGrid Expenditure data and CSO, Input-output tables

4.4 Direct and indirect labour benefits

In order to estimate the indirect labour benefits of grid investment projects, we convert the euro amount spent on Labour into a number of FTE (Full Time Equivalent) jobs.

The labour expenditure for Scenario A for each stage is shown in Table 4.8 and indicates that this investment is likely to support around 2,825 jobs in each year of the project. We note that the levels of employment supported may vary on a year to year basis but we have examined the jobs supported on an average annual basis. As discussed previously, the first step of the methodology applied in the table below is to convert the total national labour expenditure into the number of full-time equivalents (FTEs) supported. Multiplier analysis is then applied to these FTEs to estimate the economy-wide employment impacts.

Table 4.8: Value of undiscounted direct, indirect and induced impact on employment from grid investment expenditure – Scenario A

	Stage 1	**Stage 2**	**Total**
Labour Spending (€million)	160.5	749.0	909.5
Direct FTE Man Years of Employment	2,749	19,485	22,234
Direct & Indirect Man Years	3,974	30,124	34,098
Direct, Indirect & Induced Man Years	5,523	36,849	42,371
Average Annual Jobs	368	2,457	2,825

Source: Indecon analysis

The breakdown of employment impacts for the different stages under Scenario B is shown in Table 4.9 and shows the total number of direct, indirect and induced annual jobs supported is around 3,774.

Table 4.9: Value of undiscounted direct, indirect and induced impact on employment from grid investment expenditure – Scenario B

Scenario B:	Stage 1	Stage 2	Total
Labour Spending (€million)	184.8	1,021.3	1,206.2
Direct FTE Man Years of Employment	3,166	26,568	29,734
Direct & Indirect Man Years	4,576	41,074	45,650
Direct, Indirect & Induced Man Years	6,360	50,244	56,603
Average Annual Jobs	424	3,350	3,774

Source: Indecon analysis

The employment supported, based on discounted labour expenditure, for Scenario C is shown in Table 4.10 and this indicates that this level of investment is likely to support around 2,603 jobs on an annual basis.

Table 4.10: Value of undiscounted direct, indirect and induced impact on employment from grid investment expenditure – Scenario C

Scenario C:	Stage 1	Stage 2	Total
Labour Spending (€million)	160.5	681.4	842.0
Direct FTE Man Years of Employment	2,749	17,727	20,476
Direct & Indirect Man Years	3,974	27,406	31,380
Direct, Indirect & Induced Man Years	5,523	33,524	39,046
Average Annual Jobs	368	2,235	2,603

Source: Indecon analysis

It is also useful to examine the employment impacts based on the undiscounted national labour expenditure for each scenario. Our estimates of full-time equivalent employees is based on a standard approach using official CSO data and a number of assumptions as outlined above.

The analysis below shows that the number of direct and the number of indirect jobs arising from undiscounted expenditure for the different scenarios. The gross employment impacts of the expenditures should not however be misinterpreted as suggesting that this equates to net

employment impacts. The latter would need an adjustment to take account of the opportunity cost of labour and this is likely to be somewhere between 80 – 100%. The more significant employment impacts would depend on how the provision or lack of provision of adequate electricity grid infrastructure impacts on jobs in the traded sector of the economy. Some indication of this can be seen by considering the costs of disruption in electricity supply but this is only a short-term impact and the much more significant impact is likely to result from the impact on the ability of enterprises to expand and the facilitation of new investment. These factors represent the most significant potential long term benefits of the grid investment. Research on the views of enterprises in Ireland on the impact of an adequate electricity grid on investment represents one indication of the significance of this issue. Also relevant are the implications of the proposed investment for reliability, flexibility, cost competitiveness and electricity prices. This demonstrates the importance of ensuring infrastructure needs are met at the lowest feasible cost.

We estimate that grid investment in terms of the proposed Scenario A will contribute €1.6 billion to the wider Irish economy over the lifetime of the project. In present value terms, this translates to €1.2 billion. This analysis removes the expenditure on labour as this is examined in terms of actual employment supported. This level and type of investment under Scenario A is estimated using input-output analysis to support around 2,825 in average annual jobs.

Table 4.11: Gross economy-wide impacts of grid investment expenditures on Irish economy – Contributions to National Output and Employment – Scenario A

	Total
Total Direct, Indirect and induced Benefits less labour spending – discounted (€million)	1,226.4
Direct, Indirect and induced FTE Man years	42,371
Average Annual jobs equivalent	2,825

Source: Indecon analysis

Scenario B includes a significant investment and it is estimated that this investment would be worth around €1.94 billion to the economy in gross benefits. Including direct, indirect and induced employment impacts gives an annual average of jobs supported of 3,774. These economic contributions of Scenario B to the wider economy are summarised in Table 4.12.

Table 4.12: Gross economy-wide impacts of grid investment expenditures on Irish economy – Contributions to National Output and Employment – Scenario B

	Total
Total Direct, Indirect and induced Benefits less labour spending – discounted (€million)	1,939.6
Direct, Indirect and induced FTE Man years	56,603
Average Annual jobs equivalent	3,774

Source: Indecon analysis

The key expenditure and employment related benefits of grid investment as per Scenario C are shown in Table 4.13 and would lead to around €1.15 in gross economic benefits (less labour spending) to the economy. In terms of wider economy benefits, this investment is likely to support around 39,046 in FTE man years or 2,603 jobs on an annual basis.

Table 4.13: Gross economy-wide impacts of grid investment expenditures on Irish economy – Contributions to National Output and Employment – Scenario C

	Total
Total Direct, Indirect and induced Benefits less labour spending – discounted (€million)	1,147.7
Direct, Indirect and induced FTE Man years	39,046
Average Annual jobs equivalent	2,603

Source: Indecon analysis

The key gross expenditure and employment related benefits of the different scenarios for electricity grid investment are summarised in Table 4.14. This table shows that electricity grid investment is likely to lead to significant expenditure impacts, but require significant costs. These costs need to be compared to the wider benefits of the provision of the infrastructure.

Table 4.14: Summary of proposed Scenarios for Grid Development

	Scenario A	Scenario B	Scenario C
NPV (Net Present Value) of the Costs	2,229	2,864	2,097
NPV of the Gross Benefits	1,229	1,942	1,150
Difference	1,000	922	947
Economy-wide Employment (Man Years) supported	42,371	56,603	39,046
Economic Benefits of Infrastructure provision	(See below)	(See below)	(See below)

Source: Indecon analysis

4.5 Economic Cost of a Disruption

As one of the benefits of the proposed investment programme is to ensure the avoidance of electricity disruption as well as the wider benefits of being able to accommodate new and expanded projects, it is useful to consider estimates of the economic cost of an electricity disruption. This can be done using econometric techniques or detailed survey research. Previous research in other countries (including Ireland) have shown that there is likely to be a significant cost to society in terms of a loss in economic welfare due to an electricity outage. This research has also shown a range of estimates for the likely economic cost of an electricity disruption. The sources of these estimates are summarised in Table 4.15. It must be noted that there is likely to be a range of factors that are driving the different estimates in this table including weather, energy use and other socio-economic characteristics.

Table 4.15: Research on the economic cost of electricity disruption – residential consumers

Study
Carlsson and Martinsson (2008), WTP
Kariuki and Allan (1996)
Bertazzi et al. (2005), WTP
Sullivan et al. (2009)
Accent (2008), All DNOs except LPN
Bertazzi et al. (2005), WTA
Bliem (2009)
Accent (2004)
Accent (2008): LPN
Leahy and Tol (2011) – Ireland
London Economics (2013), WTA

Source: Indecon analysis based on London Economics report

Stated preference techniques are in our view probably more appropriate to the estimation of the economic cost of an electricity outage for residential consumers, and this is also the position of the Council of European Energy Regulators (CEER).[4] Stated preference techniques are able to give a comprehensive measure of the economic cost of a disruption even when intangible costs such as inconvenience and discomfort are some of the main costs associated with an outage.

Many recent studies use the production function approach to estimate the economic cost of an electricity disruption for household and industrial sectors. This is a more simplistic methodological approach based on aggregate data which is widely available. There are a number of drawbacks associated with this methodology. This is particularly true with relation to the household sector where this methodological approach typically focuses on the assumption regarding households' valuation of leisure time. Thus, there is a significant justification for using a survey based approach for estimating the economic cost of an electricity disruption in the residential sector. To consider estimates of disruption costs of electricity in Ireland, we make use of best-practice research undertaken internationally by London Economics[5] in the UK and previous research undertaken in Ireland[6] using the production function approach to provide a range of estimates of the likely economic cost associated with an electricity disruption. The economic cost of an electricity disruption is likely to vary significantly depending on a number of factors including the duration of the outage, the time of the outage, the time of the year of the outage and the day of the week of the outage. For this reason, we take an average estimate of the various disruption costs. The highest economic costs associated with a disruption are likely to be during winter at peak-times.

We show estimates of economic costs of an electricity outage in Ireland in Table 4.16 for residential users and the entire economy. These estimates show the very significant costs associated with an outage. More conservative estimates of the cost of a one hour outage for residential users suggest a figure of €24.2 million. These and the likely regional distribution are discussed in section 5.

