DRAFT FOR PUBLIC CONSULTATION

TRANSMISSION DEVELOPMENT PLAN 2007-2011

www.eirgrid.com

September 2007

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Table of Contents

Appendices

Abbreviations

ACSR	Alluminium Conductor Steel Reinforced
CER	Commission for Energy Regulation
CCGT	Combined Cycle Gas Turbine
CP No.	Capital Project identification number
CT	Current Transformer
DC	Direct Current
DSO	Distribution System Operator
EIS	Environmental Impact Statement
ESB	Electricity Supply Board
GAR	Generation Adequacy Report 2007-2013
GIS	Gas Insulated Switch-gear
HV	High Voltage
IPP	Independent Power Producer
MEC	Maximum Export Capacity
NI	Northern Ireland
NIE	Northern Ireland Electricity
NSS	National Spatial Strategy
PST	Phase Shifting Transformer
RES	Renewable Energy Schemes
SCADA	Supervisory Control and Data Acquisition
SI445	Statutory Instrument 445 (2000)
SONI	System Operator Northern Ireland
SVC	Static Var Compensator
TAO	Transmission Asset Owner
TSO	Transmission System Operator
VT	Voltage Transformer

Summary

A reliable electricity infrastructure providing quality performance is vital for Ireland's socio-economic development. The high voltage transmission system, similar to the motorways and broadband telecommunications networks, is a component of the backbone infrastructure which supports the economy.

The Transmission Development Plan 2007-2011 is the proposed plan for the development of the transmission system over the next five years and supersedes the Transmission Development Plan 2006-2010. This five year plan presents the components of the overall long term development of the transmission system where there is some level of certainty. Only projects that are either committed or about to be committed for construction are detailed in this report. However, the other likely areas where development projects may soon be required are also discussed. This report has been prepared in accordance with Regulation 8.6 of Statutory Instrument 445 (2000), entitled European Communities (Internal Market in Electricity) Regulations, 2000.

EirGrid is currently engaged in a review of its long-term development strategy and is consulting with stakeholders as part of this exercise. When completed, the Grid Development Strategy will provide a framework for future Development Plans.

The Transmission System

The transmission network forms the backbone of the electricity supply system in Ireland. It is a meshed network of high voltage lines and cables for the transmission of bulk electricity supplies around Ireland. The transmission system comprises 400 kV, 220 kV and 110 kV networks linked through transmission stations.

The network is designed to comply with the Transmission Planning Criteria. These set out objective reliability standards, which are comparable with planning standards internationally, and which have been found to deliver an acceptable compromise between cost of development and level of transmission service provided.

The Role of the Transmission System Operator

The Statutory Instrument 445 (2000), which gives effect to the current electricity industry arrangements, among other things assigns responsibilities for transmission network development to the Transmission System Operator (TSO). EirGrid, as the TSO also has the responsibility for operating and ensuring the maintenance of the transmission system. Generation, Distribution and Supply (sales) functions are carried out by other parties.

ESB, as the Transmission Asset Owner (TAO), is charged with constructing the assets for the transmission system infrastructure. This Development Plan provides the TAO with an

overview of the transmission projects that are in progress and an indication of the level of development that is likely to emerge in the period to 2011. ESB also has the role of Distribution System Operator (DSO) with which the TSO coordinates planning and development requirements.

The funding for the transmission system ultimately comes from all electricity customers and therefore developing high quality infrastructure, while investing efficiently and economically, are key considerations. The CER has the role of approving the overall level of investment in the transmission infrastructure.

Developments for 2007 to 2011

Electricity peak demand is forecast to increase by about 20% over the period of the plan. In addition to the 944 MW of new thermal generation and 120 MW of wind generation that was connected to the transmission system between November 2005 and July 2007, a further 1,095 MW of generation capacity has signed connection agreements. Most of this is expected to be connected by 2011.

In July 2006, Minister Noel Dempsey TD, then Minister for Communications, Marine and Natural Resources, requested that the Commission for Energy Regulation (CER) arrange a competition to secure the construction of a 500 MW East-West interconnector between Ireland and Great Britain. The CER was also requested to instruct the TSO to carry out the technical work of selection of a sub-sea route and other sites for the construction of the interconnector and necessary grid reinforcement.

As recommended by the TSO, the CER has since approved the choice of Woodland as the connection point on the Irish system for the interconnector. The connection point to the British transmission system has yet to be finalised. The interconnector is expected to be in place by 2012.

This Development Plan sets out the development projects that have been initiated to meet these future needs, and discusses the potential for further development in the next five years. The main features of the plan, which involves developments in all parts of the country, include:

- Completion of the 220 kV expansion project into the North-West;
- Expansion of the 400 kV system to provide necessary bulk transfer capacity out of Dublin and Moneypoint, and between this system and the Northern Ireland system;
- Strengthening of the networks in and around Athlone, Castlebar, Cavan, Cork City, Dunmanway, Galway, Letterkenny, Meath Hill, Newbridge, Tullamore, and Wexford;
- Connection of eight new DSO stations;

- Connection of seven new generators to the transmission system;
- Reduction of high short circuit levels in Dublin.

Other Potential Developments

On the basis of current assumptions, a number of areas have been identified where further infrastructure will be needed in addition to the projects currently in progress. The TSO is considering options for solving these emerging challenges. Some of these issues are expected to emerge late in the period and may be resolved with short lead times solutions. Development projects will be initiated at the optimum time to meet the network requirements.

Recent developments such as the selection of Woodland as the connection point for the planned interconnection with Great Britain and the announcement by ESB of its plans to close or divest 1,300 MW of old plant will require detailed study to identify development needs and to select optimum reinforcement projects where necessary.

Other development requirements may emerge depending on a number of factors not yet certain, such as the connection of demand, generation and interconnections, and on new refurbishment requirements that will be identified as condition assessments are carried out. The potential drivers include:

- The take-up of “Gate 2” wind farm connection offers;
- Applications for the connection of thermal generation;
- Increasing Short Circuit Levels;
- DSO plans for new 110 kV / MV transformers and connection for new 110 kV stations;
- The need to refurbish a number of stations and overhead lines which were identified after initial condition assessments and will be confirmed following more detailed refurbishment investigations.

The TSO is constantly monitoring and reviewing the above drivers and factors to determine when and how they will require attention. Once a sufficient level of confidence in the investment drivers is reached the various requirements are considered in preparing a co-ordinated development strategy to best deal with them. It is expected that some of these strategic developments will feature in future development plans.

Renewable Energy

The TSO is committed to supporting present and future government policy on renewable energy and to integrating further renewable generation as an increasingly important part of the overall generation mix. Ireland is on target to meet the current target of 15% of energy from renewable sources by 2010. The level of connected wind generation, signed connection offers and "Gate 2" offers under preparation highlights the fact that wind power generation is expected to be the major contributor to this target.

A long term view to facilitating an increased penetration of renewable generation to the generation capacity of the country is required. To this end the TSO is contributing to an All Island study on the implications and consequences of large scale penetration of renewable energy on the island of Ireland. In addition, it has contributed to the draft vision paper for renewable energy in 2020 being prepared jointly by the Department of Communications, Energy and Natural Resources and the Department of Enterprise, Trade and Investment in Northern Ireland. The TSO will take account of new renewable targets in future Development Plans.

Regional Development

Because of the importance of the electricity system to customers all over Ireland, the Transmission System Operator is very conscious of the need to support regional development.

It will be noted that a significant portion of the investment in this Development Plan will be undertaken in the Border/Midlands/Western (BMW) region. This investment will significantly improve the electricity infrastructure and provide the backbone for further economic development in the regions.

Capital Expenditure

The TSO estimates that transmission development requirements will involve major expenditure between 2007 and 2011. However, as highlighted above, many projects are at a preliminary design stage, while others have not yet been initiated. Better expenditure estimates will evolve as project scopes become more certain.

The TSO welcomes the CER's continued support for investment in the transmission network. The CER in its 2006-2010 Transmission Price Control Review Decision Paper has set a cap on capital expenditure on transmission at €520 million for the period. The impact of this capital constraint will be continually reviewed as project designs and costs evolve.

Conclusion

The TSO is committed to delivering quality connection, transmission and market services to its customers and to developing the transmission grid infrastructure required to support the development of Ireland's economy.

With the projects outlined in this development plan forming part of the overall long-term transmission system development, coupled with the constant review of the transmission infrastructure and the changing environment requirements, the TSO is confident that the needs of a growing Irish economy will be met well into the future.

1 Introduction

Electricity supply is an essential service in Ireland's economy. The transmission system is a meshed network of 400 kV, 220 kV and 110 kV high voltage lines and cable and plays a vital role in the supply of electricity. It is the backbone of the power system and provides the means to deliver power from generation sources to demand centres within acceptable technical security and reliability standards. It is analogous to the motorway and national road networks allowing producers (generators) bring their product to large customers and to major depots for onward distribution to smaller customers.

1.1 The Role of the Transmission System Operator

The Statutory Instrument 445 (2000)[1], which gives effect to the new electricity market arrangements, among other things assigns responsibilities for transmission network development to a Transmission System Operator (TSO). EirGrid, as the TSO has the legal responsibility for developing the transmission system.

The TSO's role is entirely separate to the companies which generate, distribute and sell electricity in Ireland. The funding for the transmission system comes from all electricity customers and therefore developing high quality infrastructure, while investing efficiently and economically, are key considerations.

ESB, as the Transmission Asset Owner (TAO), is charged with constructing the transmission assets as specified by the TSO. This Development Plan provides the TAO an overview of the transmission projects that are in progress and an indication of the level of development that is likely to emerge in the period to 2011. ESB also has the role of Distribution System Operator (DSO) with which the TSO coordinate planning and development requirements.

1.2 The Transmission Development Plan

The Transmission Development Plan 2007-2011 is prepared in accordance with Regulation 8.6 of Statutory Instrument 445 (2000).

This report presents the TSO's view of how the future transmission needs are likely to change and its plan to develop the network between now and 2011 to meet those needs.

[1] Statutory Instrument 445 (2000), entitled European Communities (Internal Market in Electricity) Regulations, 2000

The long term development of the transmission grid is constantly under review. This plan comprises a list of development projects that are in progress and for which there is some level of certainty and a description of other areas where further development is likely to be required.

Expected completion dates for developments may change because of the following reasons:

- Consents;
- Access and Way-leaves;
- Material availability;
- Resources;
- Site conditions;
- Construction progress;
- Inclement weather;
- Force majeure;
- System conditions, especially outage availability.

As such, some of the project dates included in this plan differ from the expected dates in the Transmission Development Plan 2006-2010.

1.3 Context of the Plan

The development of the network is a complex process involving forecasting future needs and planning solutions that strike a balance between network reliability, costs and environmental impacts. The process must be dynamic to meet the ever-evolving needs but also to enable the strategic development of the system in the long term.

The TSO is currently undertaking a review of its long-term development strategies and is consulting with stakeholders as part of this project. The new Grid Development Strategy will provide a framework for future development plans.

This plan is a snap-shot of the developments for the period 2007 to 2011 in the process at this point in time. It is possible that changes will occur in some project delivery dates, in the scope of some projects or in the need for some developments. Similarly, it is likely, given the continuously changing nature of electricity transport requirements, that new developments will emerge that will change the plan as presented. These changes will be captured in the annual review and updated in future development plans.

1.4 Document Structure

The Summary section gives an overview of the main highlights of the document and presents the plan in summary terms.

Chapter 1 gives the purpose and context of the plan.

Chapter 2 provides information on the TSO's legal requirements in relation to development and describes the TSO's planning process and strategies employed.

Chapter 3 describes the factors that drive network development and presents the TSO's forecasts and assumptions relating to the drivers for this plan.

Chapter 4 lists the development projects that are currently in progress. It provides a brief description of the scope of works and a reason for the development.

Chapter 5 lists areas where development needs are expected to emerge in the future.

Chapter 6 gives a high level summary of the network development plan.

Appendix A presents details of the demand forecasts at each transmission interface station.

Appendix B includes a map of the existing network and a second map illustrating the locations of major development projects.

Appendix C provides details of major development projects in the detailed planning or construction phase.

Appendix D provides details of major development projects currently in the public planning process.

Appendix E includes the text of Regulation 8(6) of Statutory Instrument 445 (2000) which obliges the TSO to produce this Development Plan.

Appendix F provides a glossary of terms used in the document.

2 Transmission Development Approach

A reliable electricity infrastructure providing quality performance is vital for Ireland's socio-economic development. The development of that infrastructure is of national strategic importance. The high voltage transmission network forms the backbone of the electricity supply system in Ireland which supports the economy.

This chapter provides a high level overview of the approach that the TSO follows to determine the network requirements, find the appropriate solution and implement the necessary works by presenting the context of transmission planning, the objectives, strategies and criteria as well as an explanation of the planning process within the TSO.

It is important to note that while the transmission network is studied and planned in the context of the long-term strategic development of the power system, this report concentrates on the committed transmission projects that are in progress and other potential developments identified at this point in time.

The contents of this chapter are set out under the following headings:

- Statutory and Legal Requirements;
- Development Objectives & Strategies;
- Transmission Planning Criteria;
- The Network Development Planning Process.

2.1 Statutory and Legal Requirements

Statutory Instrument 445 (2000)[1], modified by Statutory Instrument 60 (2005)[2], outlines the roles and responsibilities of the Transmission System Operator. Under Regulation 8(1)(a) of Statutory Instrument 445 (2000), the Transmission System Operator is assigned the following exclusive function:

> *to operate and ensure the maintenance of and, if necessary, develop a safe, secure, reliable, economical, and efficient electricity transmission system, and to explore and develop opportunities for interconnection of its system with other systems, in all cases with a view to ensuring that all reasonable demands for electricity are met having due regard for the environment.*

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[1] Statutory Instrument 445 (2000), entitled European Communities (Internal Market in Electricity) Regulations, 2000

[2] Statutory Instrument 60 (2005), entitled European Communities (Internal Market in Electricity) Regulations 2005

This gives the TSO exclusive responsibility for the operation and development of the transmission system within the Republic of Ireland. It also requires the TSO to strive for a balance between development to improve security and reliability and the cost and environmental impact of the developments.

The TSO has a statutory obligation to produce a Transmission Development Plan. As part of the preparation the TSO is required to consult on the Development Plan prior to submitting it to the CER for approval. The text of Statutory Instrument 445 (2000) Regulation 8(6) which deals with the Development Plan is included in its entirety in Appendix E.

In preparing this development plan the Transmission System Operator has taken account of other Regulations:

SI445 8(1) (c) *to take into account the need to operate a co-ordinated distribution system and transmission system*;

SI445 8(1) (i) *to offer terms and enter into agreements, where appropriate, for connection to and use of the transmission system with all those using and seeking to use the transmission system.*

SI445 8(3) *In discharging its functions under these Regulations, the transmission system operator shall take into account the objective of minimising the overall costs of the generation, transmission, distribution and supply of electricity to final customers.*

SI60 8(1) (c) *to plan the long term ability of the transmission system to meet reasonable demands for the transmission of electricity*;

(ca) *to contribute to security of supply through adequate planning and operation of transmission capacity and system reliability*;

Regulation 8(8) of SI445 (2000) precludes the TSO from developing generation directly as a solution to network needs. However, the TSO does facilitate connection of third-party generation and when future connections are confirmed it takes their impact into consideration when evaluating network development requirements.

SI445 8(8) *The transmission system operator shall not engage in the generation, distribution or supply of electricity in the State.*

Section 19 of SI445 (2000) gives the ESB the responsibility as Asset Owner to carry out construction work in accordance with the Transmission System Operator's Development Plan.

SI445 19. *The transmission system owner shall-*

(a) as asset owner, maintain the transmission system and carry out construction work in accordance with the transmission system operator's development plan, subject to the provisions of Regulation 18(3)

2.2 Development Objectives and Strategies

An objective of the Transmission System Operator is to develop a safe, secure, reliable, economical, and efficient electricity transmission system to meet reasonable demands for the transmission of electricity in accordance with its legal obligations. The TSO plans the development of the grid taking account of the long-term needs and the economics of various development options. In this regard the TSO is currently engaged in a project to prepare a strategy for the long term development of the transmission grid. This Grid Development Strategy, which is due to be completed by the end of 2007, will provide a framework for future development plans.

The demands for the transmission of electricity are driven by a number of factors including but not limited to growth in electricity demand, and developments of generation and interconnection. These drivers are discussed in Chapter 3.

The need for development is determined by assessing long-term future network performance against technical standards embodied in the Transmission Planning Criteria (TPC), as described in the next section.

When it is established that these demands cannot be met without violating the deterministic criteria, a wide range of issues is taken in to account in selecting a transmission enhancement strategy. These include long-term economic assessments of a range of transmission alternatives. These assessments attempt to take account of the full range of costs and benefits associated with each option. However, it is not possible to calculate with absolute precision the full range of benefits.

The factors considered in selecting the optimum development project are described in Section 2.4.1 under "*Select Optimum Development Project*". In considering these factors, the TSO adopts a number of high level strategies, described below, to optimise development.

The TSO seeks to find single development projects to meet multiple network requirements where possible. When assessing development options to address future potential network needs the TSO considers the impacts of each possible option on other potential development needs. In some cases a proposed project will meet one or more other development requirements and may prove more economic and more environmentally friendly than multiple projects.

When examining alternative development the TSO considers the effectiveness of the options in meeting the longer-term needs. In some cases it may be more cost effective to choose a higher cost project that will perform better in the long-term and may obviate the need for further development. Where a more costly development is needed in the long-term the TSO will seek ways to phase the project. For example, a 220 kV project could be selected for its long-term benefits even though the immediate requirement is for a 110 kV solution only. In some cases, a line could be constructed as a 220 kV line but initially operated at 110 kV thus deferring the more expensive 220 kV station equipment costs until the line is energised at 220 kV at a later date.

The future operation of the network is considered when evaluating options for meeting future transmission requirements to ensure that the flexibility required for an efficient market is not unduly compromised.

By making more effective use of the existing system, the TSO can delay large investment or avoid the need for additional circuits. Examples of this strategy include:

- installing a phase shifting transformer in Dublin to manage power flows on cables and delay the need for additional cables;
- using relatively low cost capacitors to support voltages, thus delaying larger investment in lines and stations;
- installing 220 / 110 kV stations rather than new 110 kV lines where economic to relieve the stress on the underlying 110 kV network and make better use of 220 kV line capacity;
- installing 400 / 220 kV stations where economic to maximise the benefit of the 400 kV network.

Consideration is also given to applications for temporary derogations while the cost of development is unduly onerous.

Overhead lines are normally used to provide new transmission circuits as they are easier to maintain and repair and so provide a more reliable means of supply than underground cables. They are also substantially less expensive. Underground cables are considered where appropriate such as in city centres or urban areas.

2.3 The Transmission Planning Criteria

The requirement for grid development is identified when simulation of the future conditions indicates that the transmission planning standards would be breached. These standards, which are in line with international standards, are set out in the Transmission

Planning Criteria (TPC) and can be accessed on the TSO's website, www.eirgrid.com (under "About Us" / "Publications").

These criteria are deterministic as are those generally used throughout the world in transmission planning. They set out an objective standard which has been found to deliver an acceptable compromise between the cost of development and the service delivered. Transmission investment planning consists of many different decisions to address different problems. Rather than attempting to carry out subjective benefit analysis in each case it is preferable to plan to meet an objective standard and carry out analysis of the range of options available to comply with the standard.

Once a violation of the criteria has been identified, a wide range of issues is taken in to account in selecting a transmission enhancement strategy as described in the previous section. The objective is to come up with investment plans that meet the transmission requirements in an efficient and cost effective manner in compliance with the principles of the Transmission Planning Criteria .

The criteria include standards for voltage range and deviations, maximum thermal loading of grid equipment, system security, dynamic stability and short circuit levels. The grid must operate within these specified standards for intact network conditions, and following an unexpected outage of any circuit or generator. This also applies during maintenance outages of any other lines, cables, transformers or generators.

Table 2-1 Contingency types tested for different demand scenarios

Contingency	Winter Peak	Summer Peak	Summer Valley
Loss of any single item of generation or transmission plant	✓	✓	✓
Overlapping single contingency and generator outage	✓	✓	✓
Trip-Maintenance i.e., loss of any single item of generation or transmission plant when another circuit is out on maintenance	✗	✓	✓

Table 2-1 indicates the contingencies tested for three separate demand scenarios. The *Winter Peak* represents the forecast maximum annual demand. The *Summer Peak* refers to the average week-day peak value between March and September inclusive, which is typically 20% lower than the winter peak. This demand level is of interest because although the overall grid power flow may be lower in summer than in winter, this may not be the case for flows on all circuits. In addition, the capacity of overhead lines is lower because of higher ambient temperatures, while network maintenance, normally carried out in the March to September period, can deplete the network, further reducing its capability to transport power.

The Summer Valley is the annual minimum which generally occurs in August. Annual minimum demand is typically 36% of the annual maximum demand. Analysis of summer valley cases is concerned with the impact of low demand and low levels of generation. This minimum condition is of particular interest when assessing the capability to connect new generation. With local demand at a minimum, the connecting generator must export more of its power across the grid than at peak times.

