

**SINGLE ELECTRICITY MARKET**

**TRANSMISSION PLANNING**

**A JOINT EIRGRID, SONI AND NIE PAPER**

**AIP-SEM-07-42**

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## 1 Introduction

Under the current licensing arrangements Northern Ireland Electricity (NIE) is responsible for planning and developing the Northern Ireland (NI) transmission and distribution system and EirGrid is responsible for planning and developing the Republic of Ireland (RoI) transmission system. Regarding interconnectors, construction of new or development of existing interconnectors may be undertaken but there are no specific licence obligations relating to undertaking ‘joint’ or ‘co-ordinated’ transmission planning by the two licensees.

In view of the planned introduction of the Single Electricity Market (SEM) in 2007, it was agreed that there is a need to develop new processes for transmission planning, designed to ensure as far as possible that solutions developed to resolve network problems will be optimised for the island as a whole.

Various aspects of the proposed processes are set out in this paper, a paper which has been developed jointly by EirGrid, NIE and the System Operator Northern Ireland (SONI). It sets out certain roles and responsibilities for the Licensees in the new market –

**EirGrid** The holder of the Transmission System Operator (TSO) licence in the Republic of Ireland. In the SEM it will also be the holder of a Market Operator (MO) Licence.

**NIE** In the SEM NIE will be the holder of the NI combined Transmission & Distribution licence. As such, NIE will have responsibility for planning, developing and maintaining the NI transmission and distribution systems.

**SONI** In the SEM SONI will be the holder of the TSO licence in NI and will also be the holder of an MO Licence.

**ESB** The holder of the Transmission Owner licence in the RoI.

The structure of the paper is as follows –

Section 2 describes an overall process for transmission planning in the SEM, including flowcharts, deliverables and dispute resolution requirements.

Section 3 sets out a proposed governance structure for the new arrangements.

Section 4 lists data items which will require to be exchanged and discusses data ownership, data transfer mechanisms and touches on confidentiality issues.

Section 5 describes the approach to developing background planning assumptions to be used in assessing the networks.

Section 6 discusses jurisdictional planning standards and how these will be applied in the SEM.

The paper has been prepared to inform the drafting of the various licences, codes and inter-company agreements.

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## 2 Transmission Planning Process

### 2.1 Introduction

This section describes a high-level view of the transmission planning process following the introduction of the SEM. It is believed to be consistent with the views of NIAER/DETI and CER on transmission planning responsibilities. Specifically, that NIE will retain primary responsibility for transmission planning in NI and will also be required to participate in the co-ordinated planning and development of both the NI transmission system and the RoI transmission system, in conjunction with EirGrid. In the RoI, EirGrid will retain primary responsibility for transmission planning and will also be required to participate in the co-ordinated planning and development of both the NI transmission system and the RoI transmission system, in conjunction with NIE.

The aim of all-island transmission planning is to plan, develop and maintain both transmission networks to comply with the relevant planning and security standards, taking due account of the needs of users and other stakeholders, and jointly developing optimal solutions to network problems, where appropriate. As part of this overall process, NIE, SONI and EirGrid will accommodate the needs of the SEM, load changes, plant retirements and new connections.

Essentially, it is proposed that there will be a co-ordinated approach to transmission planning in the SEM, which will consist of both joint and separate phases of activity, producing company specific network solutions and, where appropriate, joint network solutions. In this way the least cost overall solutions to network problems will be developed.

It is envisaged that SONI, EirGrid and NIE will have a joint strategic outlook on the future needs of the all-island transmission system, against which specific network solutions will be monitored to identify any potential conflicts or inefficiencies.

Transmission planning within an all-island context will therefore have a number of components:

- **Joint Strategic Outlook.** The Transmission Licensees are expected to have a commonly held view of the longer term requirements of the all-island transmission system to best meet the needs of the SEM participants and end customers. It would be developed from time to time by observation of connection activity, through discussions with the Regulatory Authorities, users and other interested parties, and by consideration of legislative developments and government policies. The design of new connections and the development of the medium term transmission plan will be monitored against this ‘joint strategic outlook’.
- **Development Planning.** Planning in this category is driven by general <sup>1</sup> load-related network developments in each jurisdiction, such as demand growth, generation retirements, generation and demand patterns, as well as network modifications required by the age, condition and performance of system assets.
- **New connections.** Most new connections will continue to be dealt with jurisdictionally. However, for some connection applications a joint assessment will be required in order to ensure an optimal solution. A common methodology is required to deal with this category

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<sup>1</sup> ‘General’ in this context means not specifically related to either new connections or connection modifications.

of new connections to the system, particularly for new generation connections. The methodology will need to ensure that there is agreement and commitment given on the required system developments and that there are no differences in the treatment of each application, apart from legitimate differences endorsed by the Regulatory Authorities, as set out in licences, standards, regulatory decisions and directions, codes and so on.