[4] CERR Guidelines on Estimation of Costs due to electricity interruptions and voltage disruptions.
[5] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/224028/value_lost_load_electricty_gb.pdf
[6] Leahy, Eimear & Tol, Richard S.J., 2011. "An estimate of the value of lost load for Ireland," Energy Policy, Elsevier, vol. 39(3), pages 1514-1520, March.

Table 4.16: Economic cost of electricity disruption in Ireland – (€ 2014 prices)	
	€ million
	1 hour outage
Leahy & Tol (2012) (residential sector)	41.9
London Economics (2013) (Full Economy)	45.4
Source: Indecon elaboration using costs per user from the studies	

4.6 Conclusions on economy-wide and other impacts of grid investment

The key conclusions from this section can be summarised as follows:

- Grid investment is likely to have significant impacts in terms of national expenditure and employment.
- We estimate that grid investment in the proposed Scenario A would contribute a gross €1.62 billion to the wider Irish economy over the lifetime of the project. In present value terms, this translates to €1.2 billion.
- This level and type of investment is estimated using input-output analysis to support around 2,825 in average annual jobs when account is taken of the direct, indirect and induced impacts.
- The investment as per Scenario B is estimated to contribute around €1.94 billion in present value terms to the economy in gross expenditure impacts.
- Including direct, indirect and induced employment impacts gives an annual average of jobs supported of 3,774.
- The final scenario for grid investment would lead to around €1.15 billion in gross expenditure related economic benefits (less labour spending) to the economy.
- In terms of wider economy benefits, this investment is likely to support around 39,046 in FTE man years or 2,603 jobs on an annual basis.
- The economic cost associated with an electricity outage is likely to be significant and we estimate that for a one-hour outage the economic cost to the entire economy is likely to be around €45 million. A one-day outage is likely to have a considerably higher economic cost and would impact on the attractiveness both nationally and regionally of Ireland as a location for foreign investment.

5 Impact on Regional Development

5.1 Introduction

In this section, we examine the regional profile of the various grid investment expenditures and how these national expenditures translate into local employment and expenditure. This is particularly important as some the largest grid investments are likely to cross a number of regions.

One of the aims of grid investment is to assist in achieving balanced regional development in Ireland. The grid will be developed in all regions of the country. Without such infrastructural investment, some regions would find difficulty in supporting economic expansion. Grid investment will help regions operate on a level playing field to attract new industries which will create jobs and boost existing industry. However, it must be noted that there is a large number of reasons, aside from grid development, that will promote and sustain regional development.

Indecon has grouped counties into regions in line with CSO regions and the regions promoted by the development authorities.

5.2 Socio-Economic characteristics of different regions

In this section, we present some important data on the socio-economic profile of the various regions. This is important in examining the possible future need for future reliable electricity supplies. One of the drivers of electricity demand will be population growth. Historically, there has been a strong link between population growth and electricity demand. Many electricity forecasting models[7] have used housing stock as a driver of electricity demand and this shows the importance of population change in projecting electricity demand. The most recent data on population by region is shown in Table 5.1 and show a considerable increase in the population for the Mid-East over this short time period. Overall, the data presented below indicates that the population has increased by around 0.8% per year since 2011.

Table 5.1: Recent Population Changes, by Region

	2011	2012	2013	2014
State[8]	4574.9	4585.4	4593.1	4609.6
Border	515.5	510.9	509.6	503.9
Midland	283.8	287	288.7	290.6
West	440.8	437.4	437.9	437.1
Dublin	1261.5	1262.9	1262.4	1274.6
Mid-West	377.8	380.1	378	378.2
South-East	499.3	500.8	505.1	504.8
South-West	662.3	666.2	670.6	673.4
Mid-East	533.8	540.1	540.8	546.9
Source: CSO				

[7] See Hennessy and FitzGerald (2011) "The HERMES model of the Irish Energy Sector" ESRI Working Paper 396

[8] The regions used in the section are based CSO regions aligned with the National Spatial Strategy. The regions used by EirGrid reports differ slightly

In terms of infrastructure planning, it is important to examine demographic pressures in the long term. The CSO has produced detailed regional projections of population out to 2031. These are based on different assumptions regarding mortality, fertility, immigration and internal migration.

The CSO uses the same assumption regarding the fertility rate for the three main population scenarios. This assumption (F2) is based on the total fertility rate (TFR) decreasing from its 2010 level of 2.1 to 1.8 by 2026 and remaining at the 2026 rate for the remaining years.

Another key assumption is the level of net migration between 2011-2031. Prior to 2007, there were significant levels of immigration with the peak of 151,100 coming into Ireland in 2007. This was offset by 46,300 people leaving Ireland in the same year but the total net migration was nearly 105,000. Between 2010 and 2014, the annual average total net emigration was around 29,000. The total gross emigration was around 81,000 in each of these years. The key migration assumptions that underpin the population projections are shown in Table 5.2 and these show the annual migration assumptions. Post 2016, it is assumed that the level of net migration will be positive and this will increase further after 2021. However, these levels of net migration are significantly lower than those observed in Ireland between 2000 and 2008.

Table 5.2: Assumptions regarding Net Migration used in Population Projections

	2016-2021	2021-2031
M2	+4,700	+10,000

Source: CSO Regional Population Projections

The final assumption that will drive regional population growth is internal migration. This has no impact on the overall Irish population but has very significant impacts on the regional distribution of the population.

The first assumption is called 'traditional' which assumes a gradual reversal to the 1996 pattern of inter-regional flows by 2021 and stays at this pattern for the remaining years. The implications of these assumptions are shown in Table 5.3 which shows that it is projected the total population of Ireland will be around 13% higher by 2031 which represents an annual growth rate of around 0.7%. It is projected that the largest percentage population increases are likely to be in the GDA with Dublin projected to grow by 1% per annum and the Mid-East projected to grow by 1.3% per annum. This is in stark contrast to the Border and West regions which are projected to have very low population growth.

Table 5.3: Actual and projected population of Regional Authority areas, 2011 and 2031 (M2F2 Traditional)

Regional Authority area	Population 2011	Population 2016	Population 2021	Population 2026	Population 2031	Average annual increase	Total % Increase
	Thousands					%	
Border	516	518	526	531	533	0.2%	3.4%
GDA:	1,795	1,858	1,973	2,087	2,197	1.1%	22.4%
Dublin	1,262	1,297	1,373	1,448	1,519	1.0%	20.3%
Mid-East	534	561	600	639	678	1.3%	27.0%
Midland	284	293	302	307	309	0.4%	8.8%
Mid-West	378	383	393	403	410	0.4%	8.4%
South-East	499	514	531	542	550	0.5%	10.2%
South-West	662	678	701	719	733	0.5%	10.7%
West	441	443	451	455	456	0.2%	3.4%
State	4,575	4,687	4,876	5,044	5,188	0.7%	13.4%

Source: CSO

A second assumption on internal migration is to examine the implications of using inter-regional flows as observed in the 2011 Census. This 2011 observation is applied to each year out to 2031. Using the same assumptions on fertility and immigration, the population projections under this scenario are shown in Table 5.4. This assumption considerably reduces the projected population in the GDA and this scenario projects an 18% increase compared to a 22% increase under the previous assumption.

Using the 2011 observed regional flows as the most likely scenario would indicate a much regionally balanced population growth albeit the east of the country will grow faster than other parts. It also be noted that the West and the Mid-West have the lowest levels of population growth with projected future population only around 5% above the current level.

Table 5.4: Actual and projected population of Regional Authority areas, 2011 and 2031 (M2F2 Recent							
Regional Authority area	Population 2011	Population 2016	Population 2021	Population 2026	Population 2031	Average annual increase	Total % Increase
	Thousands					%	%
Border	516	520	532	544	555	0.4%	7.6%
GDA:	1,795	1,851	1,949	2,038	2,115	0.9%	17.8%
Dublin	1,262	1,293	1,360	1,421	1,472	0.8%	16.6%
Mid-East	534	558	589	617	644	1.0%	20.5%
Midland	284	296	311	326	341	1.0%	20.0%
Mid-West	378	382	389	394	397	0.3%	5.1%
South-East	499	515	534	551	566	0.7%	13.4%
South-West	662	679	706	730	751	0.7%	13.5%
West	441	443	453	459	462	0.2%	4.8%
State	4,575	4,687	4,875	5,043	5,188	0.7%	13.4%
Source: CSO							

The final scenario considered is where there is an increased pattern of internal migration towards Dublin at the expense of all regional (except the Mid-East). This was achieved by increasing the number of movers into Dublin on the 2011 levels by 2.5% per annum up to 2016 and holding the level steady thereafter. This increase in movers into Dublin was balanced by increasing the number of movers out of the other regions by the same amount. The key different between this scenario and the 'traditional' scenario is that the Mid-East does not grow by the same amount. The difference in the overall GDA of the two scenarios is negligible. These projections are shown in Table 5.5.