2.4 The Network Development Planning Process

2.4.1 Network Development

The network development planning process is of necessity a dynamic process to deal with the ever-evolving requirements for transmission services. The Development Plan is a snap shot in time of the development needs in the process.

Figure 2-1 illustrates the various stages in the process which are described below. This process is different from that presented in the Transmission Development Plan 2006-2010. The changes have arisen following the establishment of EirGrid as TSO. The process described below reflects the new arrangements between EirGrid as TSO and ESB Networks as the owner of the Transmission Network.

Update the Network Model: The beginning of the process involves reviewing and updating the network and user information that defines the network model.

Develop Forecasts of Future Conditions: This involves reviewing and making projections of the main drivers as outlined in Chapter 3. The projections are incorporated into models of the future network.

Evaluate Network Performance: The network models are used to assess the future long-term performance of the network against planning standards. This review of network adequacy identifies areas of weakness which may require development. This includes an assessment of various factors such as: diverse generation dispatches, different interconnection power transfers, generation closure, network stability. Analysis of potential long-term needs provides useful information when considering solution options, as it enables the selection of a more optimum solution and avoids sub-optimal incremental development.

Evaluate Connection Applications: An analysis of shallow connection and associated deep reinforcements are generally carried out when an application is received for connection of new generation or demand, or for a Distribution System Operator (DSO) connection. If the applicant signs the connection agreement the shallow connections are progressed, while optimum deep reinforcement options are considered for selection.

Confirm Need for Development: The previous stages provide a list of potential problem areas that may arise in the future. In some cases there may not be an immediate need to progress a solution. Therefore, at the appropriate time, a detailed review is carried out on each problem to determine if there is a definite requirement for development.

Consider Options for Development: Once the need is confirmed, a list of potential options will be developed. Each option will be evaluated to ensure it meets the technical requirements.

Select Optimum Development Project: Where more than one technically feasible option is available, selection of the optimum project involves the consideration of many factors including:

- Compliance with the Transmission Planning Criteria;
- Government Objectives;
- Economics of alternative development options;
- Project lead-times and feasibility of options;
- The impact of constraints in the transmission system on generation costs;
- Flexibility in scheduling generation to support the operation of an effective market;
- Robustness to alternative future needs and long-term benefit of options;
- The impact on transmission operations, protection and maintenance;
- Co-ordination with the DSO requirements;
- The impact of alternative development plans on distribution costs;
- The potential impact on the environment;
- Synergy with refurbishment projects.

The challenge for the TSO is to find robust solutions that deliver the best long term value to the customer taking account of these factors and of the uncertainties in demand and generation projections. Uncertainty in generation not only relates to location and size of new connections but also to the operation level of all connected generators.

After careful analysis and internal review a preferred option is put forward as a solution. Internal approval is sought to progress the project to the next stage.

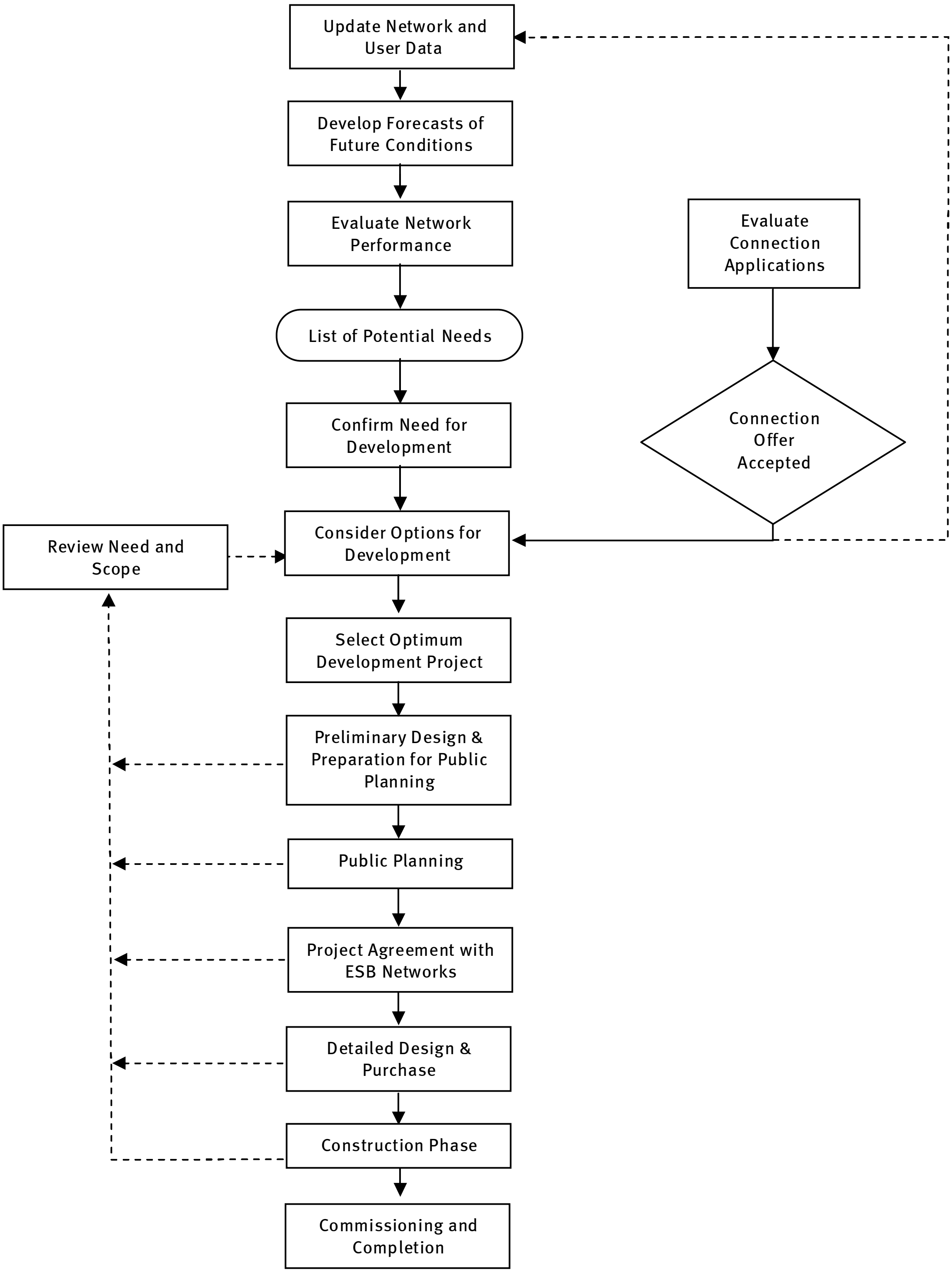


Figure 2-1 Flow Chart of Network Development Process

Preliminary Design and Preparation of Planning Applications: This phase includes a number of tasks: preparation of preliminary designs, site selection, route surveys, meetings with stakeholders (landowners and local representative bodies). For developments that require Planning Permission this stage includes a number of additional tasks: preparation of Planning Applications to the relevant statutory authorities and preparation of an environmental impact statement (EIS) as required to comply with environmental legislation.

Public Planning: The Strategic Infrastructure Act has become law since the publication of Transmission Development Plan 2006-2010. The Act introduces a new strategic consent process for major infrastructure of national and public importance. Since 1st February 2007, persons seeking permission for certain types of strategic infrastructure will apply first to An Bord Pleanála for a decision on whether the particular project is of strategic importance. Where An Bord Pleanála decides that the project is of strategic importance an application with an EIS can be made directly to An Bord Pleanála. The public, the Local Authority (including the elected members) and interested stakeholders will be consulted and their views taken into account.

An Bord Pleanála may also decide that the particular project is not of strategic importance and that the planning application be lodged with the local authority in the traditional manner. The planning authority decides whether or not to grant planning permission for the project. If planning permission is granted it may be subsequently appealed to An Bord Pleanála.

Once planning permission is secured by either of the above processes, the requirement for the project is reviewed and the project cost is re-evaluated before progressing to the next phase.

Project Agreement with ESB Networks: Under the agreed arrangements, previously referred to, EirGrid and ESB Networks conclude a Project Agreement for detailed design and construction of each committed project. The Project Agreement contains a project description, the outline design and functional specification, and a description of the methods by which the project will be realised within the agreed timescale and budget.

The next three stages are undertaken by ESB Networks. EirGrid will have a client engineering role throughout these phases.

Detailed Design and Purchase: When planning permissions are secured where necessary and internal approval obtained to proceed to construction, the materials are procured, station sites are finalised where necessary, and construction arrangements put in place.

Construction Phase: Once the detailed design and purchase are completed, construction is carried out.

Commissioning and Completion: When the development is constructed it must undergo commission testing and approval before going into operation. This is to ensure that equipment is safe, will operate as per design and that signals and controls are correctly installed.

Review Need and Scope: The process is presented above in a sequential format for explanatory purposes. It is in fact a dynamic and non-linear process i.e., there are opportunities at various stages for a review and possible change of the project scope. For example, the process includes a review following the planning process when more accurate project costs based on an actual route are obtained. If these turn out to be significantly higher than estimated, the project justification and selection would be reviewed. If planning permission is not granted, or if there are particular difficulties during construction it would be necessary to re-assess the project. If the original assumptions underlying the project justification change dramatically at any time, the project would be reviewed. This avoids unnecessary investment and ensures that the network development plan matches requirements as far as possible.

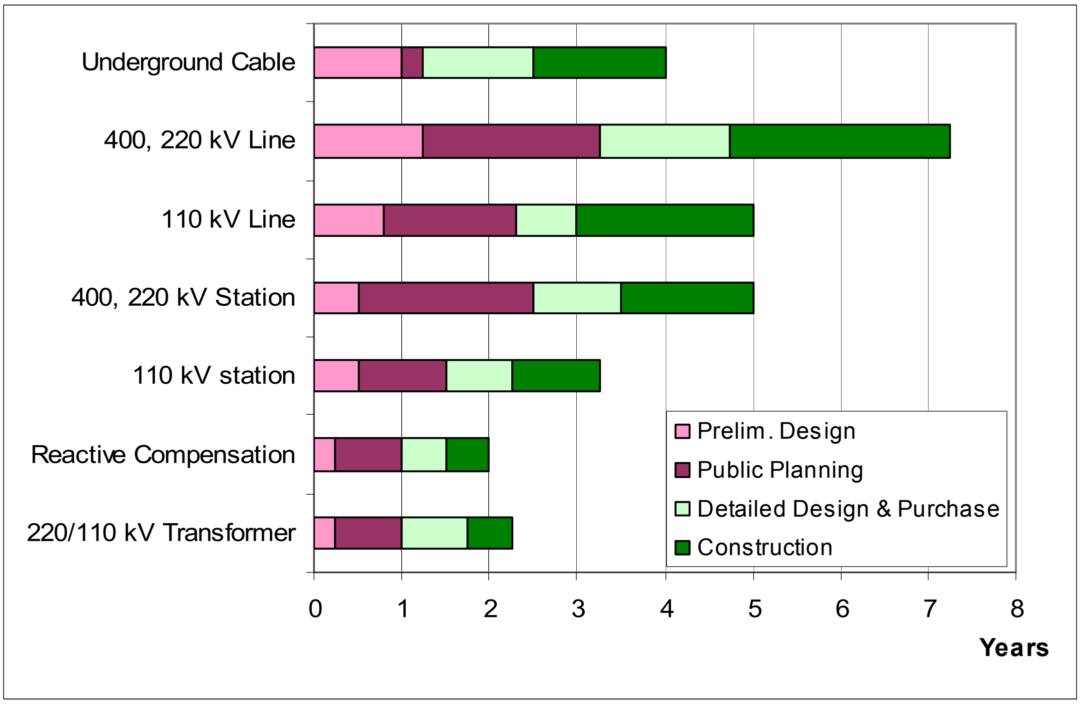


Figure 2-2 Typical Lead times for Development Projects

Figure 2-2 shows the typical lead-times for various types of development projects from the decision to proceed with a selected project to final completion. These times are based on experience of recent projects and are not meant to indicate targets or accepted practice. Because of the uncertainty in the public planning process these lead-times should be considered indicative only.

2.4.2 Refurbishment

Refurbishment involves the replacement of equipment to extend the life of the transmission assets. The development of a refurbishment programme is a complex process as described below. While age of plant may be a trigger which initiates the process it is by no means the only consideration. Other factors which impact on the decision to refurbish plant include safety and environmental considerations, increasing fault frequency, increasing cost and complexity of maintenance, lack of spares, and plant obsolescence.

The process of network refurbishment is illustrated in Figure 2-3. The main inputs into the process are represented by the two blocks titled “Initial Condition Assessment” and “Performance and Technology Review”.

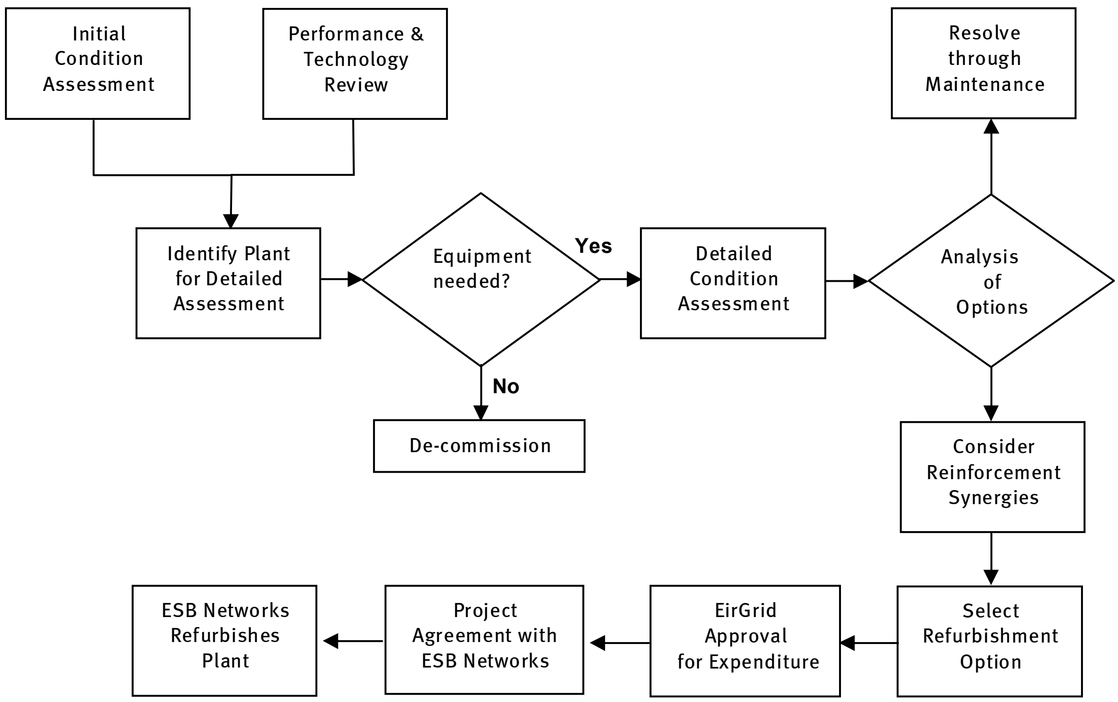


Figure 2-3 Flow Chart of Network Refurbishment Process

Initial Condition Assessment: Most transmission maintenance is condition based. Consideration may be given to a refurbishment programme when regular condition assessments identify that the condition of a significant amount of plant is showing signs of deterioration which would otherwise require costly, special or excessive amounts of maintenance to rectify.

Performance and Technology Review: The performance reviews are undertaken on an ongoing basis and the results are used to identify if a particular asset or a family of equipment type is not performing as well as expected. Technology reviews determine if any of the installed equipment is obsolete or if it is still adequate to provide the necessary performance and able to interact with the rest of the system.

Identify Plant for Detailed Assessment: Input from the first two activities result in the creation of list of plant requiring a detailed assessment of their condition.

Equipment Needed: Before embarking on a detailed assessment program the continued need for the equipment is established.

Detailed Condition Assessment: The detailed assessment of the condition of the relevant asset or plant will identify which individual items of plant, if any, need to be replaced. This could include for example, in the case of overhead lines, the replacement of individual pole-sets, insulators and hardware at selected locations and the replacement or strengthening of selected angle tower foundations. In the case of stations, such a detailed condition assessment would identify the requirement for the replacement of selected items of high voltage plant, protection and control equipment, vintage civil works etc.

Analysis of Options: Based on the detailed condition assessment report the economics and cost-benefit of a full refurbishment project versus a special maintenance project (or enhanced maintenance) will then be considered. Analysis of refurbishment options could include for example, the like-for-like replacement of old switchgear, use of more modern switchgear or the construction of a new station to replace the old one. Following the analysis a decision is made to resolve the problem either through maintenance or through a refurbishment project.

Consider Reinforcement Synergies: Having identified the refurbishment options, an analysis is then carried out to determine if synergies exist between the refurbishment and potential reinforcement projects. In the case of overhead line projects for example, the refurbishment project may provide the opportunity to uprate the line to meet future load requirements. The decision would be based on an assessment of the economics of uprating the line early during the refurbishment works as against uprating later as a stand-alone project. Likewise in station refurbishment projects, the opportunity may be taken to uprate busbars and switchgear or upgrade protection equipment, if economic to do so.

Select Refurbishment Option: The chosen option is determined by factors such as cost, economic trade-off, environmental considerations, system safety, security and reliability. A final scope of work for the selected option is developed and an estimated cost prepared.

EirGrid Approval of Expenditure: The final scope with estimated costs for the refurbishment project is submitted for internal approval.

Project Agreement with ESB Networks: Under the agreed arrangements, previously referred to, EirGrid and ESB Networks conclude a Project Agreement for detailed design and construction of each committed project. The Project Agreement contains a project description, the outline design and functional specification, and a description of the methods by which the project will be realised within the agreed timescale and budget.

Refurbish Plant: Following project agreement ESB Networks carry out the refurbishment works. EirGrid has a client engineering role during this phase of the project.

3 Context for Network Development

Section 8.1.(c) of Statutory Instrument 60 (2005) requires the TSO "to plan the long term ability of the transmission system to meet reasonable demands for the transmission of electricity". This chapter describes the factors that are expected to drive the need for network development over the period of this plan and presents the TSO's assumptions of those drivers:

- Government objectives;
- Electricity Demand Forecasts;
- Generation;
- Interconnection with Other Systems;
- Condition of the Network.

These assumptions provide the context for the current Development Plan and for the discussion on potential further development requirements.

3.1 Government objectives

The TSO seeks to take into account national and regional government policy objectives in putting together its Development Plan. There are a number which have a bearing on development needs including policy to support the development of renewables, the furtherance of interconnection and therefore trading opportunities with other jurisdictions and the development of the full potential of each region through the National Spatial Strategy. The impact of these objectives on other drivers is described in the relevant sub-sections below.

As has already been outlined it is a statutory duty for the TSO to support the development of the Irish economy and society by ensuring the network is able to support all reasonable demands for electricity. In addition, it is a requirement for the system operator to enter into agreement for connection with parties seeking to connect to the system under such terms approved by the Commission for Energy Regulation. The TSO seeks to develop the network to ensure it is able to meet both of these commitments, while continuing to have regard to its primary responsibility to operate a safe secure, economic and reliable system that underdevelopment of the network will not affect Ireland's overall economic development either locally or at an aggregate level.

The TSO must also ensure that it protects the interest of the final customer who ultimately pays for any additional investment in the network. If the network is developed in anticipation of future developments which fail to materialise in a timely manner, there would be a degree of what is known as 'stranding' in the assets which would be underutilised but which would still have to be paid for by the existing customer base.

However, given the potentially significant number of renewable generators seeking to connect to the system, and the desire to see that government targets for the penetration of energy from renewable sources are met, the TSO has in some instances as part of the group processing approach accelerated or upgraded current network connections in anticipation of the likely connection of future renewable parties. These works have been carried out where construction at a higher specification is likely to lead to both lower cost and more timely connection in the future. In such instances the regulator has looked favourably on the cost of the advancement of these works being underwritten by transmission use of system (TUoS) until such times as contributions are received from parties seeking to connect. Further details on how the TSO has helped contribute towards the delivery of the government's renewables policy are given in section 3.3.2 under renewable generation.

3.2 Electricity Demand Forecasts

Increasing or changing load demand alters the flow of power on the network, and as such will have an impact on system performance. Demand changes are dealt with in the following categories:

- Generic demand growth;
- New demand connections;
- Demand reductions;
- National Spatial Strategy.

3.2.1 Generic Demand Growth

Generic demand growth is the underlying increase occurring typically at all transmission stations resulting from economic growth[1]. Forecasts of demand growth at a system-wide and local 110 kV station level are prepared each year taking account of new and updated information available. Table 3-1 presents the forecasts of transmission demand for the five years 2007 to 2011. These forecasts of system demand were generated based on predictions of key economic variables and using a proven relationship between electricity demand and these economic variables. These values correspond to the forecasts in *Transmission Forecast Statement 2007-2013.* The forecasting process is described in

[1] Section 3 of the TSO's Generation Adequacy Report 2007-2013 explains the correlation between economic performance and electricity demand.

detail in the corresponding *Generation Adequacy Report 2007-2013*. Both documents are available on www.eirgrid.com.