This section of the paper sets out a high-level view on the process for joint planning on an all-island basis. It focuses on the annual planning cycle and goes on to describe the approach to solving network problems identified during the annual cycle. For completion it includes, but not in any great detail, the construction phase, principally to complete the loop back to the updating of network models to reflect changes on the system.

## 2.2 Transmission Planning in the SEM

It is proposed that the flowcharts in Figures 1(a) to 1(c) illustrate transmission planning in the SEM. The three figures are arranged broadly as follows –

Figure 1(a) – annual planning and testing against planning standards and the annual publication of the various licence documents.

Figure 1(b) – the process of tackling the problems identified, followed by the development and agreement of solutions.

Figure 1(c) – Detailed design, planning permission, construction and commissioning.

Those processes which are carried out annually are shown in solid blue, whereas processes which are carried out as and when required are shown in hatched green.

## 2.3 Key Processes

### Figure 1(a)

#### *Box 1*

Box 1 initiates the annual planning process. It allows the licensees to set the timetable for the work and to refresh their view of the strategic requirements of the all-island transmission system.

#### *Boxes 3 - 5*

NIE provides planning data to SONI, the scope of which would be set out in the Transmission Interface Agreement (TIA) <sup>2</sup>.

EirGrid and SONI exchange planning data, the scope of which would be set out in the System Operator Agreement (SOA). <sup>3</sup>

#### *Box 6*

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<sup>2</sup> This document will set out the arrangements between SONI, the NI system operator and NIE, the NI asset owner.

<sup>3</sup> This document will set out the arrangements between SONI, the NI system operator and EirGrid, the RoI system operator.

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Following agreement on timescales and receipt of data from NIE and Users, SONI and EirGrid would update planning and market models to be used in the planning process. This would involve the collation of users' commercially sensitive information. As a result NIE would not be involved at this stage. SONI and EirGrid will agree background planning assumptions. There is the potential for a failure to agree at this stage and a dispute resolution process may be required in the SOA.

***Box 8***

SONI will provide data to NIE to enable it to carry out a deterministic assessment of the NI network. The scope of this data transfer will need to be the subject of future detailed discussions and will be documented in the TIA. It is recognised that NIE should not be provided with any more information than it needs. The information to be provided is likely to include network models, generator merit orders, demand forecasts, wind scenarios and so on.

At this stage SONI may also flag up any operational difficulties being experienced on the network which might be resolved by investment.

***Boxes 10 and 11***

Potential problems are identified by NIE and EirGrid. The problems will be identified by testing the scenarios against planning standards, as well as making use of asset replacement requirements at this stage.

***Box 16***

All three Licensees agree which problems will be considered jurisdictionally and which will be considered jointly.

**Figure 1(b)*****Boxes 17 and 18***

NIE and EirGrid will be required to participate in the co-ordinated planning and development of both the NI transmission system and the RoI transmission system. NIE and EirGrid will therefore assess and solve the 'joint' problems.

The final planning decisions will fall to NIE and EirGrid, while ensuring that all relevant information, including SONI's views, has been taken into account.

***Boxes 19 and 23***

NIE and EirGrid will also solve network problems in their own jurisdictions.

***Boxes 18 and 19***

Constraint payments in the SEM will be a driver towards the use of economic analysis of the costs and benefits of relieving constraints. Where constraints are identified then NIE will request certain additional data and/or assumptions from SONI relating to the costs of any such constraints in order to weigh these up against investment costs.

***Box 20***



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Once the preferred solutions are developed for the ‘NI-only’ problems and the ‘all-island’ problems, SONI will be provided with proposals for its consideration. There are three possible outcomes to this –

1 SONI agrees with all proposals. This would be followed by internal financial authorisations, construction and annual publication of the various documents to reflect these developments.

2 SONI disagrees with ‘NI-only’ proposals. If this cannot be resolved then SONI and NIE would be in dispute, requiring a dispute resolution process.

