Connection Asset Costs: Guiding Principles

CER/ESB/2000/10
12 April 2000

1. Introduction

This paper provides an interpretation of the Direction issued by the CER on the 23rd of December, 1999, describing the boundary between Connection and Use-of-System (UoS) transmission assets. Based on a set of high level objectives discussed in section 3, section 4 proposes a set of guiding principles which we intend applying when deriving connection charges for individual users (generation and demand). This paper does not address connection charging for users already connected pre-19th of February, 2000.

As this is a general guide, section 5 provides a range of scenarios depicting most typical examples.

The application of these rules may appear at first sight to be relatively simple. However, it would be unrealistic to expect any allocation rule to accommodate all possible connection configurations. Some anomalous situations may occur and in those situations connection charges will be derived in accordance with the principle of shallow connection and the set of rules outlined in section 4. We begin by reviewing the demarcation between connection and UoS assets.

2. Connection Boundary

Connection charges cover the cost of network assets that are specifically installed to connect a user or (a small group of) user(s) to the transmission system. As connection costs are specific to each individual user (which could be a generator or demand user) the connection charge levied to an individual user will depend on the specific configuration required to connect that user. The connecting user will be charged directly for the full cost of the connection, which includes an appropriate share of the capital costs and an on-going operations and maintenance cost.

In accordance with the direction issued by the CER connection assets will include:

> "a transmission station which is solely or mainly for the use of a specific user, and any tail-fed lines or cables where appropriate which similarly are used solely or mainly by a single user. For the avoidance of doubt, the switching bays at each end of the lines (or cables) shall be included as part of the line (or cable) where appropriate. Other lines and cables, which form part of the meshed grid system, shall be treated as use of system assets and not as connection assets.
>
> In the event that more than one user is connected at a transmission station, the switching bay connecting a user to the station shall be designated as a connection asset. Also, the remainder of the transmission station shall be allocated as a connection asset to the users connected at that station, based on a simple and transparent rule which reflects their usage of the station (for example, based on the number of switching bays at the station). The same principle shall be applied to usage of a tail-fed cable or line.
>
> In the event that a tail-fed cable or line which is used by a single user is subsequently used by more than one user or becomes part of the meshed transmission network, then a suitable reallocation of connection assets to use-of-system, or to new user(s) as connection assets, shall be adopted"

Based on the shallow definition described above this paper provides a set of guiding principles which we intend applying when deriving connection charges for individual users.

3. High Level Objectives

There are a number of high level objectives which any connection allocation policy should aim to achieve. These high level principles are helpful when explaining the rationale behind our proposed allocation procedure. High level objectives include:

***Cost Recovery*:** It is important that the connection charge is sufficient to fully recover the reasonably incurred costs of a connection. This charge must be sufficient to recover both the capital costs and the on-going operating and maintenance costs. If capital costs are not fully paid in an up-front capital contribution, then it is important that the owner of the assets receives an adequate rate of return on his investment and appropriate protection against the risk of stranded assets. In the event that the user does not pay the full connection costs up-front, then, to safeguard against the possibility of stranding, it would be necessary to bond the user for any unpaid connection costs which would result if that user disconnects from the system. Operation and maintenance costs will be recovered based on an annual charge.

Simplicity and Transparency: It is important that the connection rules and cost allocation process are clearly understood. To avoid unnecessary administrative complexity and to avoid disputes the allocation rules should be as explicit as possible.

Fair & non-discriminatory: Fair and non-discriminatory access requires that no user is unreasonably cross-subsidising any other party. Connection assets should include assets which are solely or mainly for the use of a specific user. If a connecting user does not see the full cost associated with his connection, then the remaining cost will be borne by all users.

Users connected to the same node on the system and sharing connection assets should each be charged an amount which is representative of their connection configuration (for example, based on the number of switching bays at the station). Similar treatment of existing and new users should apply, although the difficulties in applying a new set of charging rules retrospectively needs to be recognised.

Efficiency: Unlike deep connection charges it is not the primary objective of shallow charging to provide locational prices based on full network reinforcements required to connect users. However, a key objective of an efficient connection charging framework is to ensure that charges are cost-reflective and to ensure that possible anomalies are minimised.

If for optimal planning National Grid does not select the least cost connection to accommodate a new user then that user should only be eligible to pay for the least cost connection.

Avoid arbitrariness: In order to limit the number of potential disagreements and disputes the allocation rules need to be clear and avoid arbitrariness whenever possible (the potential for industry and regulatory resources to be taken up in negotiation/disputes is considerable). The set of rules should provide for as many circumstances as possible.