Three demand values are presented for each year:

- The annual maximum, also referred to as the winter peak;
- The average summer peak;
- The annual minimum, also referred to as the summer valley.

Table 3-1 Transmission Demand Forecasts, MW

Year	Summer Peak	Summer Valley	Winter Peak
2007	4,006	1,803	5,008
2008	4,172	1,877	5,215
2009	4,335	1,951	5,419
2010	4,518	2,033	5,647
2011	4,682	2,107	5,853

The peak electricity demand forecasts presented in Table 3-1 represent a 20% increase for the period up to 2011.

Appendix A lists the forecast demand at each transmission interface station at time of summer peak, summer valley and winter peak for each year of the plan. Transmission interface stations are the points of connection between the transmission system and the distribution system, or directly connected customers.

Demand projections at individual transmission stations are developed from the system demand forecasts on a top-down basis. The forecasting process includes regular monitoring and review of trends in consumption in all parts of the country. The allocation of the system demand forecast to each station is based pro-rata on an up-to-date measurement of actual peak demand at each station. In this way, changes in the geo-diversity of electricity consumption are captured. This process provides a station demand forecast and by extension a regional demand forecast for the short to medium term.

The system-wide demand forecasts, presented in Table 3-1, include an estimate of transmission losses whereas the individual station demand forecasts do not. Transmission losses therefore account for the difference between the system-wide demand forecasts and the sum of the forecasts at each interface station in Appendix A.

3.2.2 New Demand Connections

Demand connections describe the connections of new large demands at existing or new stations. The demand could be a large industrial plant or a new DSO station.

The DSO develops its plans to reinforce the distribution system to accommodate increasing demands and embedded generation connections. Where the DSO requires new stations or changes in connection methods it submits a connection application to the TSO. The TSO will make a connection offer having considered the implications for the transmission system. Once the connection offer is accepted, the TSO and DSO cooperate in progressing these connection projects through to approval and completion.

Table 3-2 lists the new 110 kV distribution stations for which the transmission element of the project is in the preliminary design phase, in the public planning process or under construction. Details of the developments required to connect these stations are included in Section 4. In some cases, where the TSO element of the project is minor, the DSO may have progressed its element of a project to a different stage ahead of the TSO. Section 5.2.2 lists such cases. The TSO is confident however that it will deliver its element at a suitable time.

The transmission works at Galway 110 kV station to connect the new Camus 110 kV station and the transmission works at Macroom 110 kV station to connect the new Hartnett's Cross 110 kV station have been completed. Completion of the distribution works is outstanding for this two projects.

Table 3-2 DSO 110 kV Station Connection Projects

110 kV Station	Location
Athy	Athy, Co. Kildare
Ballycadden	Bunclody, Co.Wexford
Baltrasna	Ashbourne, Co. Meath
Banoge	Gorey, Co. Wexford
Bunbeg	Na Doire Beaga, Co. Dún na nGall
Camus	Camas, Co. An Gailimh
Charlesland	Greystones, Co. Wicklow
Nenagh	Nenagh, Co. Tipperary
Hartnett's Cross	Macroom, Co. Cork
Kilmurry	Waterford Port, Co. Kilkenny

In addition, projects are being progressed to provide a second connection to Meath Hill and Thornsberry 110 kV stations and to modify the connection at Kilteel 110 kV station.

The DSO has plans for other new 110 kV stations, for which the grid connection project has not yet been initiated. It is likely that some of these stations will be connected within the period of the plan. The potential for future developments arising from these connections is discussed in Section 5.2.

Major customers may apply to connect directly to the grid. Applications for new demand connections made to the TSO are studied and once the best connection option is identified a connection agreement is issued which is signed by both the customer and the TSO. Due to client confidentiality these connection agreements can only be made public when the customer signs the agreement.

There are currently two signed connection agreements for new demand customers.

Table 3-3 Demand Customers 110 kV Station Connection Projects

110 kV Station	Location
Baroda	Co. Kildare
Ballyadam	Co. Cork

3.2.3 Demand Reductions

Closure of demand facilities can reduce the power flows on lines feeding the load. However, in certain cases, where the demand is absorbing local generation and reducing the amount of generation exported from the area, the closure can lead to increased power flows.

Large customers are required to give 18 months notification of reduction in their maximum load requirements. As of the end of July 2007, the TSO has not received notification of any significant demand reduction from its directly connected customers.

3.2.4 National Spatial Strategy

The National Spatial Strategy (NSS) was published in November 2002. The NSS is a 20 year spatial planning framework covering the entire country. In implementation terms it has been further developed through a series of Regional Planning Guidelines prepared by each Regional Authority. The NSS seeks to ensure that each region grows according to its potential. To ensure this the NSS requires that areas of sufficient scale and critical mass are built up through a network of gateways and hubs, which are supported by development of transport, energy and communications infrastructure. It is not within the scope of the TSO to deliver the NSS – that is a matter for government. However, the TSO seeks to facilitate its delivery through the provision of high quality electrical transmission infrastructure where it is required while continuing to promote national competitiveness for customers currently connected to the system through only developing the system and therefore levying charges at an efficient level.

The Development Plan is based on updated demand forecasts which are derived using the latest information on regional demand shifts. The TSO, therefore, takes account of best estimates of likely growth patterns in determining which of a number of possible transmission solutions ought to be advanced to meet a particular requirement.

3.3 Generation

The network must be capable of transporting the output from generators to demand stations. Because of the relative size of generation it can have a more significant impact on changes to power flows than demand. The largest generator in Ireland is just over 400 MW, which is approximately 9% of peak demand.

The addition of new generation capacity requires network development to connect the new generator to the grid, thus providing a path for the power from the new generator. The new generation capacity will inevitably alter the power flows across the network, potentially creating overload problems deep into the network, leading to the need for reinforcements (known as deep reinforcements) to allow full grid access. Recent experience shows that connection of large generators leads to large-scale deep reinforcements. However, even relatively small generators may require some deep reinforcements. The results of the transfer capability analysis presented in the TSO's *Transmission Forecast Statement 2007-2013* indicate that spare capacity in the network has effectively been used up by generation connections and that at many locations the addition of even small amounts of new generation would require deep reinforcements.

Embedded generation i.e., that connected to the distribution system, is generally smaller than transmission connected plant. However, its impact on the network is practically the same as if the same generation was connected to the transmission system. As such it also changes flows on the network and in certain cases it can cause the network to go outside standards and hence require deep network reinforcement.

The output from existing generators can change for a variety of reasons including: relative market economics, balancing changes in the system demand, generator faults, and closure.

The network has been designed to accommodate existing generators and known additions. These provide reactive power capability to the local network, which assists the system operator to maintain voltages within allowable limits. In certain locations the generation supplies the local demand, thus reducing the import of power from other parts of the network to meet the local demand. Closure of an existing generator, therefore, will remove reactive support and local power infeed. If not replaced by generation with similar active and reactive power capabilities it can lead to the requirement for network reinforcements.

At the end of July 2007 some 7,186 MW (net) of generation capacity was installed in Ireland. Of this 6,579 MW is connected to the transmission system and a 607 MW is connected directly to the distribution system.

The assumptions regarding the changes in generation from 2007 underlying the development plan are dealt with in the following categories:

- New Thermal Generation Connections;
- New Renewable Generation;
- Planned Generation Closures.

3.3.1 New Thermal Generation Connections

New generators are expected to pay the shallow connection costs, i.e. the costs of the plant to directly connect the generator to the grid. Any further strengthening of the network that is required, referred to as deep reinforcement, to integrate the generation is implemented by the TSO and the TAO and the costs are reflected in the transmission tariff to the customers.

Table 3-4 lists the generators, as yet not connected, that have signed agreements for connection to the grid as of the end of July 2007. Capacity values listed are the maximum continuous rating (exported) which may differ from contracted MEC values.

Table 3-4 Future Planned Generation Connections

Generator	Description
Aghada (ESB)	431 MW CCGT
WhiteGen(Bord Gáis)	445 MW CCGT

In addition to these committed generators, five thermal and two pumped storage generators have submitted complete application forms to the TSO for grid connections, as of the end of July 2007. It is, therefore, reasonable to expect that some new generation capacity will be connected to the transmission system before the end of the Plan Period.

In the *Transmission Forecast Statement 2007-2013* the opportunities for connecting new generation to the system were presented. The level of generation that could be connected without requiring transmission reinforcement was indicated at a number of different 220 kV and 110 kV stations across the network. Any new generator wishing to connect at a different location to those listed or exceeding the level at a particular station may require further deep reinforcement to achieve full access to the grid. The degree of that reinforcement can only be determined once the application has been submitted and the various solution options identified and studied.

3.3.2 New Renewable Generation

A significant proportion of new renewable generation is expected to be provided by Wind Powered Generation (WPG). All new renewable generation connected to the transmission system are WPG type.

Table 3-5 lists the new wind farms and MEC changes to existing wind farms with signed agreements for connection to the transmission system.

Table 3-5 Contracted New Wind Farm Connections and MEC Changes to Existing Wind Farms.

Generator	Description
Athea	51 MW
Clahane	37.8 MW
Coomacheo	41.2 MW
Meentycat phase II	14.0 MW
Moneypoint	21.9 MW
Mountain Lodge	30.62 MW

A further 22 MW will be added to Ratrussan wind farm in addition of the 48 MW connected in 2006, bringing the total to 70 MW.

The Government's Renewable Energy policy, reflecting the RES-E Directive of the European Parliament and Council (Directive 2001/77/EC), sets a target for Ireland of 15% of total electricity consumption from renewable sources by 2010, and 33% by 2020. Wind power generation is expected to be the major contributor to the 2010 target. This 15% target can be achieved with about 1,350 MW of wind power generation installed by 2010. The figures for wind generation as at the end of July 2007 are:

- Connected wind generation: 793 MW
- Signed connection offers: 444 MW
- Connection offers in "Gate 2" wind farm: 1,316 MW
- Other applications in process: 2,685 MW

The total for wind farms connected and with signed connection agreements is 1,237 MW. A total of 1,316 MW relates, specifically, to wind farm connections being processed under the CER's "Gate 2" direction on renewable generator connection applications. Note, a further 2 MW of embedded non-wind is currently being processed in the "Gate" bringing the total to 1,318 MW. The connection studies are being carried out with "Gate 2" wind farms grouped into geographic areas, as set out in the CER direction. Figure 4-2 and Table 4-4 illustrate how "Gate 2" wind generation is distributed across the country. The main area for new applications in "Gate 2" is in the south-west where the total is almost three times that of the next highest area in the north-west.

Table 3-6 "Gate 2" Wind Generation Area Totals

"Gate 2" Area	Total Generation (MW)
A (North West)	201[2]
B (Mid North West)	104
C (Midlands)	13
D (Mid West)	66
E (South West)	592
F (South West)	44
G (North East)	14
H1 (Midlands-South West)	162
H2 (South East)	118
I (South)	2
Total	1316

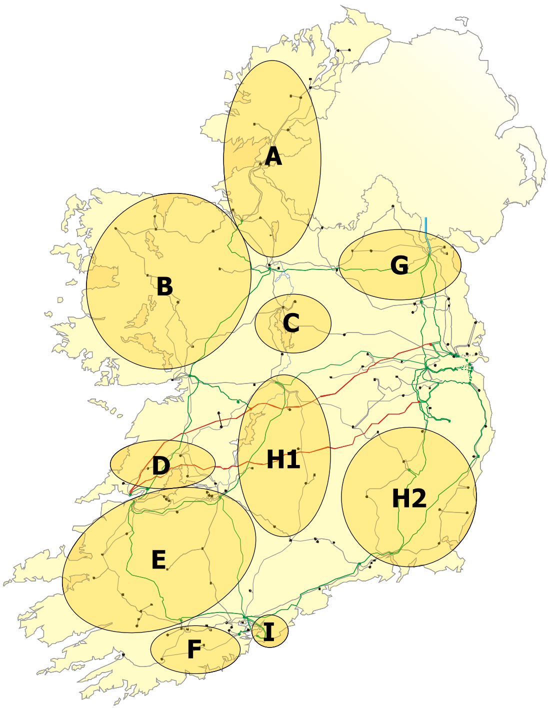


Figure 5-2: "Gate 2" Wind Generation Areas

[2] Original "Gate 2" figures included a further 3.2 MW in Area A, however this application has been withdrawn.

It is expected that all "Gate 2" offers will be issued by the end of 2007 and that some of these generators will be in place by 2010 enabling the 15% target to be achieved.

Most of the wind applications are in areas remote from the main demand centres. In addition to the shallow connection, consideration has to be given to the routes along which the power will flow to the demand. This is complicated by the variable nature of wind generation which limits how it can be dispatched. In effect the only control available is that the wind output can be constrained off but not dispatched on when required. The transmission system must therefore be able to accept the wind power as it is generated and distribute it. It must also be able to import the power from available units in other areas to supply the local demand when the local wind generation is either off or at a low level.

While it is not expected that all the wind applications will progress to completion, the network will have to be able to balance large amounts of varying wind generation with the output of thermal and hydro generation to meet the expected demand. The wind generation may also have a large variation over a relatively short period of time which the network must be able to cope with.

The transmission system will therefore have to evolve to be able to meet the changing operational demands on the network. It is likely that new reinforcement developments will be called for before the end of the Plan Period to facilitate increasing wind penetration.

In addition to the "Gate 2" wind farms, there are a large amount of wind farm applications in the connection process. A large penetration of wind-generation in any one part of the network will create a number of challenges for network development. The network must be developed to accommodate output from the wind-farms when wind is blowing and also to serve demand when it is not since the output of all the wind-farms in an area are affected by the level of wind in that particular area. Thus the network performance must be examined against a greater range of possible generation profiles. As wind penetration increases the level of development required to integrate wind is expected to increase.

An All Island study is currently being scoped to investigate the implications and consequences of large scale penetration of renewable energy on the island of Ireland. The results of this comprehensive study, when completed, will highlight what further network development is required to facilitate large penetration of wind generation and other types of renewable energy. The Department of Communications, Marine and Natural Resources and the Department of Enterprise Trade and Investment in Northern Ireland are developing a joint policy for All Island Renewables up to 2020. When the targets for wind generation and the staging of those targets are decided, the TSO can and will develop the necessary plans to accommodate it.

3.3.3 Planned Generation Closures

In November 2006, ESB and CER signed an agreement which committed ESB Power Generation to close or divest 1,300 MW of existing plant. In June 2007, ESB produced a programme to implement the agreement including the closure/divestment of Tarbert, Great Island and Poolbeg stations and the steam unit in Marina station.

The network has been designed to accommodate these existing generators. These provide reactive power capability to the local network, which assists the system operator to maintain voltages within allowable limits, and may in certain cases help reduce inter-area power flows by supplying the local demand. Divestment of these generators, therefore, would remove reactive support and local power infeed. It is likely that this would lead to the need for network reinforcements in at least one of the locations if the plant is not kept in operation or replaced with generation which provides similar active and reactive power capabilities in the same area in a minimum time after the closure.

Existing generators are required to give 24 months notice to the TSO for the closure or reduction in output of any generator unit. In the absence of such notice of plant closures, all other existing generation capacity must be assumed to remain in service for the purposes of planning the system.

3.3.4 Constraints on Existing Generation

Network constraints may dictate that more expensive generator units are required to run in place of units using a cheaper fuel. The TSO takes these constraint costs into consideration when identifying new network reinforcements to remove the network technical constraints. Future fuel cost differences may lead to new reinforcement projects in the Transmission Development Plan.

3.3.5 High Short Circuit Levels on the Network

The connection of large generators combined with the meshed nature of the transmission network results in increasing short circuit levels. The more tightly connected a network becomes the lower the impedance of the system. While this may reduce system losses, it also enables more current from all the power stations to reach connected stations during a fault. This is particularly noticeable when there are parallel paths between sections at different voltage levels, such as 220 kV and 110 kV. High short circuit levels are a safety issue and measures must be taken prevent the catastrophic failure of high voltage equipment in stations.

Investigations for the connection of new power stations and transmission reinforcement take into account the impact of the development on short circuit levels. The two most common methods of resolving short circuit level problems are upgrading the station equipment with higher rated switchgear or reconfiguring the stations and network to reduce the number of parallel paths and thus decrease the short circuit level. In some cases the installation of fault current reducing reactors are considered. Options are considered that will provide the most practical and economic solution.

The *Transmission Forecast Statement 2007-2013* shows main areas of concern are around Dublin, Cork and the Shannon estuary due to the concentration of generators connected or planning to connect in these areas. The change in the short circuit level with every development is being monitored, but short circuit level reduction developments or network reconfigurations can only be considered once there is a degree of certainty regarding the connection of new generators.

3.4 Interconnection with Other Systems

3.4.1 Interconnection with Northern Ireland

The transmission system is electrically interconnected with Northern Ireland at 275 kV and at 110 kV.

The new trading arrangements under the All Island Single Electricity Market are planned to take effect in November 2007. At this time the interconnectors will effectively become internal circuits within the new market. The new market has the potential to increase the appetite for transfers between the two systems on the island. The current interconnection and the networks in each system could pose a constraint on required transfers.

EirGrid and NIE are working on provision of a new major interconnector which will form a significant part of the robust infrastructure that is required to meet the needs of the new All Island Single Energy Market and enhance security of supply for consumers. Along with other network developments it is expected to alleviate constraints thus providing increased capacity for transfers between the two jurisdictions. This project is at an advanced stage after comprehensive joint EirGrid/NIE studies identified a preferred interconnection option at 400 kV located to the west of the existing 275 kV interconnector. The project, identified as CP466, is listed as a Network Reinforcement Project in the preliminary design phase in Section 4.3.1 of this document.

3.4.2 Interconnection with Great Britain

In July 2006, Minister Noel Dempsey TD, then Minister for Communications, Marine and Natural Resources, approved the construction of a 500 MW East-West interconnector between Ireland and Great Britain. The Commission for Energy Regulation since approved the choice of Woodland as the connection point on the Irish system for the interconnector. The connection point to the British transmission system will be in the North Wales region, with the exact point yet to be finalised. The interconnector is planned to be in place by 2012.

In addition to the connection project there is likely to be a requirement for some deep reinforcements given the size of the potential imports or exports at Woodland.

The TSO is progressing work on selection of the connection and deep reinforcements required in order to bring forward projects for development. These will feature in future Development Plans.

3.5 Condition of the Network

The decision whether to refurbish particular transmission assets is based on detailed condition assessments, as discussed in Section 2.4.2. The age of the assets is one of the contributory factors to the need to refurbish. Other factors include the local environment and the quality, reliability and serviceability of the asset. The age profile of the main transmission assets on the system are shown in Table 3-7.

3.5.1 Line Refurbishments

The expected lifespan of a transmission line is of the order of 40 years, after which either major refurbishment or uprating are generally required. The majority of the existing transmission lines were constructed after 1960. A significant amount of the older lines have been refurbished in recent years, leaving a relatively small number of lines dating from pre-1960. The remaining lines that are greater than 40 years old are approaching the age when the TSO would consider the need for their refurbishment. This will be driven by the need to replace conductors, pole-sets and hardware as they deteriorate with age. The focus of line refurbishment is, therefore, likely to be on these old lines; however, the decision to refurbish is condition based. Once a line has been identified for refurbishment, consideration will be given to take the opportunity to uprate the capacity or thermal rating of the line.

Table 3-7 Transmission Asset Age Profile [Source: ESB Networks]

	Up to 1969	1970 1979	1980 1989	1990 1999	2000 2006	Total
Overhead lines-circuit (kms)						
400 kV lines	-	-	432.7	-	-	432.7
275 kV lines	-	21.0	-	-	-	21.0
220 kV lines	479.8	772.4	300.5	122.1	84.3	1,759.1
110 kV lines	2,086.40	979.6	422.2	208.6	397.3	4,094.1
Total: -	**2,566.20**	**1,773.0**	**1,155.4**	**330.7**	**481.6**	**6,307.0**
Underground cables –circuit (kms)						
400 kV cables	-	-	1.8	-	-	1.8
220 kV cables	-	45.3	16.2	14.7	28.6	104.8
220 kV cables (sub-marine)	-	2.6	-	-	-	2.6
110 kV cables	4.3	5.5	1.8	2.8	13.3	27.8
Total:-	**4.3**	**53.4**	**19.7**	**17.5**	**41.9**	**136.9**
Switchgear (units)						
400 kV substation bays	-	-	17	-	3	20
275 kV substation bays	1	1	-	-	1	3
220 kV substation bays	25	38	57	15	65	200
110 kV CB (GIS)	-	-	4	6	8	18
110 kV CB-other	124	93	74	136	211	638
110 kV Isolators	289	319	198	294	528	1,628
110 kV Mobile switching bays	-	-	-	3	6	9
Total:-	**439**	**451**	**350**	**454**	**822**	**2,516**
Transformers (per unit)						
400/220 kV transformers	-	-	3	-	1	4
275/220 kV transformers	1	1	-	-	1	3
220/110 kV transformers	6	12	2	5	21	46
Total:-	**7**	**13**	**5**	**5**	**23**	**53**
Capacitors						
110 kV Capacitors	-	-	-	3	23	26
110 kV Mobile Capacitors	-	-	-	-	4	4
Total:-	**-**	**-**	**-**	**3**	**27**	**30**

The transmission lines that have been approved for refurbishment are listed in Section 4.4. As the condition monitoring of the transmission lines is an ongoing process it is possible that other lines may be identified for refurbishment before the end of the Plan Period. Due to the relatively short lead times for projects involving existing structures, refurbishment and upgrading projects will only be initiated closer to the time of their implementation.