Table 5.5: Actual and projected population of Regional Authority areas, 2011 and 2031 (M2F2 Modified)							
Regional Authority area	Population 2011	Population 2016	Population 2021	Population 2026	Population 2031	Average annual increase	Total % Increase
	Thousands					%	
Border	516	518	527	534	540	0.2%	4.7%
GDA:	1,795	1,861	1,978	2,089	2,192	1.1%	22.1%
Dublin	1,262	1,303	1,389	1,472	1,548	1.1%	22.6%
Mid-East	534	558	589	617	644	1.0%	20.6%
Midland	284	295	308	319	331	0.8%	16.4%
Mid-West	378	381	386	389	389	0.1%	2.8%
South-East	499	514	529	541	552	0.5%	10.5%
South-West	662	678	701	721	737	0.6%	11.4%
West	441	442	447	450	448	0.1%	1.6%
State	4,575	4,687	4,875	5,043	5,188	0.7%	13.4%
Source: CSO							

In addition to population growth a core objective of the grid investment is to meet the needs of the enterprise sector. In this context it is useful to review trends in employment across the various regions. The latest available data shows that the numbers in employment have grown in recent years in all regions in Ireland. However, it is clear that the Southern and Eastern regions have had a higher percentage increase in employment compared to the Border, Midland and Western regions. The latest figures suggest even in years where overall national employment grew, the numbers in employment decreased in certain regions. For example, the South-West had around 5,000 fewer working in 2014 compared to 2013.

Table 5.6: Number in Employment by Region (000s)					
	2010	2011	2012	2013	2014
State	1857.3	1847.7	1848.9	1909.8	1938.9
Border	187.4	180.8	171.5	185.8	185.8
Midland	103.4	102.8	105.7	111.1	113.7
West	181.5	178.8	180.9	185.9	181.1
Dublin	552.6	548.8	556.3	572.1	587.5
Mid-West	151	154.6	150.1	151.3	152.8
South-East	185.8	182.9	181.8	197.1	204.5
South-West	269.3	269.1	277	280.6	275.6
Mid-East	226.3	229.9	225.5	225.9	237.9
Source: CSO QHNS					

The most recent (and most reliable) estimates on the level of unemployment by region are shown in Table 5.7. The data shows that the level of unemployment is significantly higher in certain regions such as the South-East and Midland when compared to Mid-East or the National position.

Table 5.7: Unemployment Rate by Region (%)					
	2010	2011	2012	2013	2014
State	14.3	14.5	13.7	11.7	9.9
Border	13.5	13.9	16.5	13.5	10
Midland	16.4	18.7	16.9	13.7	13.1
West	15.4	15.4	14.4	11.9	10.2
Dublin	13	13	11.1	10	8.6
Mid-West	17.1	15.9	15.4	10.7	10.2
South-East	18.3	19.2	18.8	15.5	11.9
South-West	13	13.5	11.9	10.2	10.6
Mid-East	12.8	12.4	12.4	12.5	8.5
Source: CSO QHNS					

One of the key drivers of future demand for energy and electricity will be the levels of output growth in the economy. The most recent forecasts for the Irish economy indicate steady growth out until 2020. However, from an infrastructural planning point of view, it is important to examine the growth potential of the economy over a longer time period. Although any forecast of economic output is characterised by significant degrees of uncertainty, it is useful to consider the potential growth across the different sectors in the economy. These sectors often have very different electricity demand profiles and this will have considerable implications for future levels of electricity demand by the non-residential sector. This assumes a recovery in Ireland's growth prospects. Given the uncertainties for the international and European economies and the volatility of Irish economic growth, caution is required in interpreting this scenario. Particular uncertainty surrounds sectoral movements. Some of these forecasts are based on ESRI previously published estimates based on an economic recovery scenario. The ESRI data does not provide forecasts at this detailed sectoral level shown below and so the forecasts are the responsibility of Indecon.

Table 5.8: Scenario for Sectoral Output–Average Percentage Output Growth

	2014-2018	2019-2026	2027-2034	2035-2042	2043-2050
Agriculture, fishing, forestry	2.8%	1.9%	1.5%	1.5%	1.5%
Coal, peat, petroleum, metal ores, quarrying	4.1%	3.5%	1.4%	1.5%	1.5%
Food, beverage, tobacco	4.1%	3.5%	1.4%	1.5%	1.5%
Textiles Clothing Leather & Footwear	4.1%	3.5%	1.4%	1.5%	1.5%
Wood & wood products	4.1%	3.5%	1.4%	1.5%	1.5%
Pulp, paper & print production	4.1%	3.5%	1.4%	1.5%	1.5%
Chemical production	4.2%	3.5%	1.7%	1.8%	1.8%
Rubber & plastic production	4.1%	3.5%	1.4%	1.5%	1.5%
Non-metallic mineral production	6.4%	3.1%	3.4%	3.4%	3.4%
Manufacture of Basic Metals	6.4%	3.1%	3.4%	3.4%	3.4%
Manufacture of Fabricated Metal Products	4.2%	3.5%	1.7%	1.8%	1.8%
Agriculture & industrial machinery	4.2%	3.5%	1.7%	1.8%	1.8%
Electrical goods	4.2%	3.5%	1.7%	1.8%	1.8%
Transport equipment	4.2%	3.5%	1.7%	1.8%	1.8%
Other manufacturing	4.1%	3.5%	1.4%	1.5%	1.5%
Fuel, power, water	3.4%	3.9%	2.4%	2.3%	2.3%
Construction	6.4%	3.1%	3.4%	3.4%	3.4%
Transport	3.9%	2.1%	1.8%	1.8%	1.8%
Services*	3.3%	3.4%	4.0%	4.1%	4.1%
Health & Education	0.3%	2.0%	2.0%	2.0%	2.0%
Public Administration	-0.7%	2.0%	2.0%	2.0%	2.0%

Note: Forecasts beyond 2030 assume sectors continue to grow at 2030 rate for each year between 2030 and 2050.
*Wholesale & retail of vehicles, wholesale & retail excl. motor vehicles, accommodation, food services.
Source: Indecon analysis

It is likely that each of these sectors will have different electricity demand profiles. The most recent data on industrial electricity use is shown in Table 5.9 and this highlights the large electricity usage by the food and beverage sector, the chemicals sector and the electrical equipment sector. In the output scenario shown previously, the food sector is likely to grow considerably over this period. The chemical sector is also estimated to grow significantly with annual growth rates of around 2% projected. This growth rate would lead to an outcome where the level of output in the chemical sector will be nearly double its current level by 2050.

Table 5.9: Electricity Consumption by Industrial Sector (Ktoe) 2008-2013

	2008	2009	2010	2011	2012	2013	% change 08-13
Final energy consumption	2294	2173	2186	2139	2078	2081	-9.3%
Sum of all industry sub-sectors	686	740	783	816	788	799	16.5%
Industry- non energy mining	51	55	56	59	56	57	11.8%
Industry- food, beverages and tobacco	133	145	167	174	168	170	27.8%
Industry- textiles and textile products	6	7	10	10	10	10	66.7%
Industry- wood and wood products	26	28	34	35	34	34	30.8%
Industry- pulp, paper, publishing and printing	15	17	18	19	18	19	26.7%
Industry- chemicals and man-made fibres	119	130	142	148	143	145	21.8%
Industry- rubber and plastic products	30	32	34	36	35	35	16.7%
Industry- other non-metallic mineral products	70	77	50	52	50	51	-27.1%
Industry- basic metals and fabricated metal products	50	44	63	64	64	64	28.0%
Industry- machinery and equipment n.e.c	15	16	20	21	20	20	33.3%
Industry- electrical and optical equipment	101	110	97	101	97	99	-2.0%
Industry- transport equipment manufacture	8	9	17	17	17	17	112.5%
Industry- other manufacturing	63	68	76	79	76	78	23.8%

Source: SEAI Energy Balances

It must be noted that long-term projections of the future of the economy or the population are very uncertain and they should be used accordingly. The electricity intensity of different sector may reduce considerably overtime due to energy efficiency and different processes. In this context, it is particularly important to consider the electricity required by data centres. The electricity requirements of these centres can be very large. For this reason, it is also important to look at shorter-term regional targets.

5.3 Overall regional expenditure

As described previously, it is estimated that the total capital expenditure needed to complete Scenario A is around €2.9 billion. The regional breakdown of this expenditure is shown in Table 5.10.

Table 5.10: Benefits of grid investment by Region – Scenario A

	Discounted direct benefits (€m)	Share of Total Investment (%)	Total Spending €millions
Border	154.5	19.3%	564.4
West	87.8	11.0%	320.9
Mid-West	64.4	8.6%	249.3
South-West	174.3	21.2%	620.8
South-East	112.6	15.6%	455.1
Midlands	41.2	4.6%	136.0
Eastern	95.2	12.3%	359.6
Dublin	53.9	7.3%	211.5
Total Local Benefits	783.8	100.0%	2,917.6

Source: Indecon analysis

The same analysis is presented for Scenario B in Table 5.11 which highlights a slightly difference regional share of total expenditure.

Table 5.11: Benefits of grid investment by Region – Scenario B

	Discounted direct benefits (€m)	Share of Total Investment (%)	Total Spending €millions
Border	166.4	16.5%	646.3
West	145.3	15.4%	603.2
Mid-West	70.2	6.9%	272.1
South-West	207.9	19.8%	777.3
South-East	20.4	12.0%	446.3
Midlands	105.8	3.5%	154.0
Eastern	132.3	20.4%	782.9
Dublin	53.9	5.5%	215.9
Total Local Benefits	902.1	100.0%	3,897.9

Source: Indecon analysis

The regional analysis for Scenario C is shown in Table 5.12 which indicates the largest proportions of total spend will take place in the South-West.