3 SONI disagrees with ‘all-island’ proposals. If this cannot be resolved then SONI would be in dispute with both EirGrid and NIE, also requiring a dispute resolution process.

**Figure 1(c)**

**Box 27**

NIE provides SONI with regular progress reports on all projects and, for joint projects, engages with EirGrid.

**Box 29**

EirGrid engages with ESB Networks throughout the construction process on all projects, In addition, for joint projects, EirGrid also engages with NIE and provides SONI with regular progress reports.

**2.4 Conclusions**

NIE, SONI and EirGrid support this high level process and believe it meets all the principles of the SEM.

These proposed arrangements will need detailed consideration through discussions with the Regulatory Authorities. Particular areas of concern are:

- The potential for financial risk associated with investments arising out of joint planning; and
- The provision of mutual commitments on transmission plans.

These risks will require consideration when drafting the licences, the SOA and the TIA.

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### 3 Joint Planning Structure

#### 3.1 Proposed Management Model

The process set out in Section 2 of this paper will be overseen at two levels –

- (a) The Joint Planning Steering Group (JPSG); and
- (b) The Joint Planning Committee (JPC).

The JPSG will comprise members at executive director level in each of the three companies. The JPSG should meet at least once a year, more often where required. The role of the JPSG will be to:

- Monitor the effectiveness of co-ordinated planning by the Joint Planning Committee (including connections) and modify the process if necessary;
- Facilitate the settlement of disputes between any of the companies, where they arise;<sup>4</sup>
- Approve joint proposals for developments;
- Manage the interface with Regulatory Authorities and Government Departments regarding joint planning.

EirGrid and NIE will be separately responsible for obtaining funding for their elements of any joint capital projects. The JPSG could provide additional information to facilitate the financial authorisation process in each organisation.

The JPC will comprise members at management and operational level in each of the three companies. It will report to the JPSG. The JPC should meet as necessary and at least once every three months. Its role is to:

- Agree the timetable for annual joint planning activities;
- Ensure timely exchange of necessary data and results between the parties;
- Agree items to be brought forward for joint study;
- Co-ordinate joint studies;
- Agree and propose to the JPSG solution proposals arising from joint studies;
- Ensure co-ordination of funding applications and responses;
- Ensure that joint or co-ordinated public statements are prepared and acceptable regarding stakeholder focus and accuracy;
- Monitor the efficiency and effectiveness of co-ordinated planning and make proposals to the JPSG for changes if necessary;
- Consider the impact of changes in planning methods, techniques, standards, policies;
- Consider major disturbances on either system, or on other systems, to learn from others' experiences and improve or safeguard future network performance.

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<sup>4</sup> The System Operator Agreement and the Transmission Interface Agreement will make provisions for each of the companies to refer certain disputes to the appropriate regulatory body for determination where agreement cannot be reached between the disputing parties.

### **3.2 Interaction with other Co-ordinated Activities**

The JPSG structure and scope may be modified and adapted if necessary to align with other all island management structures.

## **4 Data**

### **4.1 Introduction**

Data transfer will be a key element in the planning and development of the transmission systems following the implementation of the SEM. This section sets out a view on the required scope of data transfer and how it is to be used in transmission planning within the context of the SEM. It also deals with confidentiality issues relating to data exchange.

### **4.2 Present position**

In recent years there have been several studies performed on the all island system. These include an EU funded North-South Interconnector study, a generation adequacy study and an ongoing renewable generation study. Data was exchanged between NIE and EirGrid in order to complete these joint studies. Confidentiality agreements were put in place for certain aspects of these data exchanges and other data was exchanged under an existing inter-licensee agreement.

### **4.3 Data ownership and responsibility**

EirGrid, SONI and NIE will continue to maintain databases of information on networks, generators and customers in their respective areas, much of which will be required for transmission planning. Maintenance of these databases with up-to-date and accurate information will continue to be the responsibility of the database owner and, for the purposes of transmission planning, certain data items will need to be exchanged between the transmission licensees.

It is assumed that the right to exchange data supplied to a licensee by a third party for planning purposes will be permitted. The data which can be exchanged will be reflected in the Grid Codes, licences, the SOA, the TIA and all other relevant agreements.

### **4.4 List of Data to be Exchanged**

The groups of data required to enable transmission planning studies are listed below. These studies cover deterministic and probabilistic analyses.

