

7 NETWORK CAPABILITY FOR NEW GENERATION

This chapter describes the results of the Incremental Transfer Capability (ITC) analysis, described in Chapter 6 and in Appendix G in more detail. The analysis was carried out to determine the capability of the grid to accommodate changes in generation. Using these results it discusses the expected “opportunity” for generation development at various parts of the network.

“Opportunity” relates to the capacity available for greater use of the grid without the need for reinforcements beyond those already planned. The purpose of these studies is to indicate the level of generation opportunity that exists at a comprehensive range of locations across the grid. The results of the studies indicate where deep⁹ reinforcements might be required in order to facilitate connection of generation of a particular size at a particular location. Appendix F provides additional information about the likely scale of developments that might be required.

Where grid capability is shown as limited, this means that additional deep reinforcements will be necessary to facilitate the connection of new generation. It should not be interpreted as meaning that new generation may not be connected. The Transmission System Operator (TSO) will initiate such reinforcement projects as necessary once a generator has signed a connection agreement. However, it should be noted that a connection that requires long lead-time deep reinforcements may have implications for the generator developer. Depending on access policy, the generator’s ability to connect or to export all its power may be limited until such time as those reinforcements are completed. It would be helpful therefore to generator developers and the TSO if the developers were to consult the TSO early in their development process to explore options relating to their proposal thus enabling timely decision making.

7.1 ITC RESULTS FOR LARGE GENERATION AT SELECTED 220 KV AND 400 KV STATIONS

This section presents the capacity for bulk power transfers on the transmission system from new generation connecting at selected 220 kV and 400 kV stations.

There are twenty-five 220/110 kV stations and four 400/220 kV stations on the system. Fourteen 220 kV stations (comprising almost all 220 kV stations outside Dublin and a representative number in Dublin) and one 400 kV station have been selected to illustrate the capability of the grid to accommodate new power transfers between different areas resulting from the connection of new generation. Figure 7-1 illustrates the locations of the stations selected. The fourteen 220 kV stations are Louth and Gorman in the north-east,

⁹ Network reinforcement, in addition to the shallow connection, that allows connecting generators to export their full capacity.

Maynooth, Finglas and Carrickmines in Dublin¹⁰, Arklow, Great Island and Cullenagh in the south-east, Knockraha, Killonan and Tarbert in the south-west, Flagford and Cashla in the west and Shannonbridge in the midlands. Dunstow is the 400 kV station for which ITC analysis was carried out. Dunstow was selected for analysis as it lies close to Bord Gáis pipelines used for the bulk transmission of natural gas.



Figure 7-1 220 kV and 400 kV Stations Studied for Generation Capability

The ITC results for generation at 220 kV and 400 kV stations are presented in Tables 7-1, 7-2 and 7-3, for the years 2008, 2010 and 2013 respectively. The levels of available ITC are classified as:

- Very high — more than 400 MW;
- High — between 250 and 400 MW;
- Medium — between 100 and 250 MW;
- Low — less than 100 MW.

The superscripts in Tables 7-1 to 7-3 provide a cross reference between the low ITCs and the tables in Appendix F that provide additional information regarding the constraints limiting the ITCs and the likely scale of development required to increase the ITCs. Superscripts prefixed with a “P” indicate that the TSO has initiated specific projects which will overcome the constraint; a “C” indicates that plans are being progressed to deal with the constraint;

¹⁰ While Maynooth is in Co. Kildare, it forms an integral part of the grid supplying the load in Dublin.

an “F” means that further investigation is required before a solution is selected. The numerical suffixes serve to uniquely identify the constraints for reference purposes.

As described in Section 6.1 in Chapter 6, results for transfers to the “South” are drawn from the results of four different scenarios of generation reduction in the south. The results of these four different scenarios have been merged in Tables 7-1 to 7-3 for simplicity.