Limit administrative overheads: If possible, the rules should be designed to limit the level of administrative overheads required to monitor the connection assets and charges over time, although any connection policy will necessitate the construction of a detailed data model which can be tracked and audited over time.

Clearly some of these objectives will in some circumstances conflict with each other, and a balance must be achieved. For example the need for a reallocation of costs amongst users over time will require additional administrative resources.

4. Connection Allocation Principles

Against these high level objectives the following guiding principles set out the basis of how we intend allocating and charging connection assets to users connecting to the transmission system. Typical examples consistent with these rules are provided in the next section.

1) A user connecting to the transmission system will be eligible to pay for the full cost associated with the direct connection of the user to the transmission system. The capital elements of the connection costs will include as appropriate:

   (a) some or all of the costs[1] of the circuit (s) connecting the transmission station at the user's location to the transmission network (which may include the cost of a "tail", a "tee" or "loop-in" sections of lines to the user's location)
   (b) the circuit bay (s) required to connect the user
   (c) the station common costs[2] associated with the station to which the user is connected (or a share of the costs depending on the number of users at that station). In the case of a tail-fed connection the user will be eligible to pay the common costs associated with the transmission station at each end of the line (or a share of the station common costs at each station depending on the number of users at each individual station).
   (d) the cost of any line retirements resulting from a new connection
   (e) the cost of upgrading of existing protection or communication equipment as a direct result of the connection. For example it may be necessary to install end-to-end optical fibre if a new loop-in results in a short line which otherwise can not adequately be protected.
   (f) the cost of metering equipment.

[1] For example in the case of a tail-fed line or looped station the user will pay for all of the costs required to connect the user whereas in the case of a mutli-line station the user may be eligible to pay for a proportion of the total costs (see examples 6 & 7).

[2] Typically, busbars, couplers, site and civil costs, control buildings, the cost of protection and the cost of common services, etc..

2) If the station connecting the user to the transmission system is connected by more than two circuits then, except where the connection of a specific user (or group of users) requires more than two system lines to connect that user (users)[3], connection costs will consist of:

   (a) the circuit bay (s) required to connect the user

   (b) a share of the station common costs. The common costs will be allocated between the total number of bays at that station

   In the case where more than two lines are required to connect a user (or group of users) two additional scenarios are specifically provided for as follows:

   Third physical connection (or more) required due to size of user

   If more than two lines are required to physically connect a user to the transmission system because the size of the user dictates it, then the user will be charged connection costs consistent with principle 1. For example, if the size of a load (or generator) is greater than the normal continuous rating of either of two connecting circuits, then a third connecting circuit would be required. The user will be eligible to pay for the appropriate share of the cost of each of the three circuits connecting the station to the transmission system, the common station costs, the lines bays connecting the user to the station and any retirement costs and protection (and communication) and metering equipment required.

   Third connection required for system reinforcement as a direct result of the user connecting.

   If at the time of connection a third line is necessary, not because the size of load (or generator) is greater than the normal continuous rating of either one of the other two connecting circuits, but because additional reinforcement is required directly as a result of the connection of the user (and had not been indicated as required for general system reinforcement, i.e. was not in the Forecast Statement[4]), then the user will not be eligible to pay for the third line as it is a "deep" or "use-of-system" asset.

   However, because the third circuit was required as a direct consequence of the user connecting, it is inappropriate to "reward" the user by reducing his charge for the station common costs in accordance with the normal rule for allocating costs in multi-line stations described above. In this case the user will be liable for the full cost of the station, less one bay cost (i.e. the cost of the bay required to connect the third line, which will be recovered in use-of-system).

   An example of both of these scenarios is provided in section 5.

3) If more than one user is connecting to a transmission station, the cost of the connection assets at that site will be shared between the connecting users at that

[3] Discussed below.

[4] Until such time that the forecast statement is published cost deviations will be determined based on projects for completion in the 5 year capital plan.

station. A user connecting to an existing transmission station will be charged connection costs based on an replacement equivalent asset basis[5].

4) A user will be eligible to receive a rebate based on the original cost of his connection if, within 10 years of the original connection, another party uses the same connection assets to connect to the transmission system. Likewise, in the event that NG connects an additional line to the station for system reinforcement reasons, within 10 years of the original connection, the user will be eligible to receive a rebate.