- Load flow system data;
- Fault level data;
- Power station and generation unit data, including dynamic data;
- Load data and models;
- Wind time series data;
- Construction cost data;
- Protection and special protection scheme data; and
- Information on any complex network management schemes in each network (e.g. where the tripping of one element will automatically trip another).

Any data exchanged should be verified as accurate by the company that has responsibility for holding it. Where data is missing, default assumptions will be agreed.

#### **4.5 Data Exchange and Timeframes**

Data will be updated annually following a data freeze date and the finalisation of demand forecasts.

The update is to be exchanged by an agreed target date in an agreed format.

Additionally, data will be exchanged as required. Examples are:-

- Notification of connection applications;
- Notification of generation and demand capacity changes or closures;
- Acceptance of connection offers;
- Notification of any network problems identified in system studies; and
- Notification of the commissioning of any new connections.

Other data will be exchanged for information purposes more frequently, as required. Examples are:-

- Approval to proceed with system developments; and
- Significant changes to data assumptions or modelling

A nominated person will be the point of contact for data and data exchange in each company.

#### **4.6 Publication of data in the Transmission Statements**

Presently, each company issues its own transmission statement to comply with its licence requirements. They are available in hard copy and also electronically from the SONI and EirGrid web sites. It is envisaged that will continue to be the case following the introduction of the SEM. These statements will be of a similar format, thereby being easier to read, compare and refer to.

Data used for these statements are usually included in the appendices of these statements. It is proposed that this continues to be the case.

#### **4.7 Analysis Software**

It is proposed that system analysis should be carried out using a consistent set of software. This may require training on any new software.

#### **4.8 Confidentiality and Legal Agreements**

It is assumed that confidentiality provisions will be contained within the System Operator Agreement and the Transmission Interface Agreements. These will permit the Licensees to share certain data between them to the extent that it is necessary for the purposes of transmission planning.

## **5 Planning Assumptions**

### **5.1 Introduction**

As part of the annual joint planning process SONI and EirGrid will meet to agree sets of planning assumptions. This will enable each company to carry out studies with a consistent set of data and assumptions.

The majority of the planning assumptions will relate to the operation of each network. Each company will have best knowledge of the operation of its network and will provide the other with that information.

In addition, the two companies will agree other assumptions to be used in the annual processes. These assumptions should not preclude any company studying other scenarios.

### **5.2 Network Operations**

Each system operator will provide the other system operator with information relating to the operation of its network, including:

1. The future configuration of the network, in particular the location of normally open points, if any;
2. An initial forecast of transmission losses for generator dispatch purposes; and
3. Network voltage profiles and voltage control methods including use of transformers taps, capacitors and reactors.

It is likely that this information will not change substantially from year to year.

### **5.3 Transmission Planning Assumptions and Scenarios**

Assumptions may be agreed for a range of different types of studies, for example, planning decisions or connection studies. These may include:

1. Use of Phase Shifting Transformers on the 110 kV interconnectors;
2. Reactive support that each system is prepared to provide to the other, both pre- and post-contingency;
3. Credible import and export scenarios for Moyle and East-West interconnections;
4. Wind-generation output assumptions;
5. Base case generation dispatch scenarios and post-contingency re-dispatch assumptions; and
6. Possible future generation.

### **5.4 Process**

SONI and EirGrid will review their assumptions annually at the same time as the data gathering exercise. These assumptions will be agreed annually at the same time as the data exchange. In the event that planning assumptions cannot be agreed then the SOA dispute resolution process will be invoked.

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## 6 Transmission Planning Standards

### 6.1 Introduction

Transmission Planning Standards are key determinants in investment decisions as they provide a guide against which future system performance is tested. Plans to develop the network are substantially based upon analyses of future system performance which indicate that the network is likely to fall outside the standards.

The standards used in the Republic of Ireland and in Northern Ireland are separate and different. They have evolved to meet the changing needs of the electricity industries as they developed in both jurisdictions. The standards represent an acceptable compromise between reliability and investment costs in each jurisdiction.

Following the establishment of the SEM, there will continue to be separate and different planning standards for Northern Ireland and Republic of Ireland. This is not unusual in cases where two systems are brought together into a single market.

Under the SEM, each licensee should, through its obligations to comply with standards, be required to participate in the planning and development of the transmission systems.

### 6.2 Existing Standards

Both the RoI and NI standards documents include similar headings of standards for various aspects of network performance e.g. circuit loading, voltage criteria, generator connections, stability, and contingencies to be tested. The detail and limits contained in these standards can be different in both documents.