Table 7-1 Incremental Transfer Capability for Generation at 220 kV and 400 kV Stations in 2008

	Station	Transfer To			
		Dublin	Northern Ireland	South	West
Transfer From	Arklow	Very High	Medium	Low ^{F7}	Very High
	Carrickmines	Very High	Low ^{P8}	Low ^{F7}	Very High
	Cashla	Medium	Medium	Low ^{P6}	Medium
	Cullenagh	High	Medium	Medium	High
	Dunstown (400 kV)	Low ^{P8}	Low ^{P8}	Low ^{F7}	Very High
	Finglas	Very High	Low ^{P8}	Low ^{P8}	Very High
	Flagford	High	Medium	Low ^{P6}	Very High
	Gorman	Very High	High	Low ^{P8}	Very High
	Great Island	Very High	Medium	Low ^{F7}	Very High
	Killonan	Low ^{F8}	Low ^{P10}	Low ^{P1}	Low ^{P2}
	Knockraha	Low ^{F8}	Low ^{P10}	Medium	Low ^{P2}
	Louth	Medium	Very High	Low ^{P8}	High
	Maynooth	Very High	Low ^{P8}	Low ^{P8}	Very High
	Shannonbridge	Medium	Medium	Low ^{P8}	Low ^{P10}
	Tarbert	Low ^{F8}	Low ^{P13}	Low ^{F2}	Low ^{P2}

Table 7-2 Incremental Transfer Capability for Generation at 220 kV and 400 kV Stations in 2010

	Station	Transfer To			
		Dublin	Northern Ireland	South	West
Transfer From	Arklow	Very High	Medium	High	High
	Carrickmines	Very High	Medium	Low ^{F5}	Very High
	Cashla	Very High	High	High	Medium
	Cullenagh	Medium	Low ^{P1}	Medium	Medium
	Dunstown (400 kV)	Very High	High	Low ^{P8}	Very High
	Finglas	Very High	Very High	Low ^{P8}	Very High
	Flagford	High	Medium	Very High	Very High
	Gorman	Very High	Very High	Very High	Very High
	Great Island	Very High	Low ^{P1}	Very High	Very High
	Killonan	Low ^{F7}	Low ^{P1}	Low ^{F9}	Low ^{P1}
	Knockraha	Low ^{F7}	Low ^{F9}	Low ^{F7}	Low ^{F9}
	Louth	Very High	Very High	Very High	Very High
	Maynooth	Very High	Very High	Low ^{P8}	Very High
	Shannonbridge	Medium	Low ^{P1}	High	Low ^{P1}
	Tarbert	Low ^{F9}	Low ^{P1}	Low ^{F9}	Low ^{P1}

Table 7-3 Incremental Transfer Capability for Generation at 220 kV and 400 kV Stations in 2013

	Station	Transfer To			
		Dublin	Northern Ireland	South	West
Transfer From	Arklow	Very High	High	High	Very High
	Carrickmines	Very High	Low ^{F6}	Low ^{F5}	High
	Cashla	Very High	Very High	High	High
	Cullenagh	Medium	Medium	Medium	High
	Dunstown (400 kV)	Very High	Low ^{F6}	Low ^{F9}	Very High
	Finglas	Very High	Low ^{F6}	Low ^{F9}	Medium
	Flagford	Very High	Very High	Very High	Very High
	Gorman	Very High	Very High	Very High	Very High
	Great Island	High	High	High	High
	Killonan	Low ^{F7}	Low ^{F9}	Low ^{F7}	Low ^{F7}
	Knockraha	Low ^{F7}	Low ^{F9}	Low ^{F9}	Low ^{F9}
	Louth	Very High	Very High	Very High	Medium
	Maynooth	Very High	Low ^{F6}	Low ^{F5}	Very High
	Shannonbridge	High	High	Very High	Low ^{F1}
	Tarbert	Low ^{F7}	Low ^{P10}	Low ^{F7}	Low ^{F7}

This Transmission Forecast Statement (TFS) includes reinforcements that have been selected and initiated as projects as at the end of December 2006, when data was frozen in order to permit TFS analyses to be carried out. In reality, additional developments are expected to be identified and, if implemented, are likely to further improve the incremental transfer capabilities in 2013. Indeed a number of additional developments have already been initiated as projects since the data freeze, the details of which are presented in Section 1.4 and the implications of which in terms of generation opportunity are discussed in Section 7.4.