Table 5.12: Benefits of grid investment by Region – Scenario C

	Discounted direct benefits (€m)	Share of Total Investment (%)	Total Spending €millions
Border	154.5	21.0%	566.2
West	87.8	11.9%	321.9
Mid-West	64.4	9.3%	250.0
South-West	166.2	21.8%	588.9
South-East	73.6	10.9%	293.6
Midlands	41.2	5.0%	136.4
Eastern	87.0	12.1%	326.7
Dublin	53.9	7.9%	212.1
Total Local Benefits	728.5	100.0%	2,695.8

Source: Indecon analysis

5.4 Contribution of grid investment to local employment

In order to examine the local employment that is supported by grid investment expenditures, it is important to establish the local labour expenditure associated with each grid investment scenario.

In the table below, regional estimates of the present value of expenditure on labour for each scenario are presented.

The method used to map the direct contribution of grid investment expenditure to regional employment is similar to that for the contribution to output. However, some changes are described below:

- Following on from the step where there are assumptions over how much of each spending category will be spent nationally; there are similar assumptions that have been described already that decide the percentage of national spending on a specific spending type (e.g., materials) that will accrue to the locality of the individual project.
- The locations of the projects will determine the region into which the local expenditure will be attributed. Where projects occur in two or more regions, the local expenditure is divided according to the geographic proportion of the project that is located in each region. For example, if there is a new overhead line planned for construction that is 10km long and passes through Mid-East (4km) and Dublin (6km) then 40% of the local expenditure is allocated to the Mid-East and 60% to Dublin.

In order to estimate the direct contribution of grid investment expenditure to employment at both national and regional levels, the direct spending amount must be converted to a number of jobs. The methodology used to estimate the number of full-time equivalent (FTE) jobs for one year, was to divide total labour spend by the annual FTE cost.

The direct contribution of grid investment expenditure to local employment, detailed by region

Table 5.13 below shows the breakdown of labour expenditure that occurs locally to the projects under grid investment by region for Scenario A. All spending is used to estimate the number of FTE jobs by region. Our analysis indicates that the largest numbers of jobs that are supported are in the Border region, the South-West and the South-East.

Table 5.13: Direct contribution of grid investment total expenditure to local employment – Scenario A			
Region	**Undiscounted €Million**	**Average annual jobs equivalent**	**Average annual jobs equivalent (including pro-rata allowance for national labour expenditure)**
Border	117	196	282
West	69	115	164
Mid-West	41	68	106
South-West	110	186	280
South-East	98	164	234
Midlands	31	50	71
Eastern	77	128	183
Dublin	75	129	162

Source: Indecon analysis of EirGrid expenditure data

Scenario B supports a higher number of jobs and this is shown in Table 5.14.

Table 5.14: Direct contribution of grid investment total expenditure to local employment – Scenario B			
Region	**Undiscounted €Million**	**Average annual jobs equivalent**	**Average annual jobs equivalent (including pro-rata allowance for national labour expenditure)**
Border	108	180	323
West	80	134	269
Mid-West	42	71	131
South-West	141	239	411
South-East	11	18	123
Midlands	91	153	183
Eastern	111	187	364
Dublin	75	129	177

Source: Indecon analysis of EirGrid expenditure data

Scenario C supports the lowest amount of employment but this employment support is quite evenly distributed across the different regions. This is shown in Table 5.15 which shows the impact of including a pro-rate allowance for national labour expenditure which raises the number of jobs supported by around 30% on average. This reflects the levels of overall expenditure but as noted earlier account has to be taken of the opportunity cost of the expenditure.

Table 5.15: Direct contribution of grid investment total expenditure to local employment – Scenario C			
Region	**Undiscounted €Million**	**Average annual jobs equivalent**	**Average annual jobs equivalent (including pro-rata allowance for national labour expenditure)**
Border	117	196	283
West	69	115	165
Mid-West	41	68	107
South-West	102	173	264
South-East	62	102	148
Midlands	31	50	71
Eastern	69	115	165
Dublin	75	129	162

Source: Indecon analysis of EirGrid expenditure data

The analysis shown in this section highlights the significant number of jobs that grid investment is likely to support during its implementation and construction phase. This varies somewhat by region and investment scenario. It also be noted that the analysis above does not account for the opportunity cost of resources. Also this only looks at the employment impact of the expenditure and not the employment expansion facilitated by the provision of sufficient grid infrastructure. In many regions this latter factor is likely to be most important.

5.5 Community Gain

In accordance with the Government Policy Statement on Energy Infrastructure July 2012 and as part of the investment programme an explicit community gain package for homes and communities that are near new Overhead lines and new rural transmission station projects has been proposed. However, while this is important, the main community gain relates to the ability of the investment to facilitate an expansion of economic output and employment in each of the regions. This combined with the local employment inputs from the expenditure programme represents the main areas of community gain.

The specific elements of the proposed Community Gain ('CG')[9] include:

- Community Payment
- Proximity Payment

The Community Payment will involve the establishment of a fund for local communities living in the vicinity of new lines and new rural stations. The fund amount is based on the length of the new transmission line. The rates per kilometre are as follows:

- €40,000 per km for 400 kV transmission lines
- €30,000 per km for 220 kV transmission lines
- €15,000 per km for 110 kV transmission lines

[9] Community Gain is only applicable on new infrastructure and is only applicable to projects granted planning permission after 17th July 2012

The proximity payment is a payment for homes that are near new OHL and new rural stations. The payment relates to the distance the new infrastructure is to a home. There is a sliding scale of payments between 50m and 200m with case by case negotiation for closer distances. The scales are shown in Table 5.16.

Table 5.16: Levels of Compensation assoicated with Proximity Allowance

Type	Distance 50m	Distance 200m
400 kV OHL (New)	€30,000	€5,000
400 kV Station (New)	€30,000	€5,000
220 kV OHL (New)	€20,000	€3,500
220 kV Station (New)	€20,000	€3,500
110 kV OHL (New Pylons only)	€10,000	€2,000
110 kV Station (New)	€10,000	€2,000

Note: Distances between 50-200m will be interpolated based on the above figures. All distances closer than 50m will be negotiated on a case-by-case basis.
Source: EirGrid

There may also be multiplier impacts with the direct expenditure on Community Gain (CG). Applying a Type II expenditure multiplier of two would indicate that the economy-wide impact of CG may be around €60 million. The actual amount of Community Gain will depend on a number of factors most importantly the selection of technology on individual projects.

Table 5.17: Direct contribution of grid investment in terms of Community Gain

Region	Community Gain Expenditure €Million (2016-2025)
Border	6.5
West	4.9
Mid-West	0.0
South-West	2.0
South-East	6.1
Midlands	2.1
Eastern	7.7
Dublin	0.4
Total	29.6

Source: EirGrid and Indecon analysis

5.6 Regional economic cost of an electricity disruption

As discussed in Section 4.5, it is very unlikely that the electricity disruptions will occur at the national level and thus the impacts are likely to vary on a regional basis. We present the likely regional impacts to residential users in Table 5.18 of a one hour outage and a 24 hour outage. It must be noted that the 24 hour outage may be an overestimation as residential users may be able to adjust to longer-term outages. Indecon also considered estimates based on applying costs per household which would have indicated lower estimates but as we were keen to attempt to take account of costs outside of direct residential costs, we used per capita estimates. At €24.2m, these

estimates are however much lower than previous estimates used for the residential sector in Ireland which as outlined in section 4 suggested a figure of €41.9 million.

Table 5.18: Economic Cost of an electricity disruption for residential uers, by region

	€Million	
Region	**1 hour outage**	**24 hour outage**
State	24.2	579.6
Border	2.6	63.4
Midland	1.5	36.5
West	2.3	55.0
Dublin	6.7	160.3
Mid-West	2.0	47.6
South-East	2.6	63.5
South-West	3.5	84.7
Mid-East	2.9	68.8

Note: Based on applying London Economics' estimates
Source: Indecon analysis

We also used an alternative approach to estimate the likely economic costs for the whole economy associated with electricity outages for the different regions in Table 5.19. These are based on applying the overall national economic cost estimates of a one-hour outage to the various regions according to the gross value added in each region. We would note however that the largest economic cost of a disruption is estimated to be in the Dublin region which reflects the significance of economic activity in Dublin and indeed this may even understate the costs in Dublin. The same caveats that were discussed previously are also important to consider for this regional analysis. This analysis however clearly shows that there are likely to be significant economic costs associated with an electricity supply disruption. This highlights the importance of a reliable electricity transmission system. These represent direct costs and the implications for economic growth and investment are likely to be significantly higher if lack of adequate provision impacts on investment.