EirGrid plans the RoI transmission system according to the planning standards contained in the document "Transmission Planning Criteria". These standards are approved by CER and are required by Condition 14 of EirGrid's licence. The document is available on EirGrid's website at [www.eirgrid.com](http://www.eirgrid.com). For reasons unrelated to the SEM EirGrid has agreed to review the application of its transmission standards commencing in 2006, mainly as a result of changing use of the transmission network.

NIE plans the NI transmission and distribution system according to the planning standards in the document entitled "Transmission and Distribution System Security and Planning Standards" which is approved by Ofreg and is required by Condition 19 of Part II of NIE's licence. The relevant standards applicable to the Transmission System are as follows:-

- ER P2/5 Security of Supply, dated October 1978, and NIE amendment sheet Issue 2, dated 7 August 1992.
- PLM-SP-1 Planning Standards of security for the Connection of Generating Stations to the System Issue 1, dated September 1975, and NIE amendment sheet Issue 2, dated 7 August 1992.
- PLM-ST-4 CEEB Criteria for System Transient Stability Studies Issue 1, dated September 1975, and NIE amendment sheet Issue 2, dated 7 August 1992.
- PLM-ST-9 Voltage Criteria for the Design of the 400kV and 275kV Supergrid System Issue 1, dated 1 December, 1985, and NIE amendment sheet Issue 2, dated 7 August 1992.

- ER-P28 Planning limits for Voltage Fluctuations.
- ER-P16 EHV or HV Supplies to Induction Furnaces.
- ER-P29 Planning limits for Voltage Unbalance.
- ER-G5/3 Limits for Harmonics. (shortly to be replaced by ER-G 5/4 -following UK practice).
- EPM-1 Operational Standards of Security of Supply, dated November 2004.

Following the introduction of the SEM the two transmission licensees in NI will be required to plan, develop or operate in accordance with the standards specified in their respective transmission licences. The above standards will therefore need to be allocated appropriately to one or other licence.

### **6.3 Application of Standards in Previous Joint Studies**

Previous joint studies have applied the planning standards in each domain i.e. the RoI network was tested against RoI standards and the NI network against NI standards. The exception to this has been in the consideration by the RoI TSO of the double circuit interconnector between Louth and Tandragee as a single contingency.<sup>5</sup>

### **6.4 Planning Standards under SEM**

Following the establishment of the SEM, both EirGrid and NIE will continue largely to plan to their own separate and different planning standards. However, the standards in both jurisdictions will be reviewed within the next two years. That review will consider whether or not it is necessary or appropriate to harmonise some or all of the standards to converge to a single set of planning standards.

It is therefore proposed that the same approach taken in previous joint studies, as outlined in section 6.3, is used in future all island joint planning. Adopting this approach raises a number of issues. These issues are discussed below and implications addressed.

#### **(a) Treatment of Louth Tandragee 275kV double circuit**

Presently, NIE considers the loss of a double circuit on the network as a single probable contingency. EirGrid considers a double circuit loss as a less probable contingency and applies less onerous standards for this event.

For joint transmission planning under the SEM, EirGrid will continue to treat the loss of the Louth-Tandragee 275 kV double circuit as a single contingency.

#### **(b) Maintenance-Trip Contingencies**

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<sup>5</sup> A fault on the Louth Tandragee 275kV double circuit interconnector, a single incident, will result in an immediate system separation. This is because, without the 275kV circuits, the two 110kV interconnectors are not strong enough on their own to interconnect the two systems and must be disconnected. The generation/load imbalance resulting from system separation may result in unacceptably high frequency in one jurisdiction and load shedding in the other. This must be managed by each system operator.



Presently, NIE and EirGrid separately plan their network to stay within standards following a range of contingency events including the unplanned loss of a single circuit during the summer while another circuit is out of service for maintenance (known as n-1-1 contingencies).

Under the SEM the effect of an unplanned outage of a circuit in one domain during the maintenance of a circuit in the other domain needs to be considered.

It is assumed that the operators will co-ordinate maintenance outages to reduce security risks. It is not intended therefore to plan for the loss of a circuit during simultaneous maintenance outages in both jurisdictions.