The transmission lines that are under consideration for refurbishment are listed below. The scopes of work are currently under investigation, including the possibility of uprating certain of the conductors.

- Ballydine-Doon 110 kV (11.3 km);
- Ballydine-Cullenagh 110 kV (21.8 km);
- Barnahely-Raffeen 110 kV (1.7 km);
- Carrigrohid Kilbarry-Macroom 110 kV (34.6 km);
- Coolroe-Kilbarry 110 kV (14.3 km);
- Coolroe-Iniscarra 110 kV (2.7 km);
- Coraclassy-Gortawee 110 kV (10.9 km);
- Crane-Wexford 110 kV (21.3 km);
- Drybridge-Louth 110 kV (31.9 km);
- Flagford-Lanesboro 110 kV (30.6 km);
- Iniscarra-Macroom 110 kV (18.1 km);
- Killonan-Shannonbridge 220 kV Line (89.7 km);
- Lisdrum-Shankill 110 kV (39.3 km);
- Lisdrum-Louth 110 kV (40.4 km).

3.5.2 Station Refurbishments

The condition of the equipment in transmission stations is constantly being reviewed and assessed as part of the regular maintenance, performance monitoring and condition assessment programmes.

The majority of the station plant and equipment was installed between 1970 and 2000. It is not expected that any transformers will have to be replaced due to poor condition or because of excessive overloading.

Provided there has not been excessive operation of the switchgear there should only be limited amount of replacement required due to poor condition. However, switchgear equipment may need to be replaced to provide higher breaking current capability where new generators increase the short circuit current levels, or higher rating where demand levels have increased. These types of replacement projects would be considered reinforcements rather than refurbishment projects.

The refurbishment of station plant and equipment will be driven in part by the need to upgrade the control, instrumentation, protection and telecommunications equipment within the station to leverage increased opportunity provided by modern SCADA systems. These types of equipment and software have a much shorter lifespan as the technology advances and therefore more refurbishment projects can be expected to emerge in the Plan Period.

A detailed review was undertaken of all the 110 kV stations that are over 25 years old. As part of that exercise the condition of all the equipment and structures within these stations was examined and a condition assessment made. Based on these assessments a list was compiled of nine stations that would require further detailed investigation to determine if any refurbishment was necessary. These detailed investigation assessments have subsequently been carried out. Refurbishment of Carlow, Dundalk, Moy, Navan, Rathkeale and Whitegate stations is proceeding, with draft scopes of works have been issued to ESB Networks. Work on these will be programmed by ESB Networks over the next few years. Decisions on the scope of works for Cowcross, Ardnacrusha and Killonan have not yet been made.

There are a further 20 stations being considered for condition assessment within the period of this plan.

3.6 Implications of Drivers for Network Development

The drivers described in the previous sections indicate that the demands made on the transmission network are set to increase significantly over the period of the plan.

The peak electricity demand forecasts presented in Table 3-1 represent a 20% increase for the period up to 2011. Analysis of system performance, based on the assumption that planned reinforcements are completed as expected, has shown that this demand increase will generally use up capacity in many areas, which would lead to breaches of voltage, thermal line loading and security standards if developments were not undertaken.

The Aghada and WhiteGen CCGTs represent a significant increase in generation in the south-west. Combined with the large wind-farm capacity in the south-west, both existing and potential “Gate 2” applications, these are likely to reverse the predominant power flows heretofore going to the south-west and will require network reinforcements to enable the power to flow out of the south-west to the rest of the system.

The “Gate 2” connection offers are currently being processed. The final offers are expected to be issued by the end of 2007. The deep reinforcements associated with the offers will then be known and are likely to feature in future development plans. In addition to the wind farms connected, committed to connect or for which offers are being prepared under "Gate 2", there are a large amount of wind farm applications in the connection queue. A large penetration of wind-generation in any one part of the network will create a number of challenges for network development. The network must be developed to accommodate output from the wind-farms when wind is blowing and also to serve demand when it is not since the output of all the wind-farms in an area are affected by the level of wind in that particular area. Thus the network performance must be examined against a greater range of possible generation profiles. As wind penetration increases the level of development required to integrate wind is expected to increase.

An All Island study is currently being carried out to investigate the implications and consequences of large scale penetration of renewable energy on the island of Ireland. The results of this comprehensive study, when completed later in 2007, will highlight what further network development is required to facilitate large penetration of wind generation and other types of renewable energy. The Department of Communications, Marine and Natural Resources and the Department of Enterprise Trade and Investment in Northern Ireland are developing a joint policy for All Island Renewables up to 2020. When the targets for wind generation and the staging of those targets are decided, the TSO can and will develop the necessary plans to accommodate it.

EirGrid and the CER are progressing the delivery of a new 500 MW HVDC interconnector between Ireland and Great Britain. As recommended by the TSO, the CER has approved the choice of Woodland as the connection point on the Irish system for the interconnector. Preliminary studies indicate that there will be a requirement for additional transmission infrastructure to permit power flows of 500 MW to and from Great Britain through Woodland station.

Analysis of system performance, based on the assumption that planned reinforcements are completed as expected, has shown that the demand increases presented in this section will generally use up capacity in many areas, which would lead to breaches of voltage, thermal line loading and security standards if further developments were not undertaken. These potential breaches of standards are discussed in Chapter 5.

4 Planned Network Developments

The network development planning process for the transmission network followed by the TSO was outlined in Section 2.4. This chapter presents and discusses the network development projects that the TSO has progressed to the point where they are the preferred option to meet the changing system requirements in the context of the long-term development of the network. The development projects are presented in four sub-sections categorised as appropriate by the main development drivers under the following headings:

- Network Reinforcements;
- DSO Connections;
- Generator Connections;
- Refurbishments.

Within each sub-section and where relevant development projects are listed in separate tables, categorised by the stage in the development programme, as follows:

- Developments in the Detailed Design and Construction Phase – projects that have received public planning permission, where appropriate, or are at:
  - The project agreement stage;
  - The initial stage of procurement and engineering design;
  - Under construction.
- Developments in the Public Planning Process - projects or developments that have been approved at the appropriate level internally and have entered the public planning process.
- Developments in the Preliminary Design Phase - projects or developments that have been approved at the appropriate level internally and are at the preliminary design stage.

Because of the uncertainties inherent in the public planning process, the dates and the scope of projects not yet in the Construction Phase are subject to change.

The tables present the following project information:

- Capital Project number (CP No.) – each project is referenced with a Capital Project number for coordination between the TSO and TAO;

- Project Description provides a project title and a brief description of the works involved; For projects in the Preliminary Design stage, the project descriptions provided are the TSO's current best estimates and are liable to change;
- Major New Equipment – a high level equipment list where appropriate describing the new transmission assets (e.g. bays, line in km[1], etc.) added to the network on completion of the project (not provided for refurbishment projects where no new assets are added);
- Reason for Development – a brief description of the reason for the network development projects (omitted for DSO and Generator connections, where the reason for the development is in all cases the connection);
- Expected Completion Date (E.C.D.) – the estimates provided are subject to the planning process where applicable, the construction progress, availability of transmission outages and commissioning and may be liable to change.
- Expected Project Agreement Date (E.P.A.D.) – this is the date the project could enter the detailed design and construction phase following agreement of the project scope with the TAO, and is provided for projects not yet in this phase. The date estimate is subject to the public planning process and construction start-up and may be liable to change.

A map in Appendix B illustrates the location of the larger network development projects.

The TSO and the TAO are co-ordinating other capital projects additional to the projects listed below. They come under the general description of minor capital works and line diversions and alterations. These projects are numerous and have little significance to the development of the network and so are not itemised below.

4.1 Network Reinforcement Developments

Section 4.1 deals with the development projects that are driven by demand growth and the deep reinforcements resulting from generator, demand and interconnector connections.

Table 4-1 lists the Network Reinforcement projects that are in the detail design and construction phase. Appendix C presents more detailed information for the larger network reinforcement projects. Table 4-2 lists the Network Reinforcement projects that are in the public planning process. Appendix D presents more detailed information for the larger network reinforcement projects in the public planning process and Table 4-3 lists the Network Reinforcement projects that are in the preliminary design phase.

[1] Line lengths are approximate for Network Reinforcement projects that are in the preliminary design phase or in Public Planning Process.

Table 4-1 Network Reinforcement Projects in the Detailed Design & Construction Phase

CP No	Project Description	Major New Equipment	Reason for Development	E.C.D.
CP122	Tarbert 110 kV works: The 110 kV bays at Tarbert station are to be upgraded with the installation of a new busbar protection scheme.	Busbar protection scheme , CT replacement and interconnection to the 110 kV bays.	The busbar protection scheme is required to improve stability as part of the integration of new generation in the area.	Oct-08
CP211	Srananagh 220 kV Station and Line: A new Srananagh 220/110 kV station connected by a new 220 kV line to Flagford 220 kV station; A 250 MVA 220/110 kV transformer installed at the station; The Cathaleen's Fall–Sligo 110 kV line looped into the new Srananagh station to form the Sligo-Srananagh 110 kV line and the Cathaleen's Fall–Srananagh No.1 110 kV line; The Cathaleen's Fall–Corderry 110 kV line looped into the new Srananagh station to form the Corderry-Srananagh 110 kV line and Cathaleen's Fall–Srananagh No.2 110 kV line; A second line from Sligo to Srananagh constructed at 110 kV.	220 kV Station: 250 MVA Trfr: 1 220 kV bays: 2 110 kV bays: 7 In other stations: 220 kV bays: 1 110 kV bays: 1 New Lines: 220 kV: 55 km 110 kV: 49 km	This development is needed to reinforce the network in the North-West area by supporting the voltage and reducing the risk of loss of supply during the winter peaks and the summer maintenance outages.	Dec-08
CP217	Newbridge loop-in of the Blake-Cushaling-Maynooth 110 kV line: Looping of the Blake–Cushaling–Maynooth 110 kV line into Newbridge 110 kV station, creating the Cushaling–Newbridge and Blake–Maynooth–Newbridge 110 kV lines.	110 kV bays: 2 110 kV line: 20 km	To improve the quality of supply to the 110 kV stations in this area by preventing low voltages and line overloads under certain contingencies.	Dec-08
CP218	Gorman-Navan No. 3 110 kV line: A third line from Gorman 110 kV station to Navan 110 kV station will be constructed.	110 kV bays: 2 110 kV line: 5 km	To alleviate unacceptable overloads of the Arva-Navan 110 kV line in 2010 and either of the existing Gorman-Navan 110 kV lines from 2012 under certain contingencies.	Mar-10
CP246	Tarbert-Tralee No.2 110 kV line: A second line from Tarbert to Tralee constructed at 110 kV.	110 kV bays: 2 110 kV line: 47 km	This is needed to overcome 110 kV line overloads and voltage collapse in the Tralee area. The final completion date is currently under review.	May-10[2]
CP254	Cashla loop-in of the Dalton-Galway 110 kV line: Looping of the Dalton–Galway 110 kV line into the Cashla station, creating the Cashla–Dalton line and the Cashla–Galway No. 4 110 kV line.	110 kV bays: 2 110 kV line: 25 km	To avoid overloading the existing Cashla-Galway 110 kV lines during certain contingencies by removing the Dalton load connection and providing an additional circuit into Galway.	Oct-09

[2] Based on current progress, the expected completion date has been revised to 2010.

CP No	Project Description	Major New Equipment	Reason for Development	E.C.D.
CP380	Clashavoon-Clonkeen and Clonkeen-Knockearagh 110 kV lines: Re-conductoring and uprate of the two lines to 425 mm² at 80°.	Uprate 110 kV line: 50 km	The majority of both lines were built in 1955. An assessment of the lines found that the 200mm² ACSR conductor was showing signs of severe internal corrosion and required replacement. In addition a higher rating of these lines is required to provide capacity for existing and committed wind farm projects.	Dec-08
CP406	Cashla-Cloon 110 kV line Uprating of the line to 425 mm² @ 80°C	Uprate 110 kV line: 23 km	The uprate will avoid unacceptable overloading of the line during certain contingencies.	Dec-08
CP418	Corduff-Mullingar 110 kV line Uprating this line to 200 mm² @ 80°C	Uprated 110 kV line: 32.6 km section	The line underwent a detailed condition assessment which recommended that a 32.6 km section of the line be refurbished. As a result of the refurbishment works the line will be uprated from 200 mm² operating at 50°C to 80°C.	Dec-07
CP419	Corduff-Platin 110 kV line Uprate: Re-conductoring of this line from 200 mm² to 425 mm² ACSR at 80°C. The replacement of the CTs at Platin 110 kV station is required to complete the project.	Uprated 110 kV line: 37 km	Under certain contingency conditions the existing line could be overloaded by more than 10%. This uprate will help reduce the limitations on the NI interconnection transfer capabilities.	Dec-08
CP429	Poolbeg 220 kV Interbus Reactor: A new 450 MVA series reactor installed in the 220 kV busbar at Poolbeg between the connections to North Wall and Shellybanks and the rest of the station.	220 kV bays: 2 450 MVA Reactor: 1	The series reactor at the 220 kV busbar at Poolbeg is part of the plan to limit short-circuit currents in the area to a safe level. The high fault levels are as a result of the connection of new generation and the increasingly interconnected network in the Dublin area. Shellybanks station will be sectionalised with units PB14 and PB16 connected to Irishtown and unit PB15 linked to Poolbeg via the new reactor.	Apr-08
CP454	Ardnacrusha-Limerick 110 kV line Refurbishment and to uprate the line to the equivalent of 425 mm² conductor operating at 80°C of the line including addition of a small section of underground cable	Uprate 110 kV line: 12 km	A complete line condition assessment indicated that the line needs to be refurbished. In addition the need of uprating has been identified to avoid potential overloads of the line.	Dec-08
CP455	Ardnacrusha-Killonan 110 kV line Reconductoring and uprating this line to 425 mm² @ 80°C	Uprated 110 kV line: 9.5 km	The line underwent a detailed condition assessment which recommended that the line to be refurbished. In addition, the need was identified to uprate the line.	Dec-07

Table 4-2 Network Reinforcement Projects in the Public Planning Process

CP No	Project Description	Major New Equipment Estimates	Reason for Development	E.P.A.D. – E.C.D.
CP184	Aghada-Raffeen 220 kV circuit: The new 220 kV circuit consisting of a section of cable and a section of overhead line. The overhead line portion of the circuit has been completed in 2006.	220 kV bays: 2 220 kV cable: 7 km	This is necessary to ensure a reliable supply of electricity to Cork city and harbour area.	Mar-09 – Dec-09
CP241	Lodgewood 220 kV Station: A new Lodgewood 220/110 kV station in county Wexford, connected into the Arklow–Great Island 220 kV line, and linked with a new Crane–Lodgewood 110 kV line, through a 250 MVA 220/110 kV transformer. Planning permission granted for the new 220 kV station and planning permission for the new Crane–Lodgewood 110 kV line is currently at the appeal stage.	220 kV Station: 250 MVA Trfr: 1 220 kV bays: 3 110 kV bays: 1 In other station: 110 kV bays: 1 New Line: 220 kV: 1 km 110 kV: 10 km	To provide support to the 110 kV network in this area and by preventing low voltages and line overloads under certain contingencies.	Apr-08 – Apr-10
CP374	Arva-Shankill No. 2 110 kV Line: A second 110 kV line constructed between Arva and Shankill 110 kV stations.	110 kV bays: 2 110 kV line: 20 km	To alleviate unacceptable overloads of a number of 110 kV lines in the area for certain contingency conditions. This reinforcement is associated with generation connection.	Aug-08 – Dec-10

Table 4-3 Network Reinforcement Projects in the Preliminary Design Phase.

CP No	Project Description	Major New Equipment Estimates	Reason for Development	E.P.A.D. – E.C.D.
CP250	Castlebar-Tonroe 110 kV line: A new Castlebar-Tonroe line constructed at 220 kV and operated at 110 kV.	110 kV bays: 2 220 kV line: 60 km (energised at 110 kV)	To alleviate unacceptable overloads of the Cunghill - Sligo 110 kV line in 2011 and other lines in the area from 2012 during certain contingencies. The line also forms part of a long term development to introduce 220 kV to support future load growth.	Jul-09 – May-11
CP261	Athlone-Shannonbridge No. 2 110 kV line: A second 110 kV line constructed between Athlone and Shannonbridge 110 kV stations.	110 kV bays: 2 110 kV line: 25 km	To alleviate unacceptable voltages at Athlone and overloading of the existing Athlone-Shannonbridge 110 kV line under contingency conditions.	Jul-09 – Oct-11
CP264	Finglas 5th 220/110 kV Transformer: Installation of a fifth 250 MVA 220/110 kV transformer and coupler.	220 kV bay: 2 110 kV bay: 1 220/110 kV 250 MVA Trf: 1	To maintain short circuit levels within standards and to alleviate potential overloading of the Maynooth-Ryebrook 110 kV line under certain maintenance-trip conditions.	May-08 – Mar-09

CP No	Project Description	Major New Equipment Estimates	Reason for Development	E.P.A.D. – E.C.D.
CP399	Moneypoint-Tarbert 400 kV circuit: A new submarine cable constructed across the Shannon Estuary from Moneypoint in Co. Clare to Tarbert in north Co. Kerry.	400 kV bays: 3 220 kV bays: 1 500 MVA Trfr: 1 400 kV cable: 10 km	To provide an alternative route for power into the south west as well as an additional link between the 400 kV and 220 kV networks.	Dec-08 –Dec-09
CP466	New North-South Circuit: Construction of a new north-south circuit at 400 kV between Northern Ireland and a new station in Co. Cavan.	400 kV Station: 400/220 kV 500 MVA Trfr: 1 400 kV bays: 3 220 kV bays: 4 New Lines: 400 kV line: 50 km 220 kV line: 5 km	To increase transfer capacity between the two systems in both directions and avoid situations where a single event could lead to system separation.	Sep-09 – Dec-12
CP467	North East Reactive Compensation: Installation of 2 fixed capacitor units at **Lisdrum (a)** 110 kV station, 1 deployable capacitor unit at the 110 kV busbar in **Louth (b)** station and 2 redeployable capacitor units at **Shankill (c)** 110 kV station.	110 kV bays: 5 30 Mvar Cap: 2 15 Mvar Cap: 3	To resolve the temporary and long-term voltage problems in the north-east	(a+b) Mar-08 – Dec-08 (c) Sep-08 – Jul-09
CP468	New 400/220 kV Station in the West Midlands near Nenagh: Construction of a new 400/220 kV station, near Nenagh in County Tipperary, connected into the Dunstown-Moneypoint 400 kV line; looping of the existing Killonan-Shannonbridge 220 kV line into the new station to form the West Midland-Shannonbridge and West Midland-Killonan 220 kV lines; uprating of the West Midland - Killonan 220 kV section.	400 kV Station: 400 kV bays: 3 220 kV bays: 3 400/220 kV 500 MVA Trf: 1 New Lines: 400 kV line: 10 km 220 kV line: 30 km	To reinforce the 220 kV network to the south and avoid overloading of this network following the loss of the planned Moneypoint Tarbert circuit.	Jun-09 – Dec-11
CP469	New 400 kV line from Woodland: A new 400 kV line constructed between the existing Woodland 400 kV station, in south east Co. Meath and a new 400 kV station in Co. Cavan, connected into the Flagford-Louth 220 kV line. (See project CP466 regarding this station.)	400 kV line: 60 km 400 kV bays: 2	The loading on the transmission network is reaching the capacity of the corridor between Dublin and the North East. Unacceptable overloads and low voltages in the area will occur in the future under contingency conditions. This project forms part of the long term development to meet the future demand of the area.	Sep-09 – Dec-12
CP501	Clashavoon – Dunmanway 110 kV line: Construction of a new 110 kV line from Clashavoon to Dunmanway station and associated stations works.	110 kV Line: 35 km 110 kV Bays: 2	The construction of a Clashavoon - Dunmanway 110 kV line will resolve the low voltage and line overloads under certain contingencies, and makes some provision for expected increases in wind generation	Feb-10 – Dec-11

CP No	Project Description	Major New Equipment Estimates	Reason for Development	E.P.A.D. – E.C.D.
CP512	New capacitors at Kilkenny: Two new 15 Mvar capacitors at Kilkenny 110 kV Station.	110 kV bays: 2 Caps.: 2 x 15 Mvar	To ensure that voltages in the Kilkenny area continue to comply with standards and to minimise the risk of voltage collapse following the tripping of the Kilkenny – Kellis 110 kV line.	Jul-08 – Dec-08
CP514	New capacitor at Ardnacrusha: One new 15 Mvar capacitor at Ardnacrusha 110 kV Station.	110 kV bays: 1 Caps.: 1 x 15 Mvar	To ensure that voltages in the Ardnacrusha area continue to comply with standards and to permit the connection of new load in the area.	Jul-08 – Dec-08
CP515	New capacitor at Drumline: One new 15 Mvar capacitor at Drumline 110 kV Station.	110 kV bays: 1 Caps.: 1 x 15 Mvar	To ensure that voltages in the Drumline area continue to comply with standards and to permit the connection of new load in the area.	Jul-08 – Dec-08
CP528	New capacitor at Kilteel: One new 30 Mvar capacitor at Kilteel 110 kV Station.	110 kV bays: 1 Caps.: 1 x 30 Mvar	To ensure that voltages in Kildare continue to comply with voltage standards following the looping of Kilteel station and to minimise the risk of voltage collapse.	Jul-08 – Dec-08
CP529	New capacitor at Thurles: One new 15 Mvar capacitor at Thurles 110 kV Station.	110 kV bays: 1 Caps.: 1 x 15 Mvar	To ensure that voltages in the Thurles area continue to comply with the Transmission Planning Criteria and to minimise voltage drop violations.	Jul-08 – Dec-08

4.2 Demand Customer and DSO Connections

Table 4-4 lists the development projects in the detailed design and construction phase that relate directly to the connection of new TSO/DSO interface stations to the grid, or to changes in existing connection arrangements. Table 4-5 lists the development projects in the public planning process and Table 4-6 lists the development projects in the Preliminary Design Phase. Table 4-7 lists the development projects in the detailed design and construction phase that relate directly to the connection Demand Customer' Projects.