7.2 ITC RESULTS FOR SMALLER GENERATION AT SELECTED 110 KV STATIONS

Thirty-six 110 kV stations were examined in the analysis of the grid's capability to accommodate smaller generators. This compares with 35 stations analysed in *Transmission Forecast Statement 2006-2012*. The 36 stations were chosen on the basis of feedback from interested developers. Figure 7-2 shows how these stations are widely dispersed and therefore representative of the entire country.

This section looks at the ability of selected 110 kV stations to accept generation. This information is useful in identifying opportunities for the connection of smaller generation stations, typically up to 100 MW in size. Generators larger than this would normally be connected at 220 kV or 400 kV.

The results of the studies are presented in Table 7-4. Stations are grouped in the table by electrical area. As in the case with the 220 kV and 400 kV results, the capability for each station is tested individually and hence the results are not cumulative. Opportunities

shown are relevant for generators connecting directly at the stations tested but can also provide an indication of opportunity at stations in the vicinity of those tested.



Figure 7-2 110 kV Stations Studied for Generation Capability

The superscripts in Table 7-4 provide a cross reference between the low ITCs and the tables in Appendix F that provide additional information regarding the plans to address the constraints or the likely scale of development required to increase the ITCs.

Table 7-4 Capability for New Generation at 110 kV Stations, MW

Region	Station	2008	2010	2013
North-east	Drybridge	<10 ^{P8}	<10 ^{P1}	240
	Dundalk	<10 ^{P8}	<10 ^{P1}	110
	Meath Hill	<10 ^{P8}	<10 ^{P1}	100
	Ratrussan	<10 ^{P8}	10	10
North-west	Bellacorick	<10 ^{P6}	80	80
	Carrick-on-Shannon	<10 ^{P6}	140	140
	Castlebar	<10 ^{P6}	140	220
	Cathaleen's Fall	<10 ^{P6}	10	20
	Corderry	<10 ^{P6}	90	90
	Letterkenny	<10 ^{P5}	<10 ^{P5}	10
	Sligo	<10 ^{P6}	170	170
Midlands	Athlone	<10 ^{P6}	100	100
	Cushaling	20	110	110
	Lanesboro	<10 ^{P6}	170	160
	Shannonbridge	150	<10 ^{P1}	120
	Thurles	120	<10 ^{P1}	130
	Tipperary	70	<10 ^{P1}	120
West	Agannygal	<10 ^{P10}	20	40
	Ennis	60	<10 ^{P1}	40
	Galway	<10 ^{P6}	140	210
South-east	Carlow	<10 ^{P8}	<10 ^{P1}	140
	Crane	10	40	110
	Doon	30	<10 ^{P1}	130
	Dungarvan	120	<10 ^{P1}	120
	Kilkenny	<10 ^{P8}	<10 ^{P1}	140
	Waterford	90	<10 ^{P1}	150
South-west	Charleville	<10 ^{F8}	<10 ^{F7}	<10 ^{F7}
	Clonkeen	<10 ^{F8}	<10 ^{F7}	<10 ^{F7}
	Cow Cross	<10 ^{F8}	<10 ^{F7}	<10 ^{F7}
	Dunmanway	<10 ^{F8}	<10 ^{F7}	<10 ^{F7}
	Macroom	<10 ^{F8}	<10 ^{F7}	<10 ^{F7}
	Mallow	<10 ^{F8}	<10 ^{F7}	<10 ^{F7}
	Marina	<10 ^{F8}	<10 ^{F7}	<10 ^{F7}
	Rathkeale	<10 ^{F8}	<10 ^{F7}	<10 ^{F7}
	Tralee	<10 ^{F8}	<10 ^{F7}	<10 ^{F7}
	Trien	<10 ^{F8}	<10 ^{F7}	<10 ^{F7}

7.3 OPPORTUNITY FOR NEW GENERATION

Opportunity is largely dependent on the size and location of the connecting generation plant. The connection of a large 400 MW generation station (the approximate size of some recent connection applications) has a much greater impact on power flows than smaller units or typical demand increases. 400 MW represents about 8% of the peak demand to date. The connection of such a large generator is likely to dramatically alter power flows, and in most cases stress the network beyond its present capacity, requiring significant reinforcements to the grid.