5) If National Grid connects an additional system line to an existing looped station (or a station consisting of more than two system lines built to connect the user to the transmission system) then the circuits connecting the transmission station to the network will be deemed Use-of-System assets and the existing user (s) at that station will be eligible to receive a rebate on assets previously defined as connection assets.

6) The connecting party will pay for the minimum cost connection to the transmission system, consistent with the planning standards[6]. If for overall optimal planning National Grid does not select the least cost connection to accommodate a new user then that user will only be eligible to pay for the cost of the least cost connection. If the user requests a non-standard, more expensive connection then that user will be eligible to pay the full cost of providing this connection[7].

7) A user's connection costs should not increase as a result of a third party connecting to the same point on the transmission system (e.g. if by connecting a new user at an existing station, the average cost allocated to existing users increases due to the level of work required to connect that user, then the existing users will not see an increase in their connection costs). Any additional costs will be borne by the connecting party.

8) A user connecting to a circuit which is due to be built (and which is part of the forecast statement[8]), but which must be advanced or altered to provide for the physical connection of the user to the transmission system, will be eligible to pay for the deviation from the original plan (including advancement costs).

---

[5] An alternative to charging the user a replacement equivalent cost is to charge users based on indexed net book value. However, this approach has the disadvantage that users connecting to existing connection assets would be required to pay the cost of any refurbishing or replacing of connection assets if the connection asset (s) is required beyond its useful (depreciated) life. Therefore in order to provide users with a predictable consistent connection cost, connection costs will be charged based on an equivalent asset basis. Charging users on this basis may lead to an over-recovery of costs. In this situation, any surplus will go towards off-setting UoS revenues and the cost of refurbishing connection assets will be paid by use-of-system revenues.

[6] The least cost connection is the minimum cost of connecting the user to the transmission system , at the time of the required connection.

[7] For example a heavy industrial user may require additional assets which are over and above the assets associated with a typical connection. In this situation the industrial user will be eligible to pay for any additional costs.

[8] See footnote 4.

5. Connection Cost Allocation Examples

This section provides examples of connection assets required to accommodate most typical installations. If additional connection assets not described in this note have been installed for user specific requirements or specialist needs then those connection assets will be allocated completely to that user. It would be unrealistic to expect any allocation rule to accommodate all possible configurations. Some anomalous situations may occur and in those cases connection charges will be derived consistent with the rules described in section 4.

The examples provided below assume single busbar configuration. In the event of double busbar configuration, or ring-busbar or breaker-and-half schemes, the principles will be applied in a similar manner. Ring-busbar and breaker-and-half schemes are not typical configurations on the Irish transmission system.

Example 1: Looped station (single connecting party)

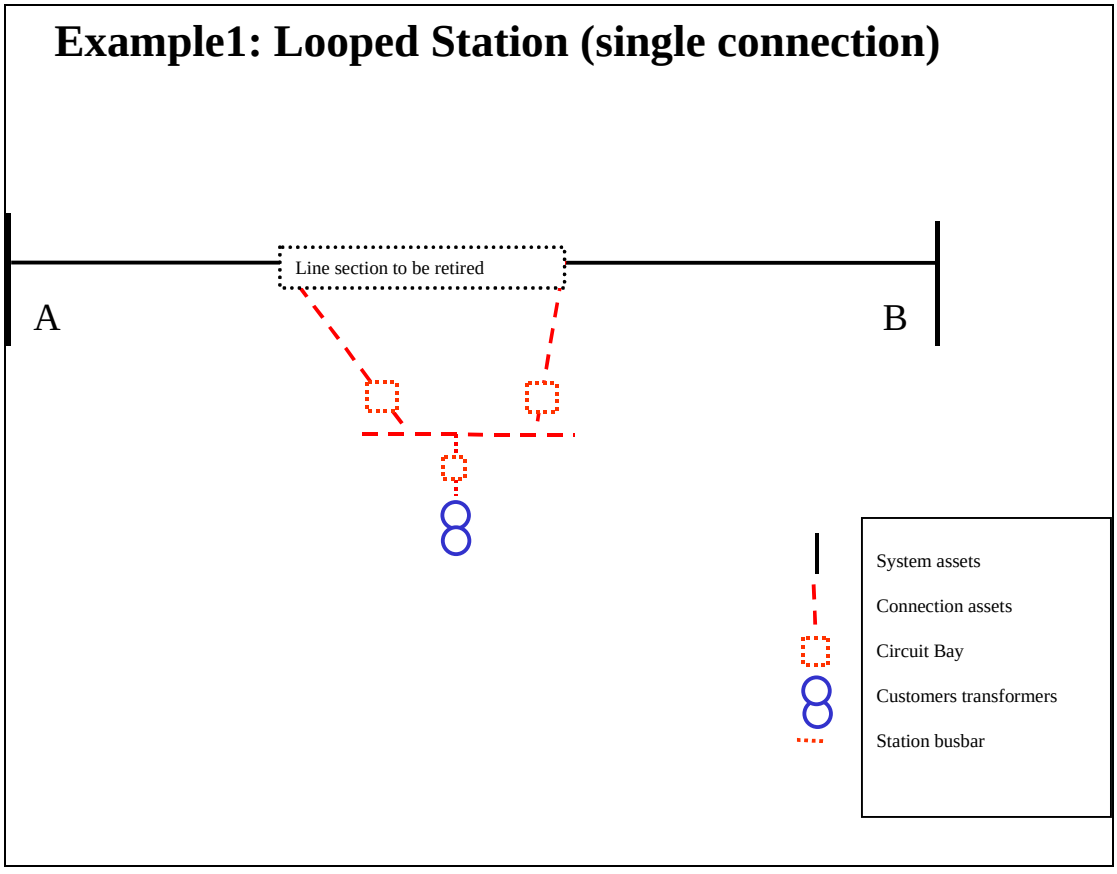
Description:

A load or generator is connected to the transmission system via two lines.

Connection Costs:

The connection costs which are highlighted by the dotted lines consist of:

- the transformer bay connecting the user to the station and associated metering and protection equipment
- the station common costs[9]
- the two new line sections ("loop-in" sections) and line bays connecting the station to the adjacent National Grid circuit
- costs associated with decommissioning of the section of the line to be retired
- any upgrading of line protection and communication equipment required as a direct result of the connection. For example if upgrading is required at the existing transmission stations A and/or B the connecting user will be eligible to pay for this cost.



[9] Typically, busbars, couplers, site and civil costs, control buildings, the cost of protection and the cost of common services, etc..

Example 2: Looped station (with two connecting parties)

Description:

A load or generator (user 1) is connected to the transmission system via two lines. A second user (user 2) connects to the same station.

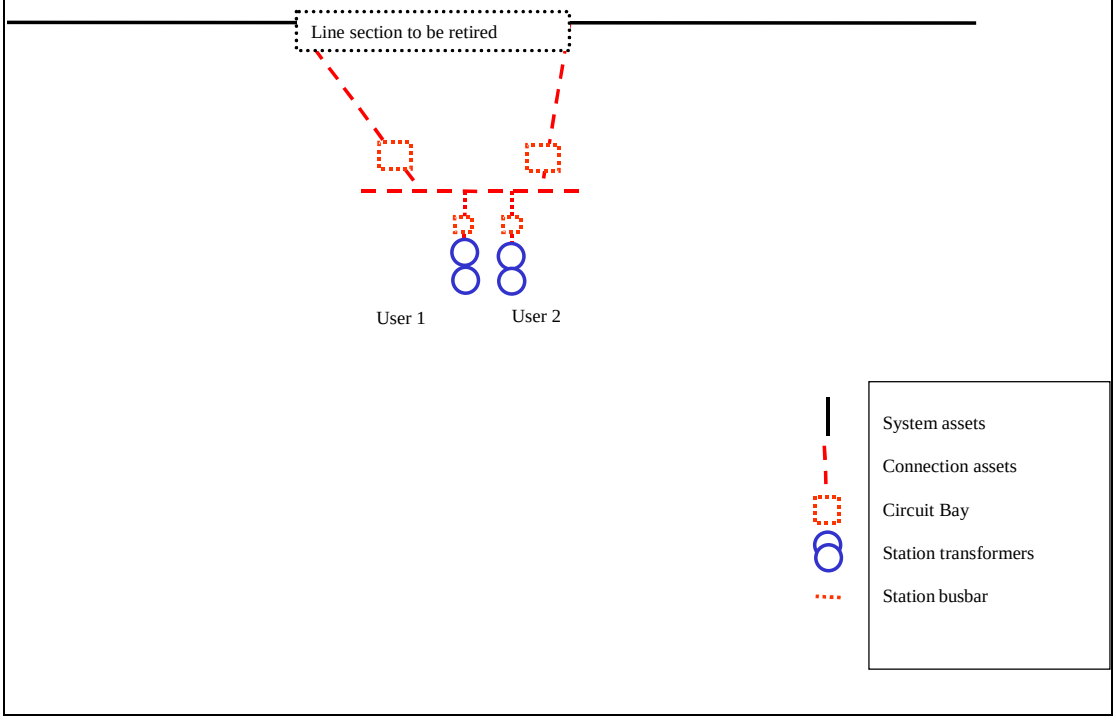
Connection Costs:

- each user will be charged separately the cost of the transformer bay connecting the user to the station and associated metering and protection equipment.
- the station common costs will be shared between the two users. If both users connect at the same point in time then each user will pay a proportion of the common costs. In this case each user will pay for ½ of the value of the common costs. If one of the users connects at a later date (e.g. customer 2) and it is necessary to extend the busbar (or station)[10] and the cost of connecting user 2 at that site exceeds the costs of the connecting of user 1, then user 2 will pay the additional cost.
- the cost of the two sections of line connecting the station to the transmission system and the two line bays will be shared between the two users (in this example each will pay ½ of the cost)
- costs associated with decommissioning of the section of the line to be retired
- any upgrading of line protection and communication equipment required as a direct result of the connection[11].

[10] For example where it is necessary to extend the station compound or station buildings.

[11] If user 2 triggers the need for busbar protection based on ESBNG's criteria then the busbar protection is not charged fully to that user, but is treated as part of station common costs. For avoidance of doubt this principle is applied in all examples.

Example 2: Looped station (two connections)



If both users do not connect at the same time then the first user will be eligible to receive a rebate, based on the original (depreciated) cost of his connection. This rebate policy also applies to the remaining examples discussed in this section.

Example 3: Tail-fed station (connecting to an existing transmission station)

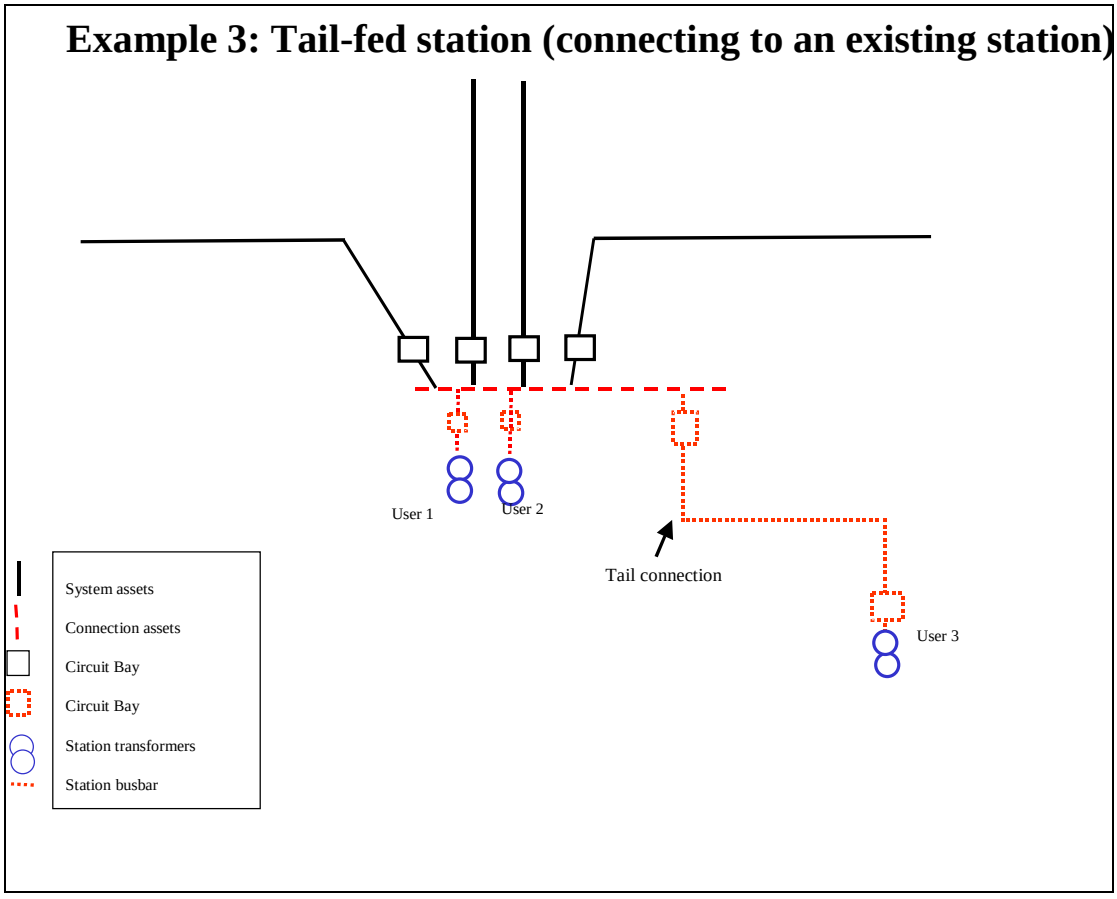
Description:

A load or generator connects to an existing transmission station by a tail-fed circuit. The lines connecting the existing station are assumed UoS assets.