Table 5.19: Economic Cost of an electricity disruption for whole economy, by region

	€Million	
Region	**1 hour outage**	**24 hour outage**
State	45.4	1,089.6
Border	2.8	67.6
Midland	1.5	36.0
West	3.6	87.2
Dublin	19.0	456.5
Mid-West	3.0	71.9
South-East	3.4	81.7
South-West	8.5	203.8
Mid-East	3.5	83.9

Source: Indecon analysis

5.7 Implications of Regional Targets on Electricity Demand

The employment and output potential of each region will be determined by the performance of the agri-food, tourism, services and manufacturing sectors including both indigenous and foreign firms. It is important that the needs of all of the key sectors can be met. It is useful to consider the key targets outlined by IDA (Ireland) as set out in Table 5.20 as some of coming projects such as data centres may have very high energy requirements. Over the next five years, it is targeted that the IDA will deliver around 900 new investments which contribute to around 35,000 of additional net employment. An increase in the number of investments of between 30 – 40% is targeted for each region outside of Dublin.

Table 5.20: IDA Ireland's Stategy, Winning: Foreign Direct Investment 2015-2019

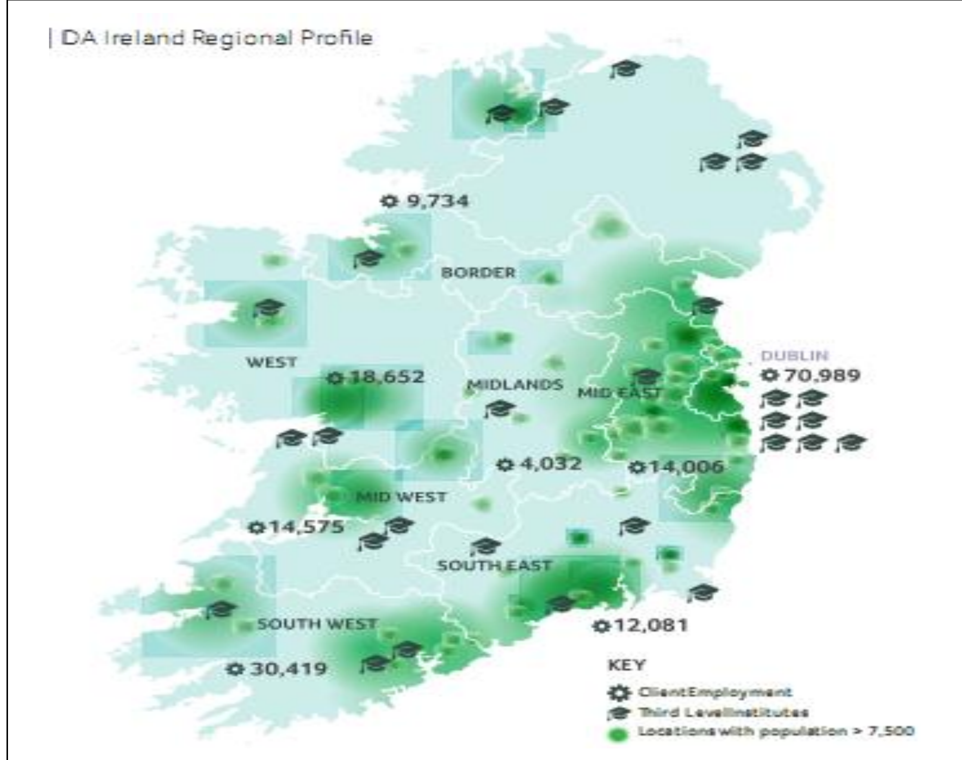
	Targets
No. of new Jobs (Gross)	80,000
No. of new Jobs (Net)	35,000
No. of Investments	900
R&D investment	€3 billion
Balanced Regional Growth	Minimum 30-40% increase in each region outside of Dublin

Source: IDA

The importance of regional infrastructure is critical to achieving these targets and the same issue applies to other traded sectors.

The current regional profile of FDI supported employment is shown in Figure 5.1 which shows FDI supports significant levels of employment in all the regions.

Figure 5.1: Regional Profile for Foreign Direct Investment.



Source: IDA Ireland

The most recent performance of FDI by different regions is summarised in Table 5.21.

Table 5.21: Recent FDI in terms of Regional Development

	Current Employment (IDA Client companies	No. of Investments over the last 5 years	Specialist Areas
Dublin & the Mid-East	84,995	450	Technology and Pharma
South-West	30,419	107	Pharma, Technology and Engineering
Mid-West	14,575	51	ICT and Med Tech
West	18,652	71	ICT, Life Sciences and services sectors
Border area	9,734	47	Engineering, Life Sciences, Financial services
Midlands	4,032	19	ICT, Life Sciences, Engineering
South East	12,081	34	Medical Technology

Source: IDA

In evaluating the ability of the electricity transmission network to accommodate the requirements of indigenous and overseas firms as well as the needs of other traded sectors, it is useful to note that there is significant variation in electricity demand by the different types of users as presented in Table 5.22. It is clear that data centre/farms are the largest users of electricity and it is important that this is considered in regional grid development.

Table 5.22: Typical Electricity Demand by different type of large user

Type	Size typical
New pharmaceutical factory	10-25MVA
New Mine	10-30MVA
New Datafarm small	10-30MVA
New Datafarm mid-sized	30-100MVA
New large Data Centre	100-300 MVA
New Semiconductor company	30-100MVA
New SME	1-10 MVA

Source: EirGrid

The largest users of electricity will typically provide some advance notice regarding expansion plans but are likely to require advance provision of basic infrastructure. The potential increase over the next couple of years from customers currently with a connection agreement was also examined but not included here for confidentiality reasons. This data indicated potential for a substantial growth in new very large demand centres in the Dublin region.

The demand of the current transmission connected customers was also examined and we reviewed the regional demand of the largest users. The data highlighted the significant non-residential electricity demand outside of the Dublin region. Over the 2010-2014 period, the new transmission connected customers were in the Dublin and Mid-East regions.

Aside from customers who connect directly with the TSO (EirGrid), there are also significant non-residential electricity users who connect with the DSO (ESBN). A regional breakdown of this data was considered but is not published here for the reasons outlined above.

In the context of the significant new non-residential demand, it is important to assess the impact of this on the electricity transmission network. The existing and projected level of demand in each of the regions is shown in the next table (see Table 5.23). The analysis below is based on assumptions for ongoing demand growth and do not include any discrete changes such as large once-off users. However, it is clear that in most of the regions significant percentage increases in demand could be accommodated.

This table also outlines the capability of the proposed investment programme to accommodate additional demand and compare this to estimated demand in each of the regions. This is based on EirGrid's median demand forecast.

This evidence suggests that there will be available capacity in all of the regions to accommodate significant expansion of demand. There are a number of technical caveats regarding the table below including:

- There may be local network access issues in the regions;
- Available capacity may vary throughout the region;[10] and
- There is a degree of interaction between the nodes/stations and regions. These are monitored on an ongoing basis.

Overall, the analysis indicates that there is significant capacity to accommodate likely significant increases in demand across all the regions outside of Dublin however there are risks of constraints in the Dublin/East area. It is clear however that the plans for regional expansion outside of Dublin would be capable of being accommodated under the various scenarios identified by EirGrid.

Table 5.23: Projected Demand by Region and Additional Capacity available

	East	Midlands	West	North East	North West	South East	South West
2014 Demand (MW)	1830	480	370	380	630	380	560
2025 Demand (MW)	2070	530	410	420	700	420	630
Additional Capacity (MW) – High	870	657	658	700	441	378	775
Additional Capacity (MW) - Median	735	469	433	425	295	284	532
Additional Capacity (MW) – Low	600	280	210	150	150	190	290

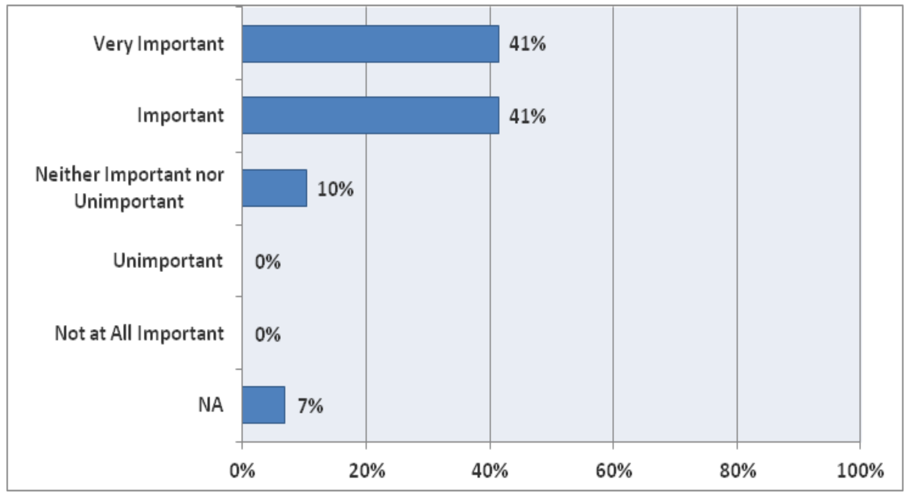
Source: EirGrid

5.8 Impact on regional development

In many ways the most important benefit of the investment programme is to support the expansion of both the national and regional economies. At a regional level the core benefit is therefore likely to be in terms of facilitating economic development in each of the regions. Figure 5.2 presents the assessment of businesses surveyed on the importance of electricity grid investment in facilitating regional economic development. 82% of respondents suggested that investment in the transmission grid is 'important' or 'very important' to facilitate regional development. This and other evidence in Section 6 is based on a survey of leading companies in Ireland which accounted for over 24,000 employees in Ireland and over 950,000 worldwide.