The results of the transfer studies indicate that, from 2010 onwards, there are a number of locations on the grid at which a large 400 MW generator could be accommodated without the need for network reinforcements. Opportunities also exist at several locations across the country for smaller units to connect without the need for further reinforcements.

The opportunities described here are derived from the results of the transfer studies described in the previous section. For a given size of generator it is likely that connection in an area of higher opportunity will incur less reinforcement than connection of a similar generator in an area of a lower opportunity.

7.3.1 Opportunities for Large Generators Connected at 220 kV and 400 KV

The results from the 220 kV and 400 kV transfer studies show that spare capacity for the connection of a new large generator exists at a number of locations on the grid. Gorman 220 kV station can accommodate a generator capable of producing at least 400 MW in both 2010 and 2013. The capacity at Gorman is limited in 2008 but TSO plans for network development serve to improve the outlook there beyond 2008. Louth 220 kV station can accommodate a 400 MW generator in 2010 but the results indicate that by 2013 network reinforcement will be required in order to accommodate this level of generation at Louth. Flagford 220 kV station is capable of accommodating a new large generator in 2013.

Connection of a large generator at any of the other locations analysed is likely to require deep reinforcement of the transmission network to allow it full grid access. Aside from the stations at which 400 MW of generation can be accommodated, the next best opportunities currently exist in the west, north-west, north-east and south-east. The 2013 ITCs indicate that between 250 MW and 400 MW of generation can be accommodated at Arklow, Cashla and Great Island and that between 100 MW and 250 MW of generation can be accommodated at Cullenagh and Louth. Of these, Arklow, Cashla and, as mentioned, Louth are the only locations capable of accommodating more than 100 MW of generation in 2010.

The most significant limit impacting on opportunity is the constraint on power transfers between Dublin and the south-west and vice versa. The greater Dublin area, Cork and the Shannon estuary represent three areas of the transmission system where there are large

concentrations of existing and planned dispatchable generation and large concentrations of demand. In addition, there is a large amount of existing and planned wind generation in the south-west. As such, there is a great deal of scope for the transfer of large amounts of power between Dublin and the south-west with the existing generation that is in place and with generation that is planned to connect over the coming years. The consequence of this is that power flows on circuits transporting power into and out of the south-west could potentially overload under certain dispatch and contingency scenarios. The deep reinforcements currently being considered for the Aghada and WhiteGen combined cycle gas turbines, which recently signed connection agreements, should relieve constraints in the south-west when commissioned.

The results from the analyses show incremental power transfers between Dublin and Northern Ireland to be limited in 2013. Situations where a low level of generation is dispatched in Northern Ireland give rise to quite large cross-border flows, with incremental cross-border power transfers leading to potential overloads on circuits between Dublin and Louth.

7.3.2 Impact of Short Circuit Levels on Opportunity for Large Generators

The impact of new generation on short circuit levels was examined as part of the analysis to determine opportunity for new generation. As high short circuit levels constitute a safety issue it is important that problems are addressed before the connection of the new generator.

The study modelled the connection of a new 400 MW generator at each of the selected 220 kV stations in turn, as well as at Dunstown 400 kV station. The fault currents were calculated at all buses in each case for winter peak 2008, 2010 and 2013. Analysis was carried out for the winter peak as the results should indicate the maximum short circuit currents on the system.

The results indicate that adding 400 MW of generation at any of the stations has some impact on the already high fault levels at Tarbert, Louth and stations in the Cork and Dublin regions, with generation connecting close to these stations having the greater impact. If a new generator wished to locate in any of these areas, more detailed studies of circuit breaker duty would be necessary, to determine whether remedial action is required.

As stated in Section 4.2 of Chapter 4, ESB plans to close/divest the Great Island, Poolbeg and Tarbert generation stations and decommission the steam unit at Marina. If ESB decides to close Great Island and Tarbert then short circuit levels at Great Island and Tarbert will reduce. Similarly if ESB opts to close the Poolbeg generation station then short circuit levels in the Dublin area would reduce. The decommissioning of the Marina steam unit will marginally reduce short circuit levels in the Cork area.