Table 4-4 DSO Connection Projects in the Detailed Design & Construction Phase

CP No.	Project Description	Major New Equipment	E.C.D.
CP074	New 110 kV Bays at Binbane 110 kV Station Two new 110 kV bays constructed at Binbane station to facilitate the replacement of the existing 31.5 MVA 110/38 kV transformer with two 63 MVA units	110 kV bays: 2	Dec-08

CP No.	Project Description	Major New Equipment	E.C.D.
CP138	New 110 kV Bay at Killonan station: A new 110 kV bay constructed at Killonan station to facilitate the tail connected DSO 110 kV circuit to a new DSO 110 kV station at Nenagh.	110 kV bays: 1	Sep-07
CP173	Banoge 110 kV Station: The existing Arklow–Crane 110 kV line looped into a new Banoge 110 kV station, creating new Arklow–Banoge and Banoge– Crane 110 kV lines.	110 kV station: 110 kV bays: 4 110 kV line: 6 km	Oct-09
CP197	Cushaling-Thornsberry 110 kV line: Construction of a new Cushaling-Thornsberry 110 kV line as a second connection to Thornsberry 110 kV station.	110 kV bays: 2 110 kV line: 30 km	Dec-09
CP201	Athy 110 kV Station: The existing Carlow–Portlaoise 110 kV line looped into a new Athy 110 kV station, creating new Athy–Portlaoise and Athy–Carlow 110 kV lines.	110 kV station: 110 kV bays: 4 110 kV line: 12 km	Dec-08
CP241c	Ballycadden 110 kV Station A new 110 kV station tailed out of Lodgewood 220/110 kV station to facilitate the connection of Ballycadden and Knockalour wind farms. This is part of the project CP241 as in listed in Table 4.2 above.	In other station: 110 kV busbar 110 kV bays: 2	Dec-09
CP285	Kilteel 110 kV loop in and 110 kV Transformer bay: The present connection of Kilteel is a solid T off the Maynooth-Monread 110 kV line. The T will be removed and the line between Maynooth and Monread will be looped into Kilteel 110 kV station. The DSO have also requested a second 110 kV transformer bay for a new 31.5 MVA transformer.	110 kV bays: 2 110 kV line: 2 km	Dec-08
CP292 (Part a)	Gorman-Meath Hill 110 kV Line: A second 110 kV line will be constructed between Gorman and Meath Hill 110 kV stations.	110 kV bays: 2 110 kV line: 30 km	Dec-09
CP401	New 110 kV Bay at Gortawee 110 kV Station: A new 110 kV bay constructed at Gortawee station to facilitate the installation of a 110/38 kV transformer	110 kV bays: 1	Mar-08
CP403	Baltrasna New 110 kV Station: The existing Corduff-Drybridge 110 kV line looped into a new Baltrasna 110 kV station near Ashbourne in Co Meath, creating the new Baltrasna-Corduff and Baltrasna-Drybridge 110 kV lines.	110 kV station: 110 kV bays: 4 110 kV line: 1 km	Sep-07

CP No.	Project Description	Major New Equipment	E.C.D.
CP487	New 110 kV Bays at Ennis 110 kV Station: Two new 110 kV bays constructed at Ennis station to facilitate the installation of two 20 MVA 110/10 kV transformers	110 kV bays: 2	Dec-07
CP488	New 110 kV Bays at Mullingar 110 kV Station: Two new 110 kV bays constructed at Mullingar station to facilitate the installation of two 20 MVA 110/10 kV transformers	110 kV bays: 2	Dec-07

Table 4-5 DSO Connection Projects in the Public Planning Process

CP No.	Project Description	Major New Equipment Estimates	E.P.A.D. – E.C.D.
CP421	Binbane-Letterkenny 110 kV line and switching station including a bay for 110 kV DSO link to the Bunbeg 110 kV station at Doire Beag: A new 110 kV line between Binbane 110 kV station and Letterkenny 110 kV station, in County Donegal; this new line looped into a new 110 kV switching station at Tievebrack, east of Glenties. Also included in this project is one 110 kV line bay for a new DSO 110 kV line to the Bunbeg 110 kV DSO station at Doire Beag.	110 kV bays: 4 110 kV line: 65 km In other stations: 110 kV bays: 1	Feb-09 – Dec-10

Table 4-6 DSO Connection Projects in the Preliminary Design Phase

CP No.	Project Description	Major New Equipment Estimates	E.P.A.D. – E.C.D.
CP196	Kilmurry 110 kV station: A new Kilmurry 110 kV station, near Bellview in Co. Waterford, connected by looping in the Great Island–Kilkenny 110 kV line. Planning permission has been granted for the TSO element of this project. However the required completion date is currently under review by the DSO.	110 kV station: 110 kV bays: 3 110 kV line: 5 km	Awaiting DSO decision to proceed
CP402	Charlesland 110 kV Station: The existing Ballybeg-Carrickmines 110 kV line will be looped into a new Charlesland 110 kV station, near Greystones in Co. Wicklow.	110 kV station: 110 kV bays: 4 110 kV circuit: 10 km	Nov-08 – Dec-09
CP437	Balgriffin 220 kV Station: A new 220 kV station in the Balgriffin area and associated networks. The development is part of a wider TSO/DSO agreed reinforcement strategy to enhance the network in the Northern Fringe of Dublin city. The station will be tail fed from Finglas 220 kV station using cable and constructed with GIS.	220 kV station (GIS): 250 MVA Trfr: 1 220 kV bays: 5 110 kV bays: 7 In other station: 220 kV bays: 1 220 kV cable: 17 km	Jan-09 – Dec-10

Table 4-7 Demand Customers' Connection Projects in the Detailed Design & Construction Phase

CP No.	Project Description	Major New Equipment Estimates	E.C.D
CP307	Baroda 110 kV Station: The existing Monread-Newbridge 110 kV line will be looped into a new Baroda 110 kV station, near Naas, Co. Kildare Associated work at Monread and Newbridge.	110 kV station: 110 kV bays: 5 110 kV circuit: 5 km	Feb-08
CP504	Ballyadam 110 kV Station: The existing Midleton-Whitegate 110 kV line will be looped into a new 110 kV station at Ballyadam, Co. Cork	110 kV station: 110 kV bays: 5 110 kV circuit: 2 km	Aug-08

4.3 Generator Connections

This section outlines the projects underway that relate directly to connection of generation to the transmission system or to changes in existing generation connection arrangements. Some of these connections are contestable, i.e. the generator has decided to build the connection assets to TSO specified standards.

The Estimated Completion Date (E.C.D.) is the TSO's current best estimate of when the generation connection will be completed. It should be noted that this is dependent on progress by the applicant. The date of completion for these projects is coordinated with the IPP programme of connection.

Table 4-8 lists the generator connection projects that are in the Detailed Design & Construction Phase. Table 4-9 lists the generator connection projects that are in the Preliminary Design Phase.

Table 4-8 Generator Connection Projects in the Detailed Design & Construction Phase

CP No.	Project Description	Major New Equipment	E.C.D
CP343	IPP42 Mountain Lodge: An additional 110 kV bay will be included in Ratrussan 110 kV station for the connection of the Mountain Lodge wind farm.	110 kV bay: 1	Mar-08
CP397	IPP51A Moneypoint: An existing 110 kV bay at Moneypoint 400 kV station will be refurbished to facilitate the IPP connection of a new wind farm.	Refurbished 110 kV bay	Awaiting IPP decision

Table 4-9 Generator Connection Projects in the Preliminary Design Phase

CP No.	Project Description	Major New Equipment	E.P.A.D. – E.C.D.
CP477	IPP38G Coomacheo: A new 110 kV station will be built to facilitate the connection of Coomacheo wind farm. The Coomacheo station will be connected to the grid via a 15 km cable to Clonkeen 110 kV station.	110 kV station: 110 kV bays: 2 110 kV cable: 15 km In other station: 110 kV bays: 1	Oct 07 - Jan-08
CP478	IPP53 Clahane: A new 110 kV station named Clahane will be built to facilitate the connection of the Clahane wind farm. The Clahane station will be connected into the existing Tralee-Trien 110 kV line.	110 kV station: 110 kV bays: 3 110 kV line: 5 km	Nov-07 - Jul-08
CP479	IPP55 Athea Connection: New Athea 110 kV station connected to the existing Trien 110 kV station, for the connection of Athea wind farm	110 kV station: 110 kV bays: 2 110 kV line: 15 km In other station: 110 kV bays: 1	Nov-07 - Jan-09
CP530	IPP102 WhiteGen CCGT Connection: A new 220 kV station tail connected to Aghada 220 kV station. Further work associated with the shallow connection is under consideration.	220 kV station: 220 kV bays: 1 220 kV cable: 4 km In other station: 220 kV bays: 1	Jan-08 – Dec-09
CP531	IPP89 Aghada CCGT Connection: A new 220 kV station tail connected to Aghada 220 kV station. Further work associated with the shallow connection is under consideration.	220 kV station: 220 kV bays: 2 220 kV cable: 1 km	Jan-08 – Dec-09

4.4 Refurbishments

This section details the development projects relating to upgrading of existing transmission equipment.

Table 4-10 lists the refurbishment projects that are currently in the Detailed Design and Construction Phase.

Table 4-10 Refurbishment Projects in the Detailed Design & Construction Phase.

CP No.	Project Description	Reason for Development	E.C.D.
CP157	Bellacorick 110 kV Station refurbishment	The closure of the power station on site necessitated the replacement of relays and control equipment to transfer the control functions to a new Control Room. The majority of the works are complete and only minor works and the new security fence remain to be completed.	Jul-08
CP213	Knockraha 220 kV Station refurbishment	Due to the age and condition of the existing station a full refurbishment of the entire station was undertaken. The replacement of all the HV equipment was included in this project. A new Control Room was constructed and all the relays and control equipment was replaced. Most of the work has been completed. One 220 kV line bay needs to be refurbished to complete the project.	Dec-08
CP225	Shannonbridge 220/110 kV Station refurbishment	The closure of the old power station on site necessitated the replacement of relays and control equipment to transfer the control functions. Due to the age and condition of the existing station a full refurbishment of the entire station is required.	Dec-09
CP228	Marina 110 kV Station Replacement	The existing Marina Station is obsolete and in poor condition, thus requiring major refurbishment. Due to operational, environmental and site restrictions a new GIS station is required to replace it. New GIS 110 kV station 110 kV bays: 12	Jun-10
CP229b	Portlaoise 110 kV station refurbishment – replacement of part of the 110 kV busbar steelwork	The busbar support structure does not have sufficient capacity to withstand the loading from the larger conductors that is required as part of the Portlaoise station refurbishment.	Oct-09
CP322	Protection Upgrades	The obsolete protection equipment at various stations will be replaced as part of an ongoing refurbishment programme.	2008 to 2011
CP337	Killonan-Shannonbridge 220 kV line refurbishment	The line underwent a detailed condition assessment, which recommended that the line be refurbished.	Dec-10
CP338	Maynooth-Shannonbridge 220 kV line refurbishment	The line underwent a detailed condition assessment, which recommended that the line be refurbished.	Dec-08
CP356	Prospect 220 kV Station relay replacement/ upgrade dist rec/ signals to NCC	Station requires upgrading	Dec-08

CP No.	Project Description	Reason for Development	E.C.D.
CP400	Remote Control Upgrade	This project involves the installation of new SCADA facilities in the Maynooth, Cathleen's Fall and Newbridge stations to improve the remote control capabilities.	2008 to 2009
CP409	Aghada 220 kV station (Knockraha bay)- replace line/earth disconnects	Following an economic assessment, a decision was made to replace the disconnects rather than continue with ongoing routine and corrective maintenance.	Oct-08
CP411	Ennis 110 kV station Replacement of protection relay and associated cabling in the Ardnacrusha Bay	Protection in Ardnacrusha bay in Ennis 110 kV station requires upgrading	Sep-08
CP413	Zamac Insulators replacement programme	Replacement required following two failures of these insulators	Jul-08
CP465	Mallow Station: Kilbarry 110 kV Line bay refurbishment	The obsolete relay equipment in this line bay will be replaced as part of a technology upgrade programme.	Sept-08
CP482	Cashla Installation of Fence and complementing works	Required for security and safety reasons	Dec-07
CP484	Steel Structures Life Extension	The painting of steel structure at various locations across the country will be undertaken as part of life extension programme.	Dec-09
CP497	Power Line Carrier Upgrade and Replacement Coupling Equipment Replacement	Upgrade of PLC equipment to digital working. Replacement of obsolete PLC equipment. Replacement of coupling equipment which has reached end of life	Dec-08
CP498	Telecommunications Services at Various NG Stations	Various Telecommunications work are required at a number of stations	Dec-07
CP499	Cashla 220 kV station (Prospect Bay) CB Replacement	Requirement to replace the existing Circuit Breaker in the Prospect Bay at Cashla 220 kV Transmission Station. The existing Circuit Breaker is nearly 30 years old.	Dec-08
CP503	Tarbert T2101 and T2102 Protection Upgrade	Protection testing on Tarbert T2102 & T2102 found that the protection on both transformers was operating incorrectly	Oct-08
CP521	Cliff 110 kV station protection upgrade	The protection in Cliff station needs to be upgraded to make it compliant with the Grid Code.	Dec-08

CP No.	Project Description	Reason for Development	E.C.D.
CP522	Killonan 110 kV station (Ardnacrusha Bay) replacement of HV equipment	HV equipment replacement required	Dec-08
CP524	Moneypoint 400 kV station T4001 & T4002 Protection Upgrade	The protection on T4001 and T4002 bays in Moneypoint 400 kV station is required to be upgraded.	Sep-08
CP527	Grange Castle – Maynooth 110 kV line fibre wrapping	The Grange Castle – Maynooth 110 kV line is operating without reliable teleprotection.	Oct-08

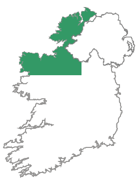
In addition a detailed investigation assessment has been carried out and capital approvals are being progressed for refurbishment of Carlow, Dundalk, Moy, Navan, Rathkeale and Whitegate stations.

Refurbishment projects do not normally require planning permission as they involve replacing "like-for-like" equipment. However some projects do involve a much higher level of detailed design. Table 4-11 lists the station and line refurbishment projects that are currently in the Preliminary Design Phase.

4.5 Regional Benefits

Most of the network is performing within the required standards at present. Some areas have been identified as likely to go outside standards in the absence of network reinforcement as the demand increases and/or new generation is connected. The network reinforcement projects identified in the above sections have been designed to deal with these emerging challenges.

Because of the meshed nature of the network, developments benefit a wider area than those supplied directly by the stations reinforced. For example the proposed Castlebar-Tonroe 110 kV line will benefit all Mayo, not just the towns of Castlebar and Ballaghaderreen (Tonroe).



North-West

Sranangh 220 kV station, due in 2008, will extend the 220 kV network and will strengthen the whole North-West region.

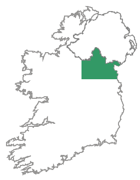
Athlone-Shannonbridge 2 110 kV line will provide greater reliability for customers supplied by Athlone 110 kV station and improve the ability of the network to move power from the south to the north-west.

Binbane-Letterkenny establishes a connection for a new DSO station giving much needed relief to the distribution system in Donegal. It will also increase the capacity for new generation in north Donegal and provide for future demand growth.

Castlebar-Tonroe 110 kV line will provide a fourth connection into Mayo and enables the network to meet the forecast demand in Mayo well beyond the Plan Period.

Some of the projects on the West will also help strengthen the North-West area. Further developments in the North-West should only be required within the Plan Period in the event that new as yet unknown generation or demand developments emerge.

North-East



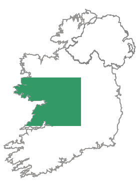
The uprating of the Corduff Platin 110 kV line will enhance the near-term performance of the network in this area.

The Arva-Shankill No. 2 110 kV line will overcome capacity problems supplying the Cavan and Monaghan loads. To achieve the full potential of this line in providing for future demand, further development will be required to prevent potential voltage problems in the area (see Section 5.1).

The Gorman-Meath Hill 110 kV line will provide a second circuit to Meath Hill, giving more reliability to the supply in east Cavan. The Gorman-Navan 110 kV line will improve the quality of supply to Navan and surrounding areas.

Reactive compensation at Lisdrum, Shankill and Louth stations will improve the voltage profile across the north-east and bring the area within standards.

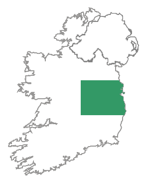
The 400 kV line from Woodland to a new station connected into the Flagford-Louth 220 kV line is a major addition to the transmission system. It will provide a step change in the ability to transfer power northwards from Dublin where there is currently an excess of generation capacity. This will benefit the whole North-East as well as the North-West and will also assist in cross-border trading.



West

The looping of the Dalton-Galway 110 kV line into Cashla station will create a fourth 110 kV circuit between the Cashla 220 kV station and Galway 110 kV station. It also removes the Mayo load from Galway station, thus improving the supply to both Galway and Mayo. This will allow for demand growth at Galway for the foreseeable future.

East

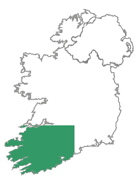


The looping of the Blake-Cushaling-Maynooth 110 kV line into Newbridge provides two more circuits to Newbridge. This will provide essential infrastructure support to this fast growing region. Reactive compensation at Kilteel will maintain system voltages within standards in this area.

The Cushaling-Thornsberry 110 kV line will provide a second circuit to Thornsberry station which will make supply to Tullamore and the surrounding area more secure and allow for further demand growth.

Connection of generation in Dublin will continue to raise short circuit current levels. The provision of a series reactor in Poolbeg and sectionalising the system in Dublin will help reduce the levels.

Balgriffin 220 kV station will provide additional capacity for the rapidly increasing load on the northern fringes of Dublin city.



South-West

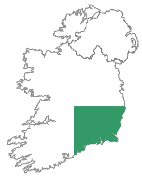
A number of important network projects identified above will enhance the network infrastructure in the South-West.

The connection of two CCGTs in east Cork and the associated network developments will provide a more secure supply to Cork City and harbour area. The area around Tralee and Killarney is currently outside standards; the planned Tarbert-Tralee No. 2 110 kV line will rectify this situation.

The Moneypoint to Tarbert 400 kV circuit and the 400/220 kV station near Nenagh will provide two additional high capacity paths from the 400 kV system into the South-West. This will greatly enhance the reliability of service to demands in the South-West. In addition it will provide much needed flexibility for the dispatch of the system generation which will improve reliability and economics for the benefit all electricity customers.

The Clashavoon-Dunmanway 110 kV line will improve security of supply in west Cork during maintenance outages of transmission equipment.

South-East



The proposed Lodgewood 220 kV station near Enniscorthy will connect the 220 kV network to the 110 kV network providing a more reliable supply into Co. Wexford. To maximise the benefit of the new Lodgewood station, the line from Crane to Wexford will be require to be uprated or reinforced following completion of this project, which is expected in 2009.

The planned reactive compensation in Kilkenny will substantially improve the voltage performance for this area.

5 Other Potential Developments

This chapter covers the areas on the network that may require some form of development to start within the next five year planning period, for which a specific development project has not yet been approved or identified. These are regarded as potential developments and they are separated into the different categories as follows:

- **Expected reinforcement requirements** identified through analysis of the system performance based on forecasted demands and generation.
- **DSO plans for further connections** which are currently under investigation or being prepared for approval.