[10] This variation is examined in the Transmission Forecast Statements

Figure 5.2: Views on the importance of investment in the electricity transmission network to facilitate regional economic development



Source: Indecon survey of multinationals and indigenous companies in Ireland

5.9 Conclusions on the regional impacts

In this section, we outlined how the grid investment will lead to different regional impacts. Main findings include:

- It is estimated that grid investment will lead to significant local expenditure. This grid investment will have different regional impacts.
- In terms of gross economy-wide employment, grid investment is likely to support local employment across the different regions.
- It is essential that there is sufficient grid infrastructure to support regions to attract new investment as well as to facilitate expansion of jobs and existing industry. The importance of regional infrastructure is a crucial factor to achieving the potential of regional development in Ireland.
- National policy is focused on expanding economic output and employment in each of the regions. This will require an expansion of tourism, agriculture and indigenous and foreign owned firms. While it would be a mistake to see this only in terms of foreign industry, the focus on winning investment for the regions is reflected in the new IDA (Ireland) strategy which is targeting a minimum of 30% - 40% increase in the number of investments for each region outside of Dublin over the period 2015 – 2019.

6 Impact of Grid investment on attracting investment

6.1 Introduction

A key factor influencing investment decisions is the availability of adequate infrastructure. Ireland has targeted sectors such as Cloud Computing and Clean Technology, Manufacturing, Life Sciences, Internet Data Centres, Software and other sectors. It is therefore important to understand how grid investment may or may not impact on this key area of the Irish economy.

It is useful in examining the role of grid investment in facilitating investments to consider the types of investments that have been achieved in recent years. While differing sectoral investments apply to indigenous and foreign firms it is useful to consider examples of key foreign investment projects as presented in Table 6.1.

Table 6.1: IDA New Investments - 2014

Company Name	Jobs	Sector
Amazon	300	ICT
Bristol Myers Squibb	400	biological medicine
Fidelity	200	Financial services
LinkedIn	600	ICT
Survey Monkey	50	ICT
Air Bnb	100	ICT
PayPal	400	ICT
Ericsson	100	ICT
SAP	260	ICT
Johnson & Johnson	100	ICT
Alexion Pharmaceuticals	200	Pharma
Zendesk	100	Data Centre
Adroll	100	ICT
New Relic	50	ICT

Source: IDA Ireland

As discussed previously, it is important to note that a number of factors influence the location of foreign direct investments. These are summarised in the table below based on the results of a major recent book by Gray, Swinand and Batt on Ireland's Comparative Advantages for Foreign Direct Investment.

Table 6.2: Elements of comparative advantage for mobile foreign investment

Element	Importance
Access to Markets	Essential Requirement
Education, Skills and Research and Development	Fundamental to Being Considered
Productivity and Labour Costs	Key in Evaluation of Locations
Taxation and Cost of Capital	Critical Factor for High Profit Sectors
Intermediate Input Costs	Influences Return on Capital Employed
Ease of Doing Business	Frequently the Deciding Issue
Exchange Rates	Important in Maintaining Cost Competitiveness
Demonstration Effects	Influences Overall Perceptions

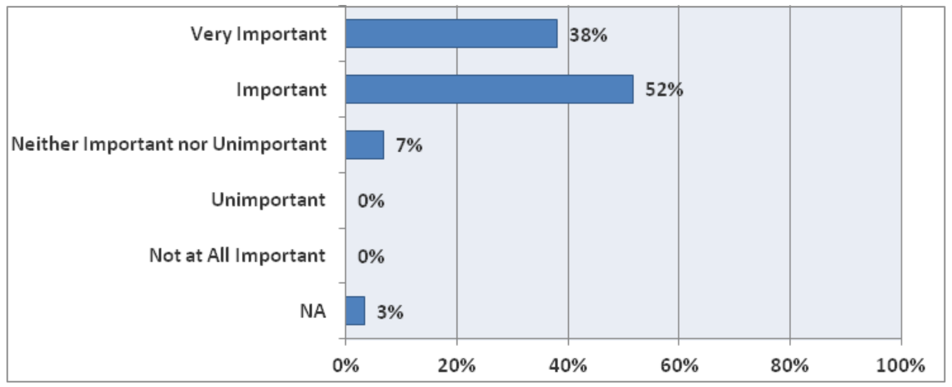
Source: Economic Analysis of Ireland's Comparative Advantages for Foreign Investment. Gray, A.W., Swinand, G.P. and Batt, W.H., ISBN 978-0-9531318-15

These factors are all likely to vary by region and thus it is important the targeting of investment takes a regional view of strengths and weaknesses.

6.2 Evidence of Importance of electricity grid

In this section, we will examine survey evidence of the importance of electricity grid investment in supporting economic development in Ireland. Figure 6.1 shows that 90% of firms surveyed believe that investment in the electricity transmission network to be either 'important' or 'very important' for our ability to attract additional foreign direct investment (FDI) to Ireland.

Figure 6.1: Views on importance of electricity transmission network on ability to attract additional foreign investment to Ireland

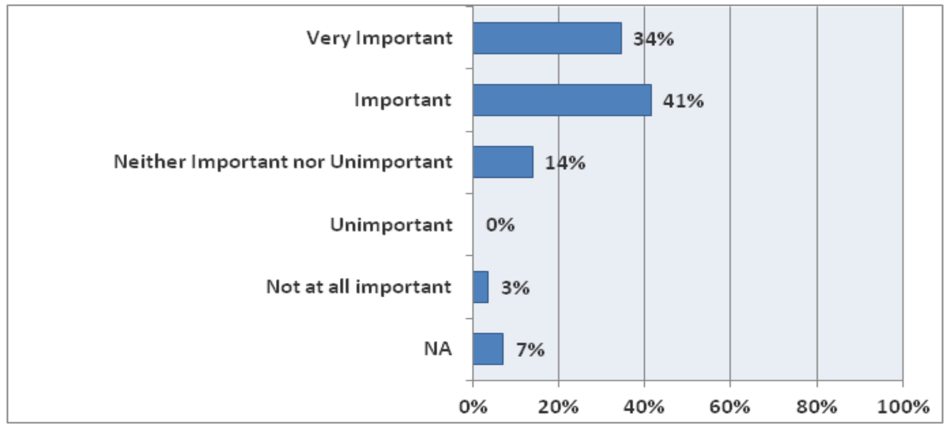


Source: Indecon survey of multinationals and indigenous companies in Ireland

The following figure shows the results of the judgment of firms surveyed on the importance of a high quality electricity supply to decisions to locate new operations or functions in Ireland. A

majority, 75%, of companies indicated it was 'important' or 'very important' to such decisions, while only 17% said high quality electricity supply had no important impact.

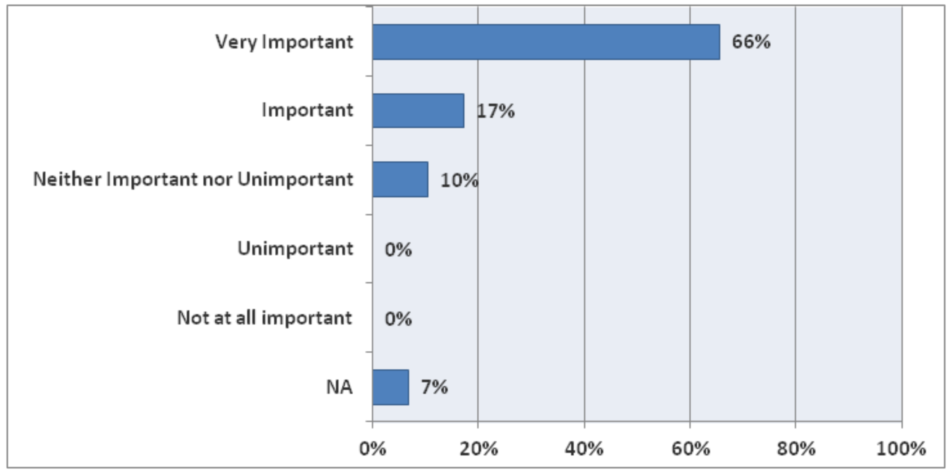
Figure 6.2: Views on the importance of access to a high quality electricity supply on decisions to locate new operations or functions in Ireland



Source: Indecon survey of multinationals and indigenous companies in Ireland

The views on companies surveyed on whether access to a high quality electricity supply would be 'important' to their continuing operations in Ireland are presented in Figure 6.3. A majority, 66%, responded that it was 'very important' while another 17% said it was 'important'.