7.3.3 Opportunities for Smaller Generators Connected at 110 kV

Connection of small generation stations, with a capacity of the order of 100 MW or less, would usually be at 110 kV. Table 7-4 summarises the results of studies to determine the capacity of new generation that can be connected at selected 110 kV stations. The patterns of results across the three years are broadly similar to those that emerged during the 220 kV analyses, with the same system constraints impacting on generation in similar areas.

The results for 2010 and 2013 are presented graphically in Figure 7-3. The results for 2010 show a considerable improvement in the capability of stations in the north-west to accommodate new generation as compared against the 2008 results. The improved results for 2010 indicate the benefit of the network development programme, in particular the benefit of the Moneypoint-Tarbert 400 kV cable. The graphics indicate that in 2010 there is spare capacity for connecting additional generation at a variety of stations across the west, north midlands and north-west, as well as at Crane.

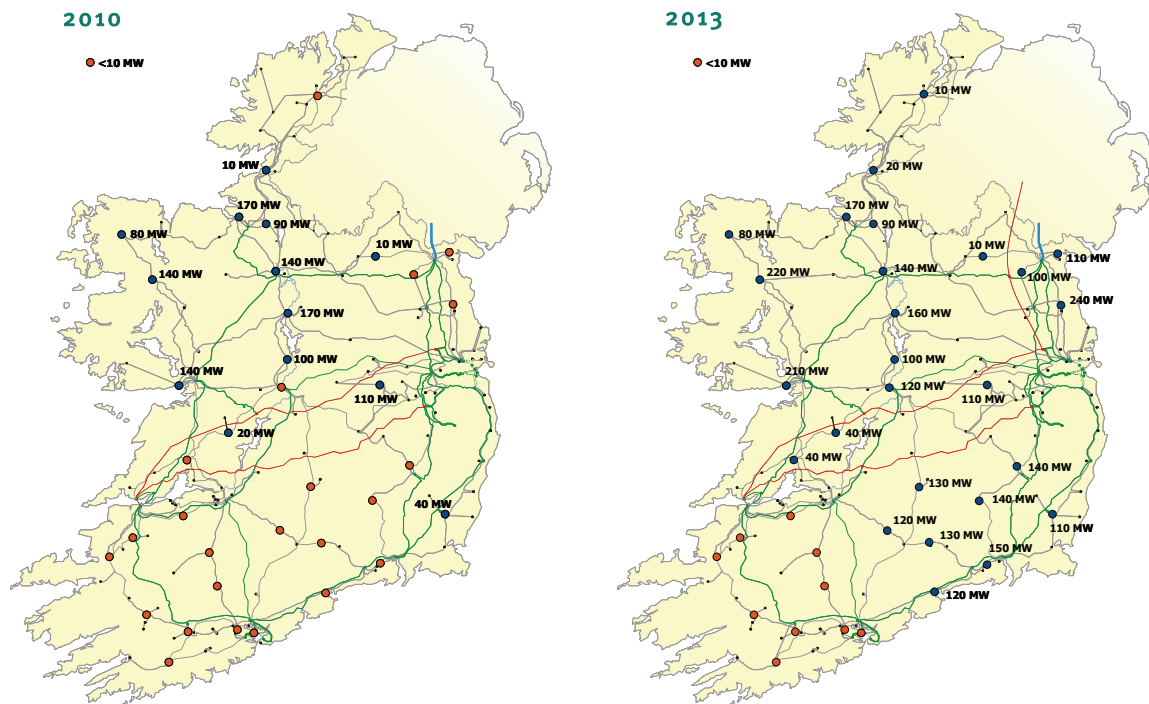


Figure 7-3 Capability for New Generation at 110 kV Stations in 2010 and 2013

The outlook for generation opportunity further improves in 2013. The network development programme relieves a number of constraints, leading to marked improvements in the capability of the transmission system to accommodate new generation in the south-east, midlands and north-east. Network development projects that have a significant impact on opportunity include the second Athlone-Shannonbridge 110 kV line, due for completion

towards the end of 2010, and the planned 400 kV station near Nenagh, Co. Tipperary, which is due for completion in 2011.

It must be stressed that the opportunities presented are not cumulative. If new generators sign agreements for connection in an area that is shown to have opportunity e.g., the north-west, they will use up some or perhaps all of the available capacity in that area.