The two categories of potential development are discussed separately below.

5.1 Expected Reinforcement Requirements

The results of long-term technical analysis of future network performance have identified a number of areas where, in the absence of further development, sub-standards performance will arise. The analysis is based on the expected demand growth and generation connection assumptions outlined in Chapter 3 and on the assumption that the reinforcement and refurbishment projects covered in Chapter 4 are completed and in service by the given completion dates.

The areas are listed in Table 5-1 below grouped together on a regional basis to place them in context. They are discussed separately after the table and are broadly indicated in the map in Figure 5-1.

It is expected that if demand and generation evolve as assumed it will be necessary to commence further developments to meet these needs within the period of this plan.

Table 5-1: List of Areas with Future Development Needs Identified

Identified Areas of Future Needs by Region	Section
North-West Overloading of numerous 220 kV and 110 kV lines as a result of "Gate 2" wind farm connections	5.1.1
North-East Low voltage at Mullingar 110 kV station	5.1.2
West Line overloading of the Cashla-Ennis 110 kV line Line overloading in the Cahir area Transformer loading at Killonan 220/110 kV station	5.1.3
East Line overloading of: • Arklow-Banoge 110 kV line • Crane-Wexford 110 kV line • Corduff-Finglas 220 kV circuits • Dallow-Portlaoise-Shannonbridge 110 kV line Transformer loading Dublin transmission stations	5.1.4
South-West Line overloading of: • Charleville-Killonan 110 kV line • Kilbarry-Mallow 110 kV line Low voltages at Charleville, Glenlara and Mallow 110 kV stations Possible reinforcement following the closure of the Tarbert generation station Overloading of numerous 220 kV and 110 kV lines as a result of two Cork CCGTs and "Gate 2" wind farm connections	5.1.5

Table 5-1: List of Areas with Future Development Needs Identified (contd.)

Identified Areas of Future Needs by Region	Section
South-East Line overloading of: • Kilkenny-Kellis 110 kV line • Great Island-Kilkenny-Kilmurry 110 kV line Low voltages at Kilkenny 110 kV and the South-East Security of supply in the South-East Possible reinforcement following the closure of Great Island generation station	**5.1.6**

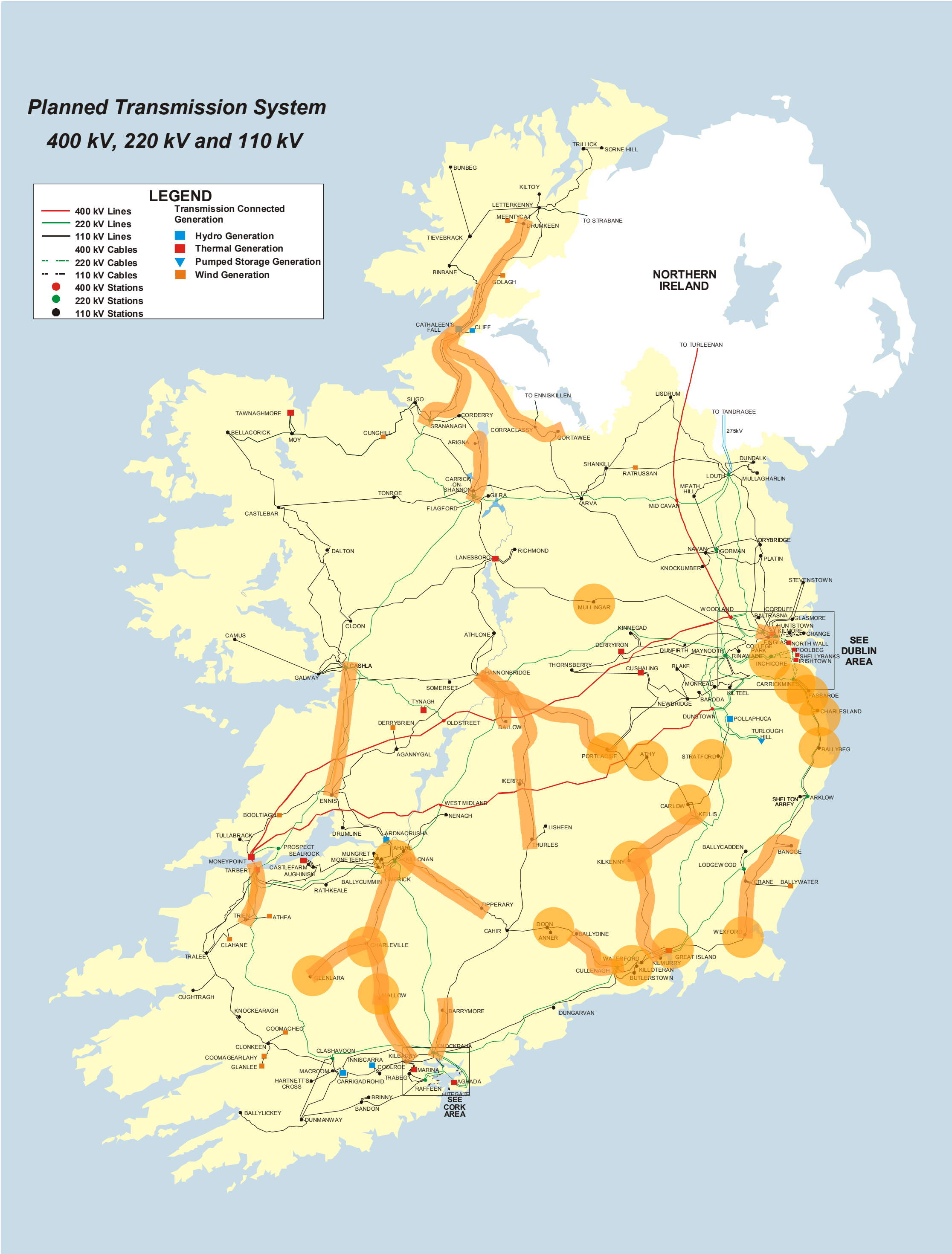
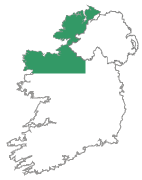


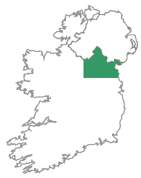
Figure 5-1: Map Indicating Location of Areas Requiring Future Development



5.1.1 North-West

Overloading of 110 kV lines in the North-West

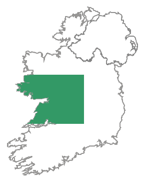
The "Gate 2" integration studies are underway and have identified a number of 110 kV lines at risk of overloading as a result of the increased generation in the North-West.



5.1.2 North-East

Low voltages at Mullingar 110 kV station

The Mullingar 110 kV station is connected to the Lanesboro station and the new Corduff 220/110 kV station. Low voltages could occur at the Mullingar 110 kV station for a contingency involving the Lough Ree Power generator and the Corduff-Mullingar 110 kV line towards the end of the Plan Period 2011. At present the most likely option is to support the voltage by installing a capacitor at Mullingar. This will only be put forward for approval when appropriate if no other option becomes more attractive in the interim.



5.1.3 West

Overloading of 110 kV lines and low voltages in Clare and Limerick

From early 2011, if generation output is low in the South, the Cashla-Ennis 110 kV transmission line could overload under certain contingency conditions as it tries to route additional power to the south.

The same 110 kV line could overload during summer 2011 for the trip-maintenance outages of the Ardnacrusha-Killonan and Ardnacrusha-Limerick 110 kV lines when there is little or no generation at the Ardnacrusha hydro power station. Similarly, from 2011, the outage of the Cashla-Ennis 110 kV line and one of the two above 110 kV lines to Ardnacrusha will result in the remaining 110 kV line overloading.

There are potential refurbishment projects under consideration which could have an impact on these performance issues. The condition of the equipment in the Ardnacrusha station is poor and much has become obsolete. A project for the refurbishment of the entire station is being investigated. The timing of the refurbishment project will be co-ordinated with any new reinforcement projects.

Transformer loading at Killonan 220/110 kV Station

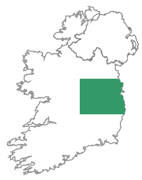
There are three transformers at the Killonan station, two 63 MVA and one 125 MVA units. These transformers will suffer heavy loading under certain conditions, especially from 2011, and are being carefully monitored with a view to replacing them with larger units.

Line overloading in the Cahir area

The Cahir area of the transmission system consists of a four-legged star network which is centred at the Cahir 110 kV station in Co. Tipperary. Near the end of the Plan Period, from around 2010, the following four 110 kV lines feeding this area could overload following the trip-maintenance contingency of two of the other legs forming this star network, placing this part of the 110 kV network at risk:

- Ikerrin-Shannonbridge-Thurles;
- Killonan-Tipperary;
- Barrymore-Cahir-Knockraha;
- Ballydine-Cullenagh.

Some reinforcement will be required to strengthen the network in this area. The TSO is considering alternatives which would benefit the wider region.



5.1.4 East

Line overloading of the Crane-Wexford and Banoge-Crane 110 kV lines

The establishment of the new Lodgewood 220/110 kV station (see Section 4.1) results in a power injection into the 110 kV network running in parallel with the 220 kV network between Arklow and Great Island. When there is no generation output from Great Island power station and a high level of generation in Dublin the resulting high power transfer to the South could lead to an overload of the Crane-Wexford 110 kV line under contingency conditions such as the loss of the Great Island-Lodgewood 220 kV circuit as a single contingency.

Uprating these two 110 kV lines has been identified as a potential short lead-time solution.

Line overloading of the Dallow-Portlaoise-Shannonbridge 110 kV line and low voltage in the Portlaoise area

From summer 2010 studies have shown that scenarios with high generation in the south and low generation in Dublin can lead to an overload on the 110 kV network connecting the Shannonbridge and Portlaoise stations. The overload could arise following the loss of either of the 400 kV circuits into the east of the country. Such a contingency diverts generation through the lower-rated 110 kV network and could lead to the overload of the Shannonbridge to Portlaoise 110 kV line as power flows from to Dublin. The problem also materialises following loss of the Edenderry Power station during conditions when Dublin generation is low. The possibility of an overload is increased when “Gate 2” wind is considered.

In similar circumstances shortly after the Plan Period, with high South generation and low generation in Dublin, the single contingency loss of the Dallow-Portlaoise-Shannonbridge 110 kV line could result in low voltages at the Athy and Portlaoise 110 kV stations.

High loading of the Dublin 220 kV Cable Network

Recent network studies have indicated that the 220 kV cables within the Dublin area will experience very high loading during contingency conditions, towards the end of the Plan Period. This is as a result of the planned reconfiguration of the 220 kV and 110 kV networks and the introduction of an in-line series reactor which are necessary to reduce the rising short circuit level currents in the Dublin area following new generation connections. Although the loadings are within their emergency thermal limits these cables will have to be monitored to ensure that their integrity is not compromised. This will be reviewed in conjunction with the analysis of the DSO plans for the Dublin area, as discussed in Section 5.2.

It is possible that some reconfiguration of the 220 kV and 110 kV networks and/or some reinforcement will be required in the future to meet the DSO demands and avoid network constraints in the Dublin area.

Overloading of the Dublin 220 kV System Transformers

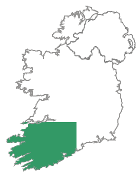
There are four primary bulk supply points in the Dublin area, comprising the Carrickmines, Finglas, Inchicore and Poolbeg 220/110 kV stations. Projected load growth suggests that by 2010, transformers at Carrickmines, Finglas and Inchicore could overload following single event contingencies. A recently-approved fifth Finglas 220/110 kV transformer will provide a solution at Finglas while TSO and DSO are working together to provide additional transformer capacity at Carrickmines and Inchicore 220 kV stations.

Charlesland and Ballybeg 110 kV stations are fed from Carrickmines. Further development in the area is required to maintain voltage levels at the Charlesland and Ballybeg 110 kV stations, under certain contingencies.

Overloading of the Corduff-Finglas 220 kV lines

There are two parallel 220 kV circuits connecting Corduff 220 kV station to the Finglas 220 kV station in Dublin. These lines help to supply Dublin demand via the Finglas 220/110 kV station. When generation in the South is high and generation is low at Huntstown and Dublin, one of these lines could overload following the single contingency loss of the other circuit.

5.1.5 South-West



Low voltages at Charleville, Glenlara and Mallow 110 kV stations

From 2010, if output from generation stations in the South is low the single contingency loss of Charleville-Killonan 110 kV line could result in low voltages at the Charleville and Glenlara 110 kV stations. During the same period the loss of the Kilbarry-Mallow 110 kV line could result in a similarly low voltage level at the Mallow 110 kV station. A project to provide reactive power support is the more likely solution and will be submitted for approval at the appropriate time unless a new alternative becomes more attractive before then.

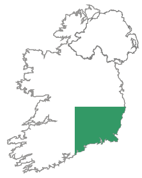
Overloads on the Charleville-Killonan and Kilbarry-Mallow 110 kV lines

Demand associated with Charleville and Glenlara 110 kV stations is supplied by the Charleville-Killonan and Kilbarry-Mallow 110 kV lines. Shortly after the Plan Period the Charleville-Killonan 110 kV line could overload following the single contingency of the Kilbarry-Mallow 110 kV line. During the same period, for the single contingency of the Charleville-Killonan 110 kV line, the Kilbarry-Mallow 110 kV line could experience high loading and eventually overloading during the following years.

Overload of numerous 110 kV lines as a result of “Gate 1” and “Gate 2” wind farm connections

All the transmission-connected wind generators from “Gate 1” have signed by the end of 2005. The “Gate 1” integration studies identified a number of 110 kV lines at risk of overloading as a result of the increased generation in the South-West: Charleville-Killonan, Clahane-Tralee, Clashavoon-Clonkeen, Clonkeen-Knockearagh, Killonan-Limerick, Limerick-Rathkeale, Rathkeale-Tarbert, and Tarbert-Trien 110 kV lines. The “Gate 2” integration studies are underway and have identified a number of 110 kV lines at risk of overloading as a result of the increased generation in the South-West. The TSO will put together an optimum plan for dealing with all these loading issues.

5.1.6 South-East



Low voltage, line-overloading and demand in the Kilkenny area

Two transmission lines supply the Kilkenny 110 kV station. One from the Kellis 220/110 kV station and the other from the Great Island 220/110 kV station. From 2007 onwards, low voltage could occur at the Kilkenny 110 kV station following the single contingency outage of either of the Kilkenny-Kellis or Great Island-Kilkenny 110 kV lines.

From 2011 onwards low voltages could occur at Athy 110 kV, Carlow 110 kV and Stratford 110 kV stations following the same contingencies.

The Kilmurry 110 kV station is expected to be complete in 2011. By this time the combined load at the Kilkenny and Kilmurry 110 kV stations will exceed 80 MW. The Transmission Planning Criteria (TPC) states that the load isolated following a trip-maintenance contingency should not exceed this figure.

Towards the end of the Plan Period, the loss of Kilkenny-Kellis 110 kV or Great Island – Kilmurry 110 kV lines could overload the other circuit.

A 30 Mvar capacitor bank is planned for the Kilkenny 110 kV station by the end of 2008. This will form the first phase of work that will keep the area within standards towards the end of the Plan Period.

Low voltages in the South-East

From 2008, in the absence of Great Island generation and when other generation in the South-West is low, stations including Anner 110 kV, Butlerstown 110 kV, Cullenagh 220/110 kV, Doon 110 kV, Great Island 220/110 kV, Killoteran 110 kV, Waterford 110 kV and Wexford 110 kV could all experience low voltages following a single contingency loss of the Dunstown-Kellis 220 kV line.

Shortly following the Plan Period when Dublin generation is high, the same list of stations could experience low voltages during the single contingency of the Cullenagh-Knockraha 220 kV line.

5.2 DSO Plans for Further Connections

Most demand connections to the transmission system are sought by the Distribution System Operator (DSO) which applies for new station connections. The DSO has further development plans which are at various stages of preparation, several at an advanced stage.

The TSO is co-operating with the DSO on these expansion plans in order to bring them forward to project initiation when required. The TSO will initiate the necessary transmission connections when the formal notifications from the DSO to proceed are received. These plans include new additional transformers for the DSO at existing TSO supplied stations as well as new DSO 110 kV stations to be connected to the transmission grid. The DSO connection plans that are currently being prepared in conjunction with the TSO are listed below, following receipt of formal notifications from the DSO. In some cases, where the TSO element of the project is minor, the DSO may have progressed its element of a project to a different stage ahead of the TSO. The TSO is confident however that it will deliver its element at a suitable time.

5.2.1 Additional DSO Transformers

The DSO plans include connection of the following additional transformers:

- 110 kV / MV transformer at College Park 110 kV station;
- 220 kV / 110 kV transformer at Inchicore 220 kV station;
- 110 kV / 38 kV transformer at Trien 110 kV station.

5.2.2 New 110 kV Stations

The DSO plans include the construction and connection of new 110 kV stations at the following locations:

- Ballycummin, Raheen, Co. Limerick[1];
- Ballymurtagh, Shannon, Co. Clare;
- Carrowbeg, Westport, Co. Mayo;
- Kentstown Road, Navan, Co. Meath;
- Salthill, Galway City, Co. Galway;
- Singland, Co. Limerick;
- Southgreen, Kildare, Co. Kildare.

5.2.3 Dublin Load

The Balgriffin project, listed in Table 4-6, will provide essential transmission infrastructure to cater for the fast growing demand in the northern fringes of Dublin City. The TSO is carrying out studies for the strategic long-term development of the network in south and west Dublin. Based on the current level of load enquiries it is envisaged that

[1] Since Transmission Development 2006-2010, a revised connection method for Ballycummin has been agreed with the DSO.

the transmission network will need to be substantially reinforced to accommodate the expected growth in these areas. Such reinforcement developments are likely to commence within the period of this plan.

Other transmission considerations (see Section 5.1.4) will also impact on the further development of the Dublin area networks.

6 Summary of Developments

From 2007 to 2011 electricity peak demand is forecast to increase by 20%. Signed generation connection agreements at the end of July 2007 include 1,095 MW of new capacity most of which is expected to be connected to the grid by 2011. This is in addition to the 944 MW of new thermal generation and 120 MW of wind generation that was connected between November 2005 and July 2007. Further development of the network is required to keep pace with these significant changes. The reinforcement developments included in this plan have been selected to ensure that the network remains within standards given the projections for demand growth and generation connections in the years up to 2011.

The development plan includes a total of 80 projects that are in progress, 51 of which are in the detailed design and construction phase. In addition, the TSO and the TAO are co-ordinating other capital projects not list in the plan which come under the general description of minor capital works and line diversions and alterations. The totals of new equipment currently planned are presented in Table 6-1. These are estimates only because scopes, particularly circuit lengths, can change during the course of a project.

Table 6-1 Estimates of Planned New Transmission Assets

	400 kV	220 kV	110 kV
No of New Stations	3	5	12
Total New Station Bays	11	30	106
Overhead Line, km	120	151	424
Underground Cable, km	10	29	15

	400/220 kV	220/110 kV
Transformers, number of	3	4
Transformers, Total MVA	1500	1000

There are a total of eight 220 kV and ten 110 kV station bays that are planned to be refurbished at seven stations in the Plan Period. There will also be a total of 195 km of 220 kV transmission lines that will be involved in refurbishment at some level. Over 160 km of 110 kV transmission circuits will have their thermal ratings increased.

In addition to those development projects that have been initiated, other developments are likely to be required in the Plan Period.

An assessment of future network performance based on current assumptions has identified a number of areas as likely to require network development. Most of these potential development needs are expected to emerge late in the Plan Period around 2010 and 2011, based on the expected demand growth. The TSO is considering network options to meet these emerging challenges. Development projects, some of which may have short lead-times, will be initiated at the optimum time to meet these network requirements.

Recent developments such as the selection of Woodland as the connection point for the planned interconnection with Great Britain and the announcement by ESB of its plans to close or divest 1,300 MW of old plant will require detailed study to identify development needs and to select optimum reinforcement projects where necessary.

Other development requirements will emerge depending on a number of factors including connections of demand, generation and interconnection, and on refurbishment requirements that will be identified as condition assessments are carried out. The potential drivers include:

- The take-up of "Gate 2" wind farm connection offers;
- Applications for the connection of thermal generation;
- Increasing Short Circuit Levels;
- DSO plans for new 110 kV / MV transformers and connection for new 110 kV stations;
- A number of stations and overhead lines identified after initial condition assessments for more detailed refurbishment investigations.

It is expected that as the level of confidence in these potential drivers increases the necessary transmission projects to deal with them will feature in future development plans.

The TSO estimates that transmission development requirements will involve major expenditure between 2007 and 2011. However some projects are at a preliminary design stage, while others have not yet been initiated. Better expenditure estimates will evolve as project scopes become more certain.

The CER in its 2006-2010 Transmission Price Control Review Decision Paper has set a cap on capital expenditure on transmission at €520 million. The impact of this capital constraint will be continually reviewed as project designs and costs evolve.

With this development plan in place, coupled with the constant review of the transmission infrastructure and the changing environment requirements, the TSO is confident that the needs of a growing Irish economy will be met well into the future.