(c) Connection of Generators

A preliminary assessment of the standards relating to the security of generation connections has been carried out. The Transmission Planning and Connections workstreams have identified a number of issues relating to generator connections which require further thought, including:

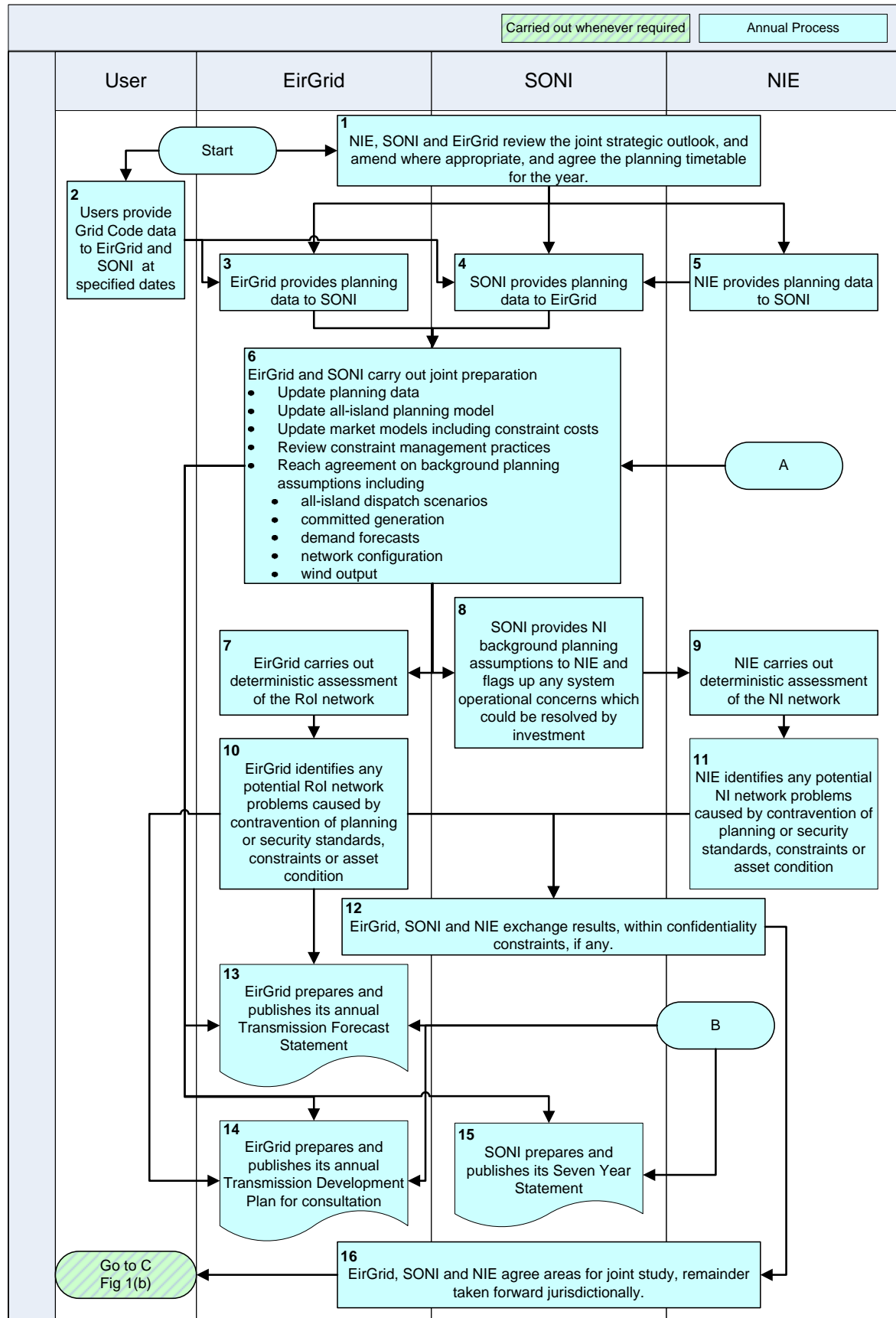
- Connection guiding principles which will cover connection designs and draft rules for applying the Least Cost Technically Acceptable connection principle;
- Principles for reinforcement associated with new or modified connections; and
- Interactivity between connection applications.

The two work streams are working towards agreeing principles on these issues.

(d) Modelling Assumptions

The EirGrid standards include a section on “Modelling Assumptions”. This section will form part of the annual process of agreeing planning assumptions, as outlined in Section 2 of this paper.

Figure 1 (a) – Annual Planning and Testing



**Figure 1 (b) – Addressing identified problems and determining solutions**