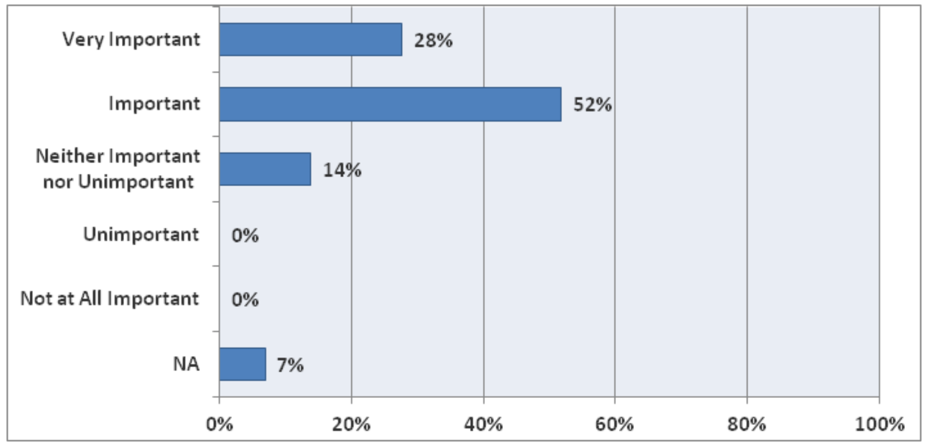
Figure 6.3: Views on the importance of access to a high quality electricity supply on continuing operation in Ireland?



Source: Indecon survey of multinationals and indigenous companies in Ireland

Figure 6.4 shows the views of the surveyed companies on the importance of investment in the electricity transmission network for facilitating companies to remain in Ireland. 52% of respondents felt that investment in the National Grid was 'important' to help facilitate companies to remain in Ireland with a further 28% considering it 'very important'.

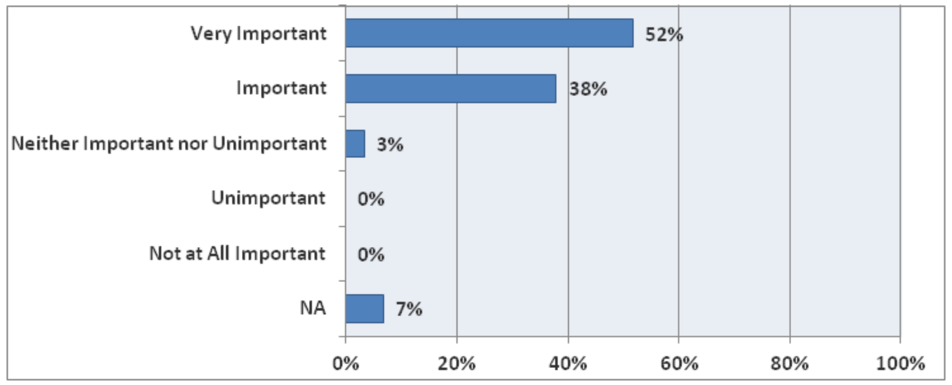
Figure 6.4: Views on the importance of electricity transmission network to facilitate companies to remain in Ireland



Source: Indecon survey of multinationals and indigenous companies in Ireland

Figure 6.5 shows the views of surveyed firms on the importance of investment in the electricity transmission network to facilitate companies in Ireland to expand their operations. 90% suggested that it is either 'important' or 'very important' to companies when making the decision to expand their operations in Ireland.

Figure 6.5: Views on importance of investment in the electricity transmission network to facilitate companies in Ireland to expand

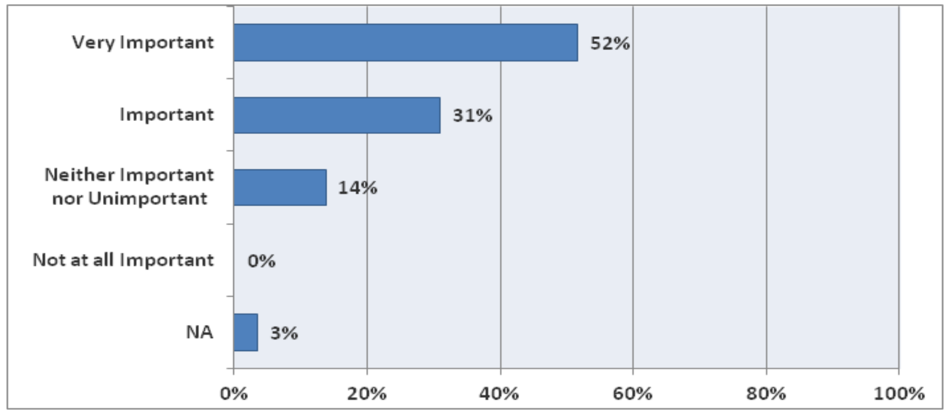


Source: Indecon survey of multinationals and indigenous companies in Ireland

Figure 6.6 reflects the views of the surveyed firms on the importance of available capacity to their decisions to expand their operations. 83% of firms indicated that additional available capacity was

'important' or 'very important' to any expansion plans. The majority of firms (52%) considered it to be 'very important' to any future expansion plans.

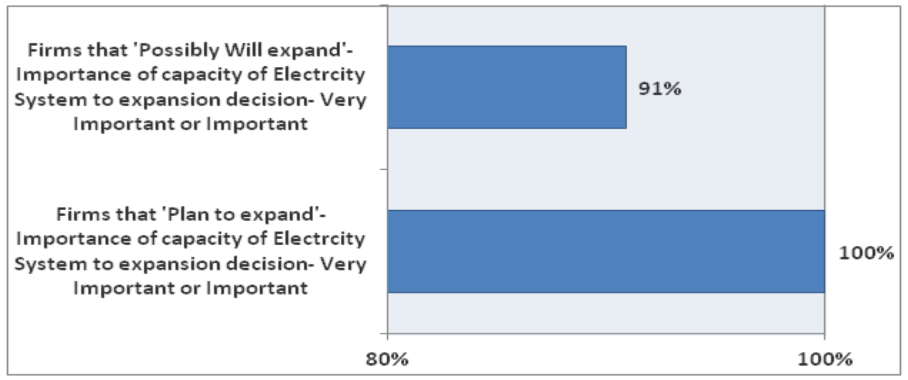
Figure 6.6: Importance of additional available capacity on the electricity system in terms of expansion plans



Source: Indecon survey of multinationals and indigenous companies in Ireland

Figure 6.7 shows the opinions of surveyed firms that indicated they 'Plan to Expand' or that they 'Possibly Will Expand'. Of those firms that planned to expand, 100% of them believed that the additional capacity of the national electricity transmission network was very important or important to the expansion decision. 91% of the firms that indicated a possible plan to expand considered it to be very important or important.

Figure 6.7: Priorities of firms with plans for expansion



Source: Indecon survey of multinationals and indigenous companies in Ireland

6.3 Data Centres

In evaluating the role of the electricity grid infrastructure in meeting the needs of the economy it is useful to consider one area in more detail, namely data centres. The importance of added analysis of data centres is due to the fact that such projects are very large and intensive users of electricity and the scale of individual projects can impact on grid infrastructure requirements. A summary of the key features of Data Centres is provided in Box 6.1. This type of FDI is directly linked to the ability of the grid to provide a reliable source of electricity.

Box 6.1: Case study: Importance of Data Centres

Introduction and Background:
Data Centres are large groups of networked computer servers used for the remote storage, processing and distribution of significant volumes of data. Ireland currently hosts a combined electrical capacity of 224 MVA in 12 commercial co-location Data Centres. These large data centres are predominantly situated in clusters in West Dublin. However as outlined below a major new centre has been proposed for Co. Galway

Locational choice:

Data Centre investment decisions are inter-alia governed by two fundamental criteria; proximity to high-bandwidth fibre and the availability of a reliable power supply.

Recent developments:
A significant recent announcement with relation to data centres has been by Apple. It has announced that it will invest around €850 million in a new data centre in Athenry in forestry land previously owned by Coillte. This is the largest data centre in Ireland to be located outside of the wider Dublin area. It has been announced that the Athenry centre will provide 300 jobs during its multiple phases.

Impact of Data Centres:
There are a number of important impacts of data centres including:

- Transmission system benefits associated with the typically flat loads of data centres.
- Employment created during the operation of the centre.[11]
- Significant employment generated during the construction of the data centre.[12]
- Data Centres may attract corporate headquarters nearby or spin-off industries for cooling, digital rights, software development, data mining and analysis. In other words, Data Centres may attract increasing amounts of FDI.
- Transmission Use of System contributions from Data Centres can reduce the obligations of other users while any network reinforcement costs may be recouped in a reasonable pay-back period.

Source: Indecon and EirGrid

11 EirGrid estimate that Circa 1 high value telecoms or electrical engineering role is created per 1 MW installed
12 EirGrid estimate that Every 10,000 sq. ft. installed creates approximately 150 construction jobs over 1 year

6.4 Conclusions on impact of grid investment on attracting investment

The findings in this chapter highlight the importance of a high quality electricity sector to the expansion of the internationally traded sectors of the Irish economy.

- Analysis shows that 90% of firms surveyed believe that investment in the electricity transmission network to be either important or very important for our ability to attract additional foreign direct investment to Ireland.
- 75% of companies indicated it was 'important' or 'very important' to this decision, while only 17% saying high quality electricity supply had no important impact.

7 Conclusions

7.1 Key Conclusions on overall Economic Impacts

This study has estimated the economic value of the expenditures arising from EirGrid's development strategy for the high-voltage electricity grid in Ireland.