APPENDIX A DEMAND FORECASTS

Transmission interface stations are the points of connection between the transmission system and the distribution system or directly connected customers.

Table A-1 lists the forecast demand at each interface station at the time of winter peak for each year from 2007 to 2011 inclusive. The demand values do not include transmission losses. However, an allowance for distribution losses is included in demand at stations that interface with the distribution system. The source for this Appendix is from the Transmission Forecast Statement 2007 -2013, for which the data was frozen in Jan 2007. Please note that demand projections at individual transmission stations may not reflect more recent step changes in load.

All transmission interface stations are 110 kV stations except for the four 220 kV interface stations that supply the Dublin City networks operated by the DSO. These 220 kV interface stations, Carrickmines, Finglas, Inchicore and Poolbeg, are included at the bottom of the table.

Table A-1 Forecast Demand at Transmission Interface Stations

Station Name	Winter Peak Forecast Demand (MW)				
	2007	2008	2009	2010	2011
Ardnacrusha	87.3	84.6	98.9	103.5	107.5
Aghada	1.6	1.6	1.7	1.8	1.8
Ahane	9.2	9.5	9.8	10.3	10.7
Anner	11.0	11.0	11.0	11.0	11.0
Arigna	4.0	4.1	4.3	4.5	4.6
Arklow	38.0	39.2	40.6	42.5	44.2
Athlone	65.8	67.9	70.3	73.5	76.4
Athy	19.8	20.4	21.1	22.1	23.0
Baltrasna	21.9	22.4	23.0	23.7	24.4
Bandon	30.6	31.6	32.7	34.2	35.6
Barrymore	25.9	26.7	27.7	29.0	30.1
Ballycummin	0.0	0.0	18.9	19.4	19.9
Baroda	0.0	19.0	19.0	19.0	19.0
Ballyadam	19.6	19.6	19.6	19.6	19.6
Ballydine	18.2	18.6	19.0	19.6	20.2
Ballybeg	10.8	11.1	11.5	12.1	12.5
Binbane	22.1	22.8	23.6	12.9	13.4
Bellacorick	5.1	5.2	5.4	5.7	5.9
Ballylickey	12.3	12.7	13.1	13.7	14.3

Station Name	Winter Peak Forecast Demand (MW)				
	2007	2008	2009	2010	2011
Blake	37.0	38.2	39.6	41.4	43.0
Banoge	16.6	17.1	17.8	18.6	19.3
Brinny	4.2	4.2	4.2	4.2	4.2
Barnahely	51.9	53.5	55.4	58.0	60.3
Bunbeg	0.0	0.0	0.0	17.6	18.3
Butlerstown	52.4	54.0	56.0	58.5	60.8
Cahir	28.2	29.0	29.9	31.2	32.3
Camus	0.0	0.0	5.7	5.9	6.1
Castlebar	61.9	63.9	66.2	69.2	71.9
Cathaleens fall	16.8	17.4	18.0	18.8	19.6
Castlefarm	44.0	44.0	44.0	44.0	44.0
Charleville	26.4	27.2	28.2	29.4	30.6
Charlesland	0.0	23.8	23.8	23.8	23.8
Cloon	28.2	29.0	30.1	31.5	32.7
Carlow	56.3	58.1	60.1	62.9	65.4
College Park	24.3	24.8	25.4	26.1	26.8
Carrick-on-Shannon	33.0	34.1	35.3	36.9	38.3
Cow Cross	19.2	19.8	20.5	21.4	22.2
Crane	26.0	26.8	27.8	29.1	30.2
Coolroe	11.8	12.2	12.6	13.2	13.7
Castleview	16.2	16.7	17.3	18.1	18.8
Dallow	14.1	14.5	15.0	15.7	16.3
Dundalk	76.1	78.5	81.3	85.0	88.4
Dunfirth	7.1	7.3	7.6	7.9	8.2
Dungarvan	33.1	34.2	35.4	37.0	38.5
Dalton	24.3	25.1	26.0	27.2	28.3
Dunmanway	37.1	38.3	39.7	41.5	43.1
Doon	34.7	35.8	37.1	38.8	40.3
Drumline	31.7	32.7	33.9	35.5	36.9
Drybridge	92.3	95.2	98.6	103.1	107.2
Ennis	57.2	59.0	61.2	64.0	66.5
Fassaroe	69.4	71.6	74.2	77.6	80.6
Galway	154.3	159.1	159.2	166.5	173.0
Grange Castle	14.8	15.3	15.8	16.6	17.2
Great Island	26.5	27.3	28.3	29.6	30.7
Gilra	11.9	11.9	11.9	11.9	11.9
Glasmore	57.5	59.3	61.5	64.3	66.8

Station Name	Winter Peak Forecast Demand (MW)				
	2007	2008	2009	2010	2011
Glenlara	16.5	17.0	17.6	18.4	19.2
Grange	59.6	61.5	63.7	66.6	69.2
Griffinrath	67.6	69.7	72.2	75.5	78.5
Gortawee	27.6	27.9	28.3	28.8	29.3
Harnetts Cross	9.4	9.7	10.1	10.5	11.0
Ikerrin	29.5	30.5	31.6	33.0	34.3
Kilbarry	100.0	103.2	106.9	111.8	116.2
Knockeragh	36.8	38.0	39.3	41.1	42.8
Kinnegad	10.9	10.9	10.9	10.9	10.9
Kilkenny	77.3	79.8	82.6	86.4	89.8
Kilmore	14.9	31.5	33.6	34.2	34.6
Kilmurry	0.0	0.0	0.0	0.0	23.4
Kilteel	28.2	37.5	38.9	40.6	42.2
Killoteran	2.0	2.1	2.2	2.3	2.3
Knockumber	24.2	24.2	24.2	24.2	24.2
Lanesboro	16.3	16.8	17.4	18.2	18.9
Letterkenny	66.6	68.6	71.1	68.6	71.3
Liberty Street	18.0	18.6	19.2	20.1	20.9
Limerick	87.9	96.1	76.4	79.9	83.1
Lisdrum	30.3	31.2	32.3	33.8	35.2
Lisheen	17.1	17.1	17.1	17.1	17.1
Macroom	7.6	7.9	8.1	8.5	8.9
Mallow	23.9	24.6	25.5	26.7	27.7
Macetown	34.8	35.8	36.9	38.3	39.7
Midleton	42.2	43.5	45.1	47.1	49.0
Mullagharlin	7.6	7.6	7.6	7.6	7.6
Monread	12.0	12.4	12.8	13.4	13.9
Moy	34.9	36.0	37.3	39.0	40.6
Marina	23.8	24.5	25.4	26.6	27.6
Meath Hill	36.4	37.5	38.9	40.7	42.3
Mullingar	52.3	53.9	55.9	58.4	60.7
Mungret	25.7	25.7	25.7	25.7	25.7
Nangor	26.0	26.0	26.0	26.0	26.0
Navan	75.8	78.1	80.9	84.6	88.0
Nenagh	30.2	31.1	32.2	33.7	35.0
Newbridge	54.9	48.2	50.0	52.3	54.3
Oldcourt	0.3	0.3	0.3	0.3	0.3

Station Name	Winter Peak Forecast Demand (MW)				
	2007	2008	2009	2010	2011
Oughtragh	25.8	26.6	27.6	28.9	30.0
Platin	15.9	31.8	31.8	31.8	31.8
Portlaoise	48.7	50.2	52.0	54.4	56.5
Rathkeale	28.6	29.5	30.5	31.9	33.2
Richmond	33.8	34.9	36.1	37.8	39.3
Rinawade	15.2	15.2	15.2	15.2	15.2
Ringaskiddy	3.9	4.0	4.2	4.4	4.6
Ryebrook	81.0	81.0	81.0	81.0	81.0
Shelton Abbey	0.2	0.2	0.2	0.2	0.2
Shankill	59.2	61.0	63.2	66.1	68.7
Sligo	62.2	64.2	66.5	69.5	72.3
Somerset	32.1	33.1	34.3	35.9	37.3
Stratford	25.2	26.0	26.9	28.1	29.3
Stevenstown	13.8	14.2	14.7	15.4	16.0
Trabeg	76.5	78.9	81.8	85.5	88.9
Tulabrack	12.5	12.9	13.3	14.0	14.5
Thurles	33.3	34.4	35.6	37.2	38.7
Tipperary	15.9	16.4	17.0	17.7	18.4
Trillick	22.5	23.2	24.0	25.1	26.1
Tonroe	14.7	15.1	15.7	16.4	17.1
Trien	24.2	25.0	25.9	27.1	28.1
Tralee	52.6	54.2	56.2	58.8	61.1
Thornsberry	38.5	39.7	41.1	43.0	44.7
Waterford	50.2	51.7	53.6	56.0	34.9
Wexford	61.0	62.9	65.2	68.2	70.9
Whitegate	7.0	7.0	7.0	7.0	7.0
Carrickmines	254.0	278.3	288.3	301.5	313.4
Finglas	400.1	379.9	414.4	432.5	448.7
Inchicore	233.1	240.4	249.0	260.4	270.7
Poolbeg	205.4	211.4	218.5	227.9	236.4
TOTAL	4875	5074	5270	5489	5686

APPENDIX B NETWORK MAPS

Figure B-1 Map of the Transmission System at December 2006

Figure B-2 Map Indicating the Planned Network Developments 2007-2011

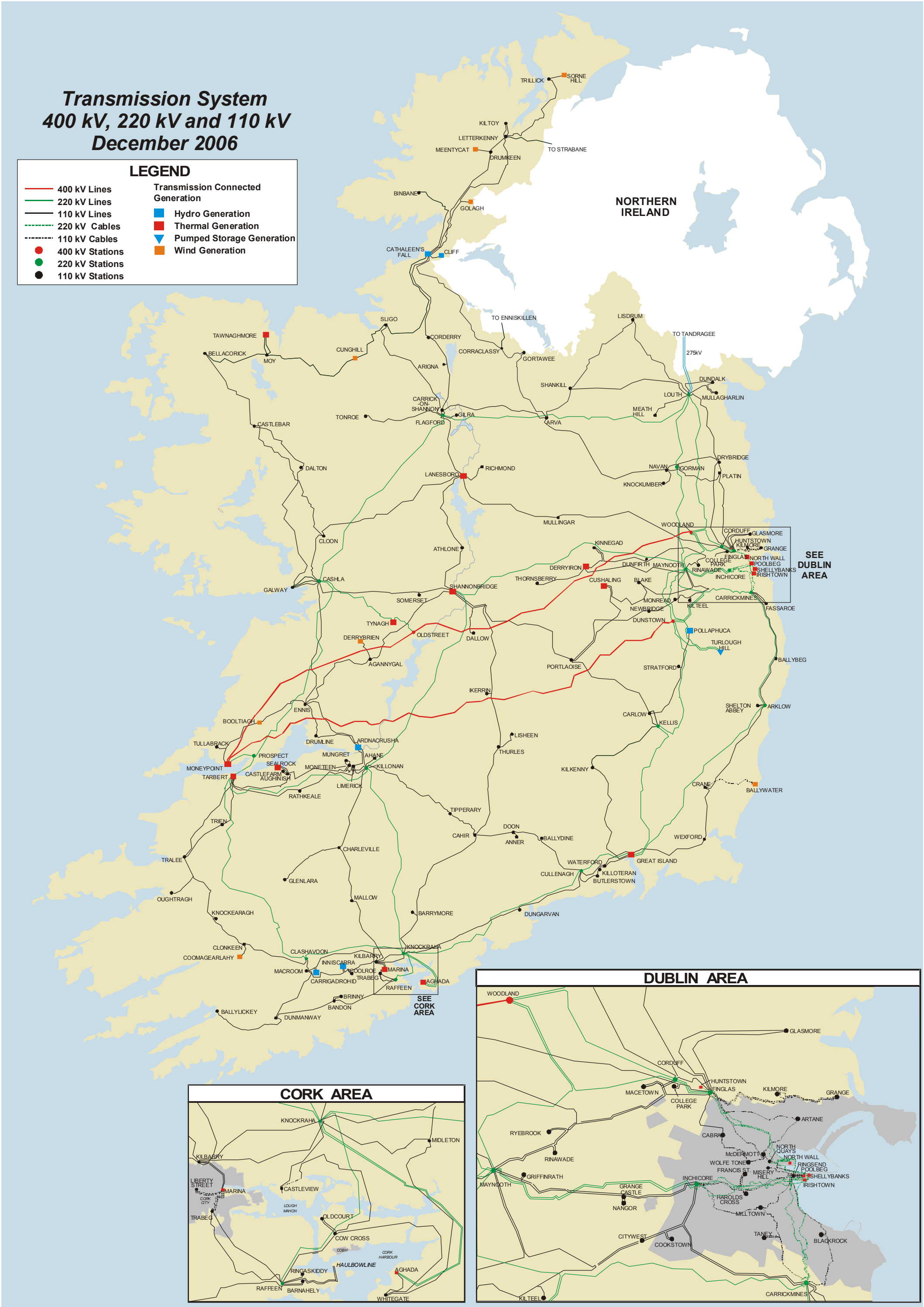


Figure B-1 Map of the Transmission System at December 2006

Figure B-2 Map Indicating the Planned Network Developments 2007-2011

APPENDIX C DETAILS OF MAJOR DEVELOPMENT PROJECTS IN THE DETAILED DESIGN AND CONSTRUCTION PHASE

Details are provided in this appendix for the following major development projects:

- C.1 Blake–Cushaling–Maynooth 110 kV line looped into Newbridge Station
- C.2 Cushaling-Thornsberry 110 kV line
- C.3 Dalton–Galway 110 kV looped into Cashla 220/110 kV station
- C.4 Gorman-Meath Hill 110 kV line
- C.5 Srananagh 220 kV Project
- C.6 Tarbert–Tralee No. 2 110 kV line

C.1 BLAKE-CUSHALING-MAYNOOTH LOOP INTO NEWBRIDGE (CP217)

C.1.1 Description

This project involves looping the existing Blake–Cushaling–Maynooth 110 kV line into Newbridge 110 kV station in Co. Kildare. This project is due for completion in 2008.

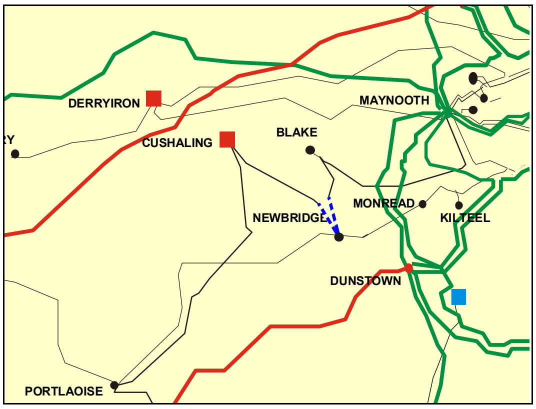


Figure C-1 – Proposed Blake-Cushaling-Maynooth loop into Newbridge

C.1.2 Reason for Development

For an outage of the line between Maynooth and Kilteel or Monread, the entire load in the area must be supplied from the Portlaoise end. This contingency leads to voltages below the minimum specified in the Transmission Planning Criteria.

Most recent load forecasts indicate that from 2008 over 80 MW of distribution load would be lost for the trip maintenance combination of Kilteel–Maynooth and Newbridge–Portlaoise 110 kV lines, therefore violating the Transmission Planning Criteria. This trip-maintenance combination would also lead to unacceptably low voltages.

The expansion plans of one of Co. Kildare's key industrial customers are subject to reinforcement of the existing network, including the completion of this project.

In addition two new 110 kV stations (near Newbridge and Portlaoise) are planned to provide additional infeeds to the local distribution networks from the main transmission system and meet the increasing electricity demand of industrial, commercial and domestic customers in the area. These essential stations cannot be connected until the two proposed transmission lines are completed.

The timely delivery of this project is a key element of the strategic long term plans to continue to provide Co. Kildare and west Co. Wicklow with an adequate electricity network to meet this growth.

C.2 CUSHALING-THORNSBERRY 110 KV LINE (CP 197)

C.2.1 Description

This project involves construction of a 110 kV line from Thornsberry station (near Tullamore) to Cushaling station (near Edenderry), approximately 30 km in length. The project is due for completion in 2009.

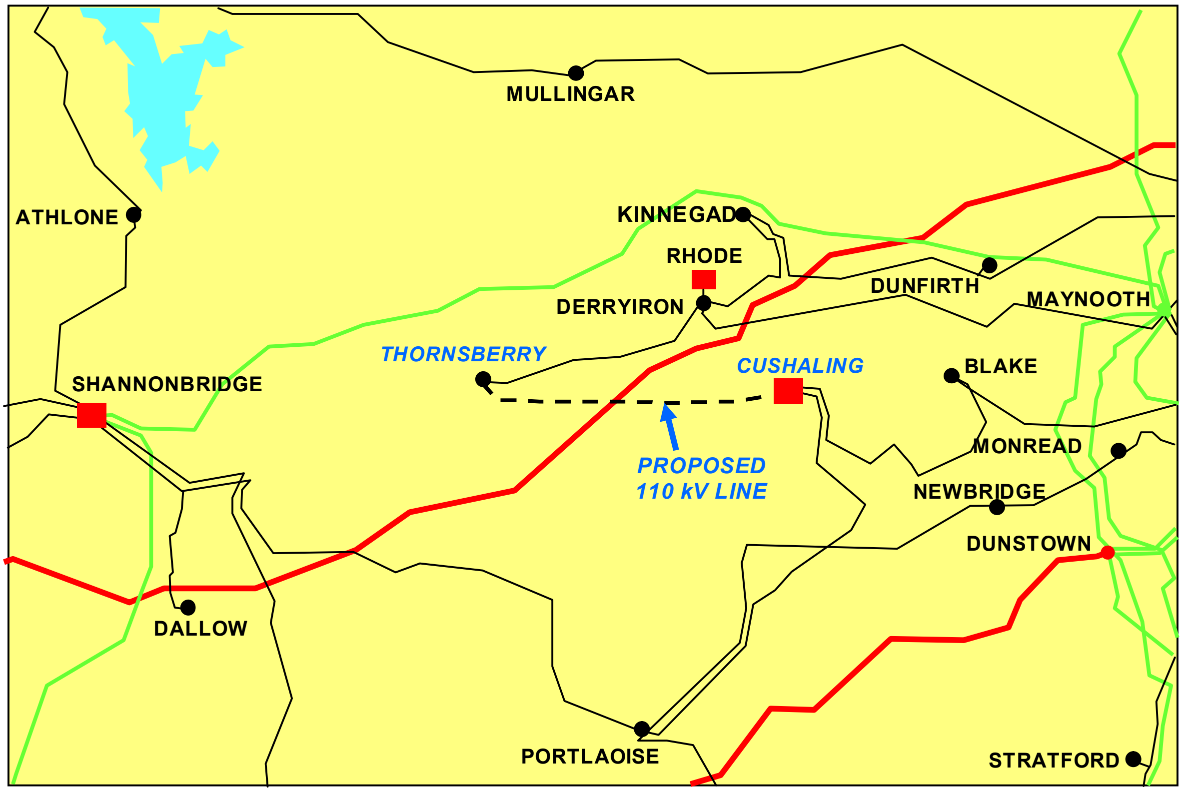


Figure C-2 Proposed Cushaling-Thornsberry 110 kV line

C.2.2 Reason for Development

The Distribution System Operator (DSO) requested and accepted an offer from ESB National Grid to provide a 2nd connection to the existing Thornsberry 110kV station. This will be achieved by constructing a new Cushaling-Thornsberry 110kV line. The need for this expenditure is driven by the DSO.

C.3 DALTON-GALWAY LOOP INTO CASHLA STATION (CP254)

C.3.1 Description

There are three 110 kV circuits between Cashla and Galway 110 kV stations. It is planned to loop the Dalton-Galway 110 kV line into Cashla station, thus providing a fourth 110 kV connection between Cashla and Galway. Dalton station will then be fed from Cashla instead of Galway. This project is due for completion in 2009.

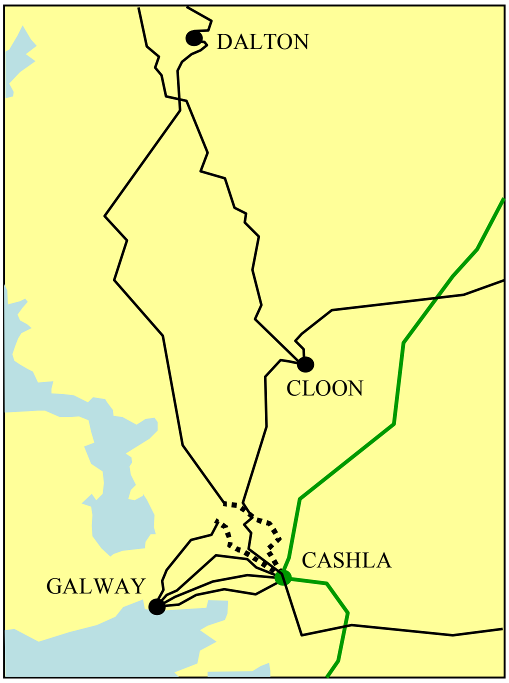


Figure C-3 – Illustration of Dalton-Galway loop into Cashla station

C.3.2 Reason for Dalton-Galway loop into Cashla

There are three 110 kV lines between Cashla 220 kV station and Galway 110 kV station. These 110 kV lines transfer power not only to Galway city and its surrounding area, but they also supply a significant proportion of power into Co. Mayo.