7.4 IMPACT OF CHANGES SINCE THE DATA FREEZE

As outlined in Section 1.4, a number of changes in projections have occurred since the data freeze at the end of December 2006.

One significant development is the uprating of the Cashla-Cloon 110 kV line. This project should have a relatively short lead-time and is likely to improve opportunities for the connection of generation at Cashla 220 kV station and Galway 110 kV station.

The planned closure/divestiture of the Great Island and Poolbeg generation stations and decommissioning of the steam unit at Marina could have a significant impact on generator opportunity. Initial indications suggest that there may be significant opportunity for the connection of new generation at Great Island if ESB opted to close the existing plant there.

Increases in the Maximum Export Capacity (MEC) of the existing Huntstown 2 generator and planned Mountain Lodge wind farm at Ratrussan 110 kV station are not expected to have a significant impact on the ability of the transmission system to accommodate new generation.

7.5 POTENTIAL IMPACT OF “GATE 2” WIND GENERATION

Figure 4-2 and Table 4-4 in Chapter 4 show that there is relatively little wind generation being processed under the CER’s “Gate 2” direction in the north-east of the country. As such, “Gate 2” wind generation is unlikely to have a material impact on the ability of Gorman 220 kV station to accommodate a generator capable of producing more than 400 MW or to have a significant impact on generation opportunity at the Drybridge, Dundalk and Meath Hill 110 kV stations. Depending on the uptake of connection offers, “Gate 2” wind generation may impact negatively on generation opportunity in other parts of the country to accommodate additional generation.

7.6 HOW TO USE THE INFORMATION FOR GENERATION

Although not every station was considered, the results presented can be regarded as a guide to opportunities at other stations in the same area. Those considering development of generation in the Republic of Ireland should consult the maps in Appendix A to find the nearest station to their proposed development for which opportunity has been assessed. For generation greater than 100 MW the nearest 220 kV or 400 kV station would most likely be appropriate. Smaller generators should consider the 110 kV stations. The opportunity for

generation at the relevant nearest station will provide a reasonable indication of whether the development under consideration is likely to necessitate network reinforcements.

The following example is presented as an illustration of how to use the information provided. Developers considering connecting a 50 MW generator in Carlow in 2010 would see by looking at the map that Carlow station is the nearest 110 kV transmission station tested for generation opportunity. The capability results presented in Table 7-4 show that the opportunity at Carlow is less than 10 MW in 2010 but 140 MW in 2013. This means that if planned network reinforcements are commissioned as expected, generation could expect to be connected in this period without the need for further development.

The results of the analysis described above are dependent on the assumptions made about generation and demand, and on the completion dates of transmission reinforcement projects as described in this statement. In evaluating the results and statements of opportunity, the generation developer should consider these assumptions. In addition they should be aware of any subsequent developments that may change these assumptions and hence the opportunity indicated. For instance, if other new generators sign agreements for connection in an area that is shown to have opportunity they will use up some or all of the available capacity.

It is important to note that a total of 1,316 MW of wind farm connection applications are currently being processed under the CER's "Gate 2" direction. Figure 4-2 and Table 4-4 in Chapter 4 show how this generation is distributed across the country. Up-to-date information on applications and new generation connection agreements is available on www.eirgrid.com under 'Customers/Policy/Connection Offer Process'. Before making any commercial decisions the developers should contact EirGrid for discussions on the proposed development.

There are a number of technical, commercial and timing issues relating to the connection of new generation to the transmission system that are specific to any individual proposal. The TSO will discuss potential generation proposals with developers in the strictest confidence. In addition, the TSO will analyse generation connections on a consultancy basis with the aim of identifying some of these issues before a developer proceeds to a formal request for connection to the transmission system.

A document entitled 'Process for Connection' can be found on www.eirgrid.com under 'Customers/Policy/Connection Offer Process'. This document sets out the method by which a formal offer of connection to the transmission system may be obtained by a generation scheme or demand developer. This TFS is published solely for the purposes of Section 38 of the 1999 Electricity Act and is not intended to have any legal effect in relation to the negotiation of contractual terms for connections to the transmission system.