Grid investment will have significant economic benefits for Ireland. The benefits can be grouped into a number of main categories:

- Direct economic benefits (economic impact) from the planned investment expenditure;
- Indirect benefits (the knock-on economic impacts) from the planned investment expenditure;
- Improvements in security of supply, which is highly valued by both households and business;
- Improvements in the attractiveness of Ireland as a location for existing and future direct investment; and
- Improvements in the ability of the electricity system to accommodate new demand and new supply, especially renewables.

Table 7.1: Summary of proposed scenarios for grid development

	Scenario A	Scenario B -	Scenario C
NPV (Net Present Value) of the Gross Expenditure Benefits	2,229	2,864	2,097
NPV of the Costs	1,229	1,942	1,150
Difference	1,000	922	947
Economy-wide Employment (Man Years) supported	42,371	56,603	39,046
Economic Benefits of Infrastructure provision	(See below)	(See below)	(See below)

Source: Indecon analysis

A number of other key factors are important in considering electricity grid investment. These are summarised in Table 7.2. This highlights the fact that the costs of the investment needs to be compared to the likely benefits and reinforces the importance of ensuring cost-effective solutions. It is also important to consider other issues such as visual amenity which are outside the scope of this economic report.

Table 7.2: Summary of proposed Sceanrios for Grid Development – Other Economic Impacts

	Scenario A	Scenario B	Scenario C
Supports Regional Development	✓	✓	✓
Provides adequate capacity	✓	✓	✓
Minimises Cost to Electricity Users	-	×	✓

Source: Indecon analysis

7.2 Conclusions on Economic Benefits and Grid Infrastructure

Economic Benefits of Grid Infrastructure on Investment and Economic Output

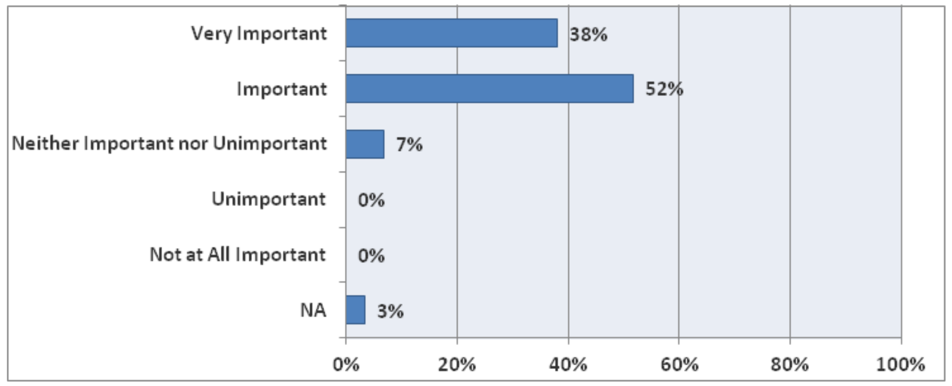
The economic benefits of providing grid infrastructure can also be considered in the context of the economic cost of an electricity outage. Indecon estimates that this is likely to be significant and we estimate that for a 1-hour outage the cost to the Irish economy is likely to be around €45 million.

In addition to the economic costs of an electricity outage, of more fundamental significance is the impact on investment if sufficient infrastructure is not available. Such a scenario would impact on the ability of existing firms to expand and the ability to attract new investments.

Grid investment is an essential component in meeting the requirements of industry connection to the transmission system. This is particularly relevant for firms in the internationally traded sector.

Indecon's analysis shows that 90% of firms surveyed believe that investment in the electricity transmission network is important or very important for Ireland's ability to attract additional foreign direct investment (FDI).

Table 7.3: Views on importance of electricity transmission network on ability to attract additional foreign investment to Ireland



Source: Indecon survey of multinationals and indigenous companies in Ireland

- 75% of companies indicated it was 'important' or 'very important' to decisions to locate new operations or functions in Ireland.

7.3 Adequacy to Meet Regional Needs

Adequacy to Meet Regional Needs

In evaluating the scenarios being considered by EirGrid it is critical to consider the ability of each scenario to accommodate the likely future demand in each region. In the table below we outline the capability of the proposed investment programme to accommodate additional demand and compare this to estimated demand in each of the regions. This suggests that there will be available capacity in all of the regions to accommodate significant expansion of demand. There are a number of caveats regarding the table below regarding differences within regions and the interaction between nodes/stations and regions. However the evidence suggests that all of the plans for regional expansion outside of the Dublin/East region could be accommodated under the various scenarios identified by EirGrid.

Table 7.4: Projected Demand by Region and Additional Capacity available

	East	Midlands	West	North East	North West	South East	South West
2014 Demand (MW)	1830	480	370	380	630	380	560
2025 Demand (MW)	2070	530	410	420	700	420	630
Additional Capacity (MW) – High	870	657	658	700	441	378	775
Additional Capacity (MW) - Median	735	469	433	425	295	284	532
Additional Capacity (MW) – Low	600	280	210	150	150	190	290

Source: EirGrid

7.4 Issues for Consideration

A number of issues have been identified by Indecon during our research which Indecon believes merit consideration in order to maximise the use of scarce resources at the lowest cost to the economy. These are summarised in the table and discussed below and include possible measures to increase the attractiveness of regional locations for investment.

Table 7.5: Issues for Consideration

1. Examine regional economic outlook and map against infrastructure gaps
2. Consider adjustments to transmission pricing policy to facilitate lower pricing in regions
3. Evaluate the current and likely future economic costs and benefits of energy policy concerning renewables and wind and its impact on grid infrastructure requirements

Source: Indecon

Examine Regional Economic Outlook and Map against Infrastructure Gaps

A key focus of policymakers is to strengthen and develop job creation in the regions. While governments cannot create jobs at regional level (as recognised in policy statements), it is essential that infrastructure provision, including electricity transmission network, facilitates realisation of the potential of every region. Research undertaken by Indecon has demonstrated that over 82% of multinationals and indigenous firms rated investment in the electricity

transmission network as important, or very important, to facilitate regional economic development.

Indecon has analysed the existing level of transmission grid capacity and current demand by region and considers this is in the context of the investment plans proposed by EirGrid. Our preliminary research suggests that all of the three scenarios are likely to be sufficient to meet expected demand by each of the main regions outside of Dublin, but this needs careful ongoing evaluation and monitoring.

There is also a challenge to ensure investment takes place quickly enough to meet rapidly growing demand in Dublin and to also meet the needs of other regions. It is therefore essential that EirGrid continues to examine national and regional economic projects and their implications for any electricity infrastructure. Meeting transmission network infrastructural needs on time is critical for economic and regional development. The costs to the economy of any infrastructural deficiencies would be very high.

Consider Adjustments to Transmission Pricing of Infrastructure to Facilitate Lower Pricing in Regions

At present, national policy involves geographically uniform pricing for electricity grid access for demand regardless of the location of the investment. Indecon believes that this does not make economic sense. The cost to EirGrid and to the economy of facilitating grid access varies depending on the location of the investment and the grid's capacity. This economic consequence is not reflected in the costs faced by firms choosing between different locations and in our judgement is not appropriate. A realignment of pricing to reflect the overall system wide costs could enable EirGrid to offer discounted pricing to investors locating in certain regional areas. Such an outcome would enhance economic welfare and would enable EirGrid to meet infrastructure needs at lower costs.

The original geographically uniform pricing was designed to ensure that regional investments did not face higher pricing. However, Indecon believes such a standardised pricing approach is not currently aligned with supporting regional development and the current variance in excess capacity in grid infrastructure means that EirGrid could offer lower pricing to firms locating in certain regional locations compared to investing in Dublin. If geographically non-uniform pricing were aligned with geographic-specific cost elements (such as losses, cost of disruption for installation, etc.) geographical or zonal pricing could reduce overall national costs would improve overall competitiveness of electricity prices, besides enhancing the incentives to invest in certain regions. It could also reduce potential electricity grid infrastructure gaps in certain areas.

Indecon accepts this is not an issue for decision unilaterally by EirGrid but believe that it should be addressed as a priority by EirGrid, CER and the central Government.

Evaluate the Economic Costs and Benefits of Energy Policy concerning renewables and wind and its Impact on Grid Infrastructure Requirements

The net cost to EirGrid of connecting additional wind energy to the network varies by location. Indecon believes it is essential that an ongoing evaluation of the economic costs and benefits of wind policy and of specific wind investments should be undertaken to assess the implications and costs on grid infrastructure requirements.

Indecon understands that there are legal, regulatory and other issues in such decisions but ensuring that policy objectives are met by the lowest cost method is a key challenge for a small open economy such as Ireland's. If there are existing wind projects in planning which would involve significant additional economic costs to EirGrid in terms of providing access and they do not proceed, Indecon supports a very rigorous approach to enforcement of legal requirements in order to minimise national costs. Wider evaluation of the costs and benefits of wind policy is also an issue for national policymakers which merit ongoing review.

7.5 Overall Conclusions

This independent report suggests that grid investment will lead to significant benefits for the Irish economy in terms of increased output and employment arising from the expenditures in Ireland from the grid development strategy. It will also support regional development. The development strategies will however also involve significant costs which must be evaluated against the benefits of facilitating an expansion of the Irish economy both nationally and at a regional level. Ways to ensure this is achieved at the lowest cost taking into account all relevant factors is a key challenge.