From summer 2004, the Transmission Planning Criteria are violated under maintenance/trip conditions of the transmission network in the North West. Loss of one of the existing three Cashla–Galway 110 kV lines, during an outage at summer peak for maintenance of another, leads to overloading of the remaining Cashla-Galway 110 kV line.

This will seriously decrease the standard of supply to all customers in the Galway area. Reinforcement is therefore required to reduce the risk of potential overloads.

The looping of Dalton – Galway into Cashla station provides for the long term needs of the transmission network in the area. It will separate the existing power transferred into Co. Mayo (via Dalton 110kV station) from Galway onto a direct feed from Cashla 220kV station. As a consequence, the load carried on Cashla-Galway 110kV lines will be reduced extending the life expectancy of this reinforcement.

C.4 GORMAN-MEATH HILL 110 KV LINE (CP 292)

C.4.1 Description

This project involves construction of a 110 kV line from Meath Hill station to Gorman 220/110 kV station, approximately 30 km in length. The project is due for completion in 2009.

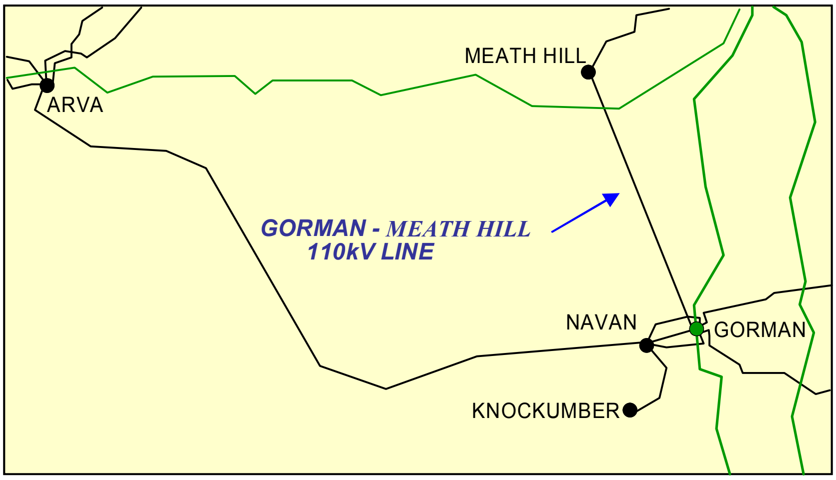


Figure C-4 Proposed Gorman–Meath Hill 110kV line

C.4.2 Reason for Development

The Distribution System Operator (DSO) requested and accepted an offer from the TSO to provide a 2nd connection to the existing Meath Hill 110kV station. This will be achieved by constructing a new Gorman-Meath Hill 110kV line. The need for this expenditure is driven by the DSO.

C.5 SRANANAGH 220 KV PROJECT (CP211)

C.5.1 Description

This project involves construction of a new Sranangh 220 kV station, east of Sligo town, connected to the 220 kV network by 55 km of overhead line from Flagford, near Carrick-on-Shannon, thus extending the 220 kV network into the north-west. A number of 110 kV lines connected into the new station, makes Sranangh a new hub for power flows into the north-west. This project is due for completion in 2008.

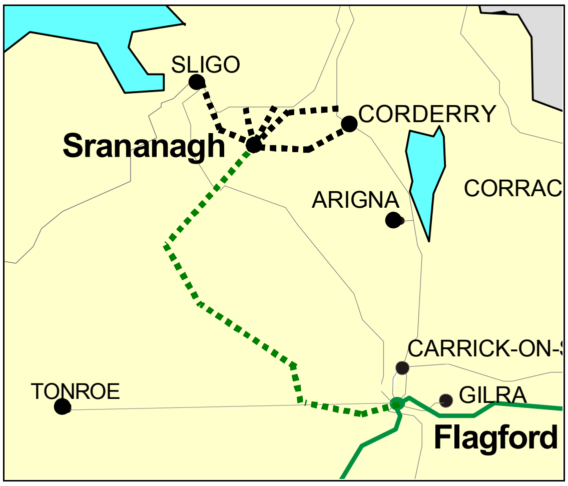


Figure C-5 New Sranangh 220 kV station and 220/110 kV lines

C.5.2 Reason for Development

From summer 2006, the Transmission Planning Criteria are violated under maintenance/trip conditions. Loss of any one of a number of 110 kV lines during an outage for maintenance of another leads to network overloads and/or voltage collapse in the North West.

The Flagford Sranangh 220 kV project is a major development which provides for the long term transmission needs in the area and provides a platform for future network development within the North West area. It also provides the network flexibility to accommodate developments envisaged by the National Development Plan and National Spatial Strategy.

C.6 TARBERT–TRALEE NO. 2 110 KV DEVELOPMENT (CP 246)

C.6.1 Description

A second line, approximately 47 km in length, from Tarbert to Tralee in County Kerry constructed to overcome line overloads and voltage collapse in the Tralee area. Based on current progress, the expected completion date has been revised to 2010.

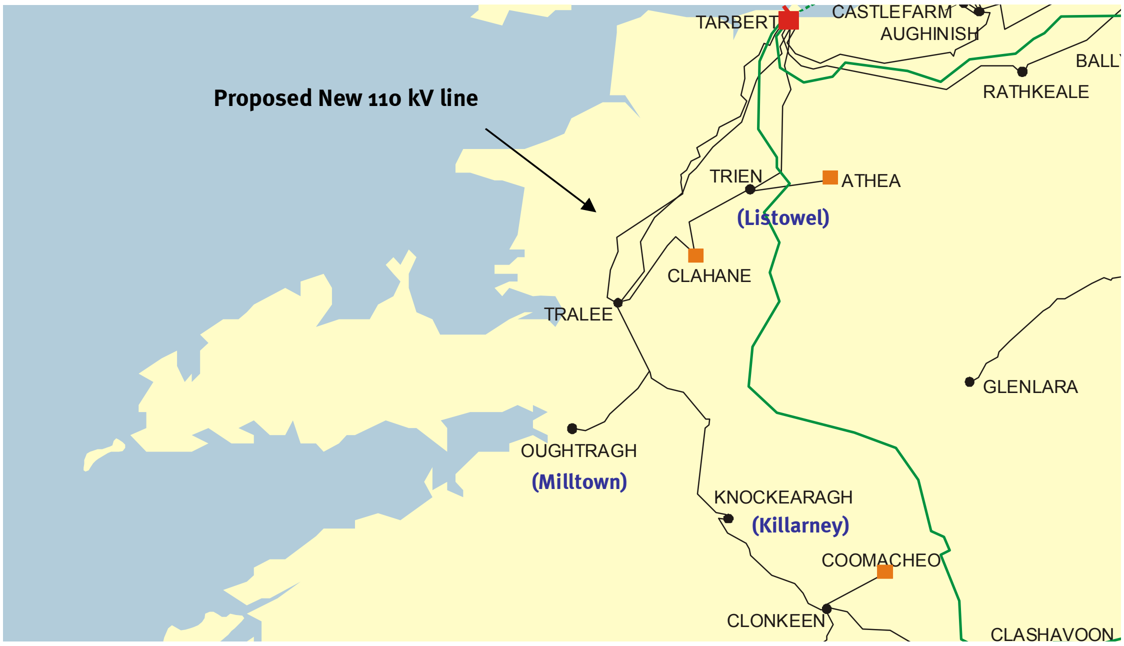


Figure C-6 Proposed new Tarbert-Tralee No.2 110 kV line

C.6.2 Reason for Development

There are three 110kV lines supplying Listowel, Tralee, Milltown and Killarney. When one of these three lines is switched out (for maintenance or new works or third party work), a fault tripping of a second line at peak demand times, would result in immediate loss of supply to the area, or cause severe overloads or localised voltage collapse, again resulting in the disconnection of load in the area.

Consequently, there is a risk of seriously decreased standard of supply to all customers, including potential damage to customer equipment.

The Tarbert-Tralee No.2 110 kV line meets the needs identified and is consistent with the long-term strategy for development of the transmission system in the south-west. In addition this development is one of a number identified that will increase transmission capacity for generation export capability in County Kerry.

APPENDIX D DETAILS OF MAJOR DEVELOPMENT PROJECTS IN THE PUBLIC PLANNING PROCESS

Details are provided in this appendix for the following major development projects:

D.1 Aghada-Raffeen 220 kV Circuit

D.2 Arva-Shankill No. 2 110 kV line

D.3 Lodgewood 220 kV station

Each project is shown on a map of the relevant part of the network. The proposed lines are for illustration purposes only and are not meant to indicate actual routes.

D.1 AGHADA–RAFFEEN 220 KV CIRCUIT (CP 184)

D.1.1 Description

The project involves construction of a new 220 kV circuit from Aghada generation station to Raffeen transmission station, consisting of 3.5 km of underground cable, 3.2 km of submarine cable and 7.9 km of overhead line. The overhead line line portion of the project has been completed in 2006. The remaining work of the project is due for completion in 2009.

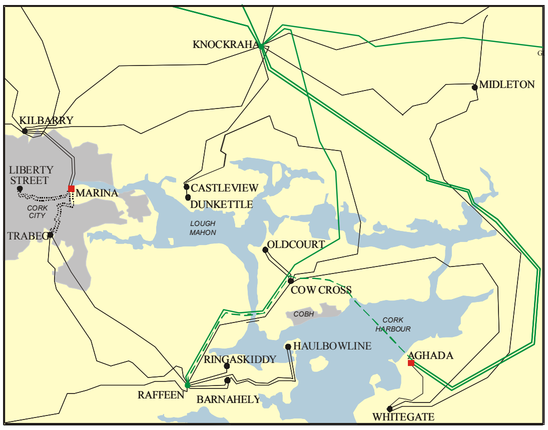


Figure D-1 Cork Area showing the Aghada–Raffeen 220 kV Circuit

D.1.2 Reason for Development

Most recent studies show that from 2009 onwards, a maintenance-trip combination of the Knockraha-Raffeen 220 kV circuit and one of a number of 110 kV circuits will overload the remaining 110 kV network in Cork City.

The Aghada-Raffeen 220 kV circuit is a robust solution which provides for the long-term development needs of the Cork city and harbour area which is a possible location for IDA development. In addition it improves security of supply from Aghada generation station, allows maintenance of transmission plant in the Cork area, and reduces the impact of any possible closure of Marina.

D.2 ARVA-SHANKILL NO. 2 110 KV LINE (CP 374)

D.2.1 Description

This project involves construction of a second Arva-Shankill 110kV line, approximately 20 km in length. The project has been submitted for Planning Approval and subject to favourable outcome from this process it is expected to be completed in 2009.

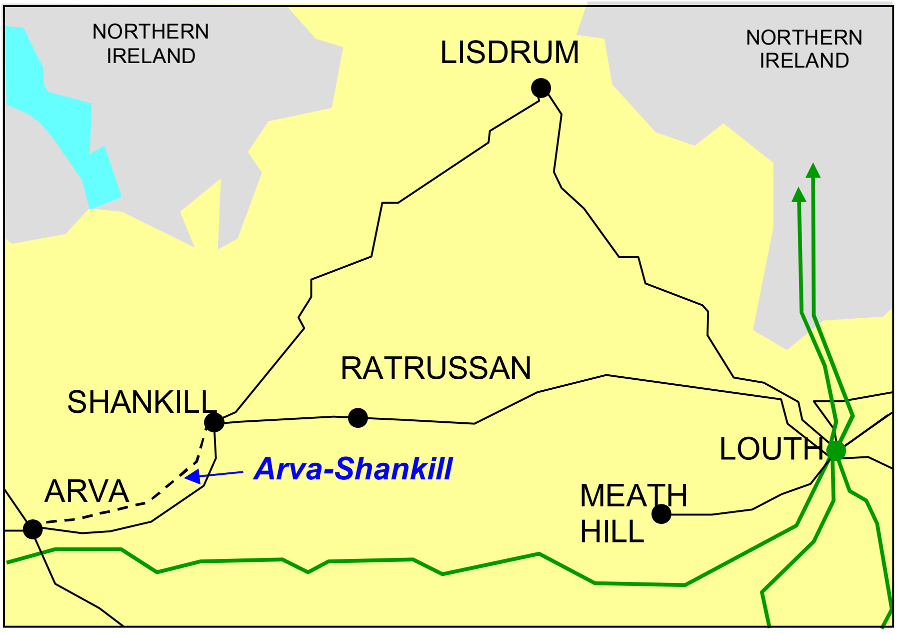


Figure D-2 Proposed Arva-Shankill No.2 110kV line

D.2.2 Reason for Development

At present, there are three 110 kV lines feeding the combined load of Lisdrum (Monaghan) and Shankill (Cavan) 110 kV stations. Studies indicate that the loss of one of the existing three 110 kV lines, during an outage at summer peak for maintenance of another, leads to overloading of the remaining 110 kV line feeding the combined Lisdrum (Monaghan) and Shankill (Cavan) stations loads. The new line will provide a fourth 110 kV line into the Shankill/Lisdrum area thus securing supplies to the area.

D.3 LODGEWOOD 220 KV STATION (CP 241)

D.3.1 Description

This project comprises of a new 220/110 kV station at Lodgewood east of Ferns town in Co. Wexford, into which the Arklow-Great Island 220 kV line will be looped. The new station will be linked to Crane 110 kV station by a new 110 kV line, approximately 10 km in length.

The project has been submitted for Planning Approval, and is expected to be completed in 2009.

Figure D-3 Proposed Lodgewood 220 kV Station

D.3.2 Reason for Development

This development is required to maintain system voltages within standards, to avoid overloads on the 110 kV lines in Wexford and to avoid the loss of the combined load fed by Wexford, Crane and Banoge stations following a maintenance-trip contingency of Great Island-Wexford and Arklow-Banoge 110 kV lines.

In addition, the DSO's Ballycadden 110 kV station will be connected to the new Lodgewood station this facilitating the connection of the Ballycadden and Knockalour wind farms at Ballycadden 110 kV station.

APPENDIX E REGULATION 8(6)

8 (6) (a) Within such time that the Commission may direct, the transmission system operator shall prepare a plan (in these Regulations referred to as the "development plan") for the development of the transmission system in order to guarantee security of supply, which shall relate to a period of 5 calendar years from the date on which the plan is prepared by the transmission system operator.

(b) The transmission system operator shall, at least once each year, revise the development plan, and the revised plan, which shall relate to a period of 5 calendar years following the date on which the plan is revised, shall be submitted to the Commission for approval.

(c) The development plan shall take account of-

(i) existing and planned generation, transmission, distribution and supply,

(ii) forecast statements prepared under section 38 of the Act of 1999,

(iii) interconnections with other systems, and

(iv) national and regional Government development objectives.

(d) The development plan shall indicate the manner in which the transmission system operator shall discharge its functions under paragraph 1.

(e) The development plan shall be submitted to the Commission for approval.

(f) The transmission system operator shall-

(i) engage in a public consultation process, including any other form of consultation that the Commission may direct, before submitting the development plan to the Commission for approval, and

(ii) report in writing to the Commission on the results of that process not later than when submitting the development plan to the Commission for approval.

(g) The Commission may from time to time give directions to the transmission system operator in respect of -

(i) the matters to be specified in the development plan, and

(ii) the review and revision by the transmission system operator from time to time of the development plan,

and the transmission system operator shall comply with directions given by the Commission under this subparagraph.

APPENDIX F GLOSSARY

Aluminium Conductor Steel Reinforced (ACRS)	A conductor consisting of aluminium wires wound around a steel core.
Bay	A bay in a connection point to a busbar, and comprises switchgear and measurement equipment.
Busbar	An electrical conductor located in a station that makes a common connection between several circuits.
Capacitor	An item of plant normally utilised on the electrical network to supply reactive power to loads (generally locally) and thereby supporting the local area voltage.
Circuit	A line or cable, including associated switchgear, which carries electrical power.
Circuit Breaker	A device used to open a circuit that may be carrying electrical current.
Combined Cycle Gas Turbine	A collection of gas turbines and steam units; waste heat from the gas turbines(s) is passed through a heat recovery boiler to generate steam for the steam turbines.
Contingency	An unexpected failure or outage of a system component, such as a generation unit, transmission line, transformer or other electrical element. A contingency may also include multiple components, which are related by situations leading to simultaneous component outages. The terms "contingency" and "loss" are used interchangeably in this Development Plan.
Current Transformer	Current transformers are commonly used in protection systems to facilitate the measurement of large currents which would be difficult to measure more directly.
Deep Reinforcement	Refers to network reinforcement additional to the shallow connection that is required to allow a new generator or demand to operate at maximum capacity.

Demand	The peak demand figures in Table 2-1 in Chapter 2 refer to the power that must be transported from grid connected generation stations to meet all customers' electricity requirements. These figures include transmission losses.
Demand-Side Management	The modification of normal demand patterns usually through the use of financial incentives.
Dropper	Refers to a short piece of conductor used to connect an overhead line to a line bay.
EirGrid	As part of the EU's electricity liberalisation programme an independent electricity Transmission System Operator must be set up for each EU member state.
Embedded Generation	Refers to generation that is connected to the distribution system or at a customer's site.
Gas Insulated Switchgear	A compact form of switchgear where the conductors and circuit breakers are insulated by an inert gas.
Generation Dispatch	The configuration of outputs from the connected generation units.
Grid	A meshed network of high voltage lines and cables (400 kV, 220 kV and 110 kV) for the transmission of bulk electricity supplies around Ireland. The grid, electricity transmission network, and transmission system are used interchangeably in this Development Plan.
Interconnector	The tie line, facilities and equipment that connect the transmission system of one independently supplied transmission network to that of another.
Maximum Export Capacity	The maximum export value (MW) provided in accordance with the generator's connection agreement. The MECs are contract values which the generator chooses to cater for peaking under certain conditions that are not normally achievable or sustainable e.g., a CCGT plant can produce greater output at lower temperatures.
Plan Period	The five-year period covered by this Development Plan i.e., 2007 to 2011 inclusive.

Power Flow	The flow of 'active' power is measured in MegaWatts (MW). When compounded with the flow of 'reactive power', which is measures in MegaVars (Mvar); the resultant is measured in MegaVolt-Amperes (MVA)
Phase Shifting Transformer	An item of plant employed on the electrical network to control the flow of active power.
Reactive Compensation	The process of supplying reactive power to the network.
Reactive Power	Reactive power is that portion of electricity that establishes and sustains the electric and magnetic fields of alternating current equipment. It is utilised to control voltage on the transmission network.
Reactor	An item of plant employed on the electrical network to either limit short circuit levels or prevent voltage rise depending on its installation and configuration.
Supervisory Control and Data Acquisition systems	Used to monitor and control system equipment from the relevant control centre.
Shallow Connection	Shallow Connection means the local connection assets required to connect a customer to the transmission system and which are for the specific benefit of that particular customer.
Split Busbar	Refers to a busbar at a given station which is operated electrically separated. Busbars are normally split to limit short circuit levels or to maintain system reliability.
Static Var Compensator	Device which provides fast and continuous capacitive and inductive reactive power supply to the power system.
Summer Valley	The annual minimum that usually occurs in August. Annual minimum demand is typically 36% lower than the winter peak.
Summer Peak	The average week-day peak value between March and September, inclusive, which is typically 20% lower than the winter peak.
Switchgear	A combination of electrical disconnects and/or circuit breakers used to isolate equipment in or near an electrical station.

Tailed connection	A radial (single-circuit) connection into an existing station.
Tee connection	An un-switched connection into an existing line between two other stations.
Transformer	An item of equipment connecting equipment at two different nominal voltages.
Transmission Interface Station	A station that is a point of connection between the transmission system and the distribution system or directly connected customers.
Transmission Losses	A small proportion of energy is lost as heat whilst transporting electricity on the transmission system. These losses are known as transmission losses. As the amount of energy transmitted increases, losses also increase.
Transmission Peak	The peak demand that is transported on the grid. The transmission peak includes an estimate of transmission losses.
Transmission Planning Criteria	The set of standards that the transmission system is designed to meet. The criteria are deterministic as is the norm throughout the world. They set out objective standards which have been found to deliver an acceptable compromise between the cost of development and the transmission service provided.
Uprating	To increase the rating of a circuit. This is achieved by increasing ground clearances and/or replacing conductor, together with any changes to terminal equipment and support structures.
Voltage Transformer	Voltage transformers are commonly used in protection systems to facilitate the measurement of large voltages which would be difficult to measure more directly
Winter Peak	This is the maximum annual system demand. It occurs in the period October to February of the following year, inclusive. Thus for transmission planning purposes the winter peak in 2011, the final year of this plan, may occur in early 2012. The winter peak figures take account of the impact of projected Demand Side Management initiatives.

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