Connection Costs:

The user connecting via a tail-fed circuit will be charged:

- the full cost of the tail fed circuit connecting the user to the existing station and associated metering and protection equipment.
- the full cost of the tail fed station
- as there is more than two system lines connecting the station to the transmission system the station common costs will be shared between the number of lines connected to the station. In this case user 3 will be allocated 1/7 of the station common costs, except where the actual station costs incurred in connecting user 3 at the site exceed that amount, in which case the full cost of connecting user 3 is borne by user 3.
- any upgrading of line protection and communication equipment required as a direct result of the connection



Example 4: Tail-fed station (connecting to a new transmission station)

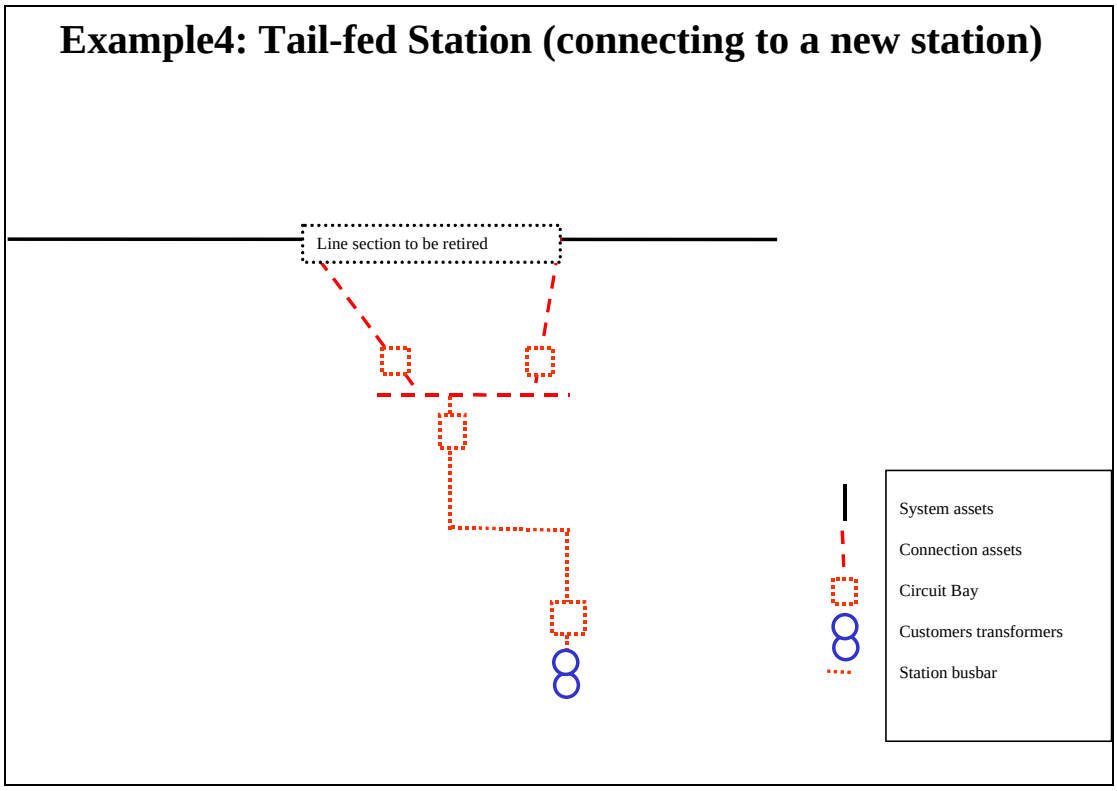
Description:

A load or generator connects to a new transmission station via a tail-fed circuit.

Connection Costs:

The user connecting via a tail-fed circuit will be charged:

- the full cost of the tail fed station
- the full cost of the tail fed circuit connecting the user to the new transmission station and associated metering and protection equipment
- any upgrading of line protection and communication equipment required as a direct result of the connection
- the costs associated with a looped connection as described in example 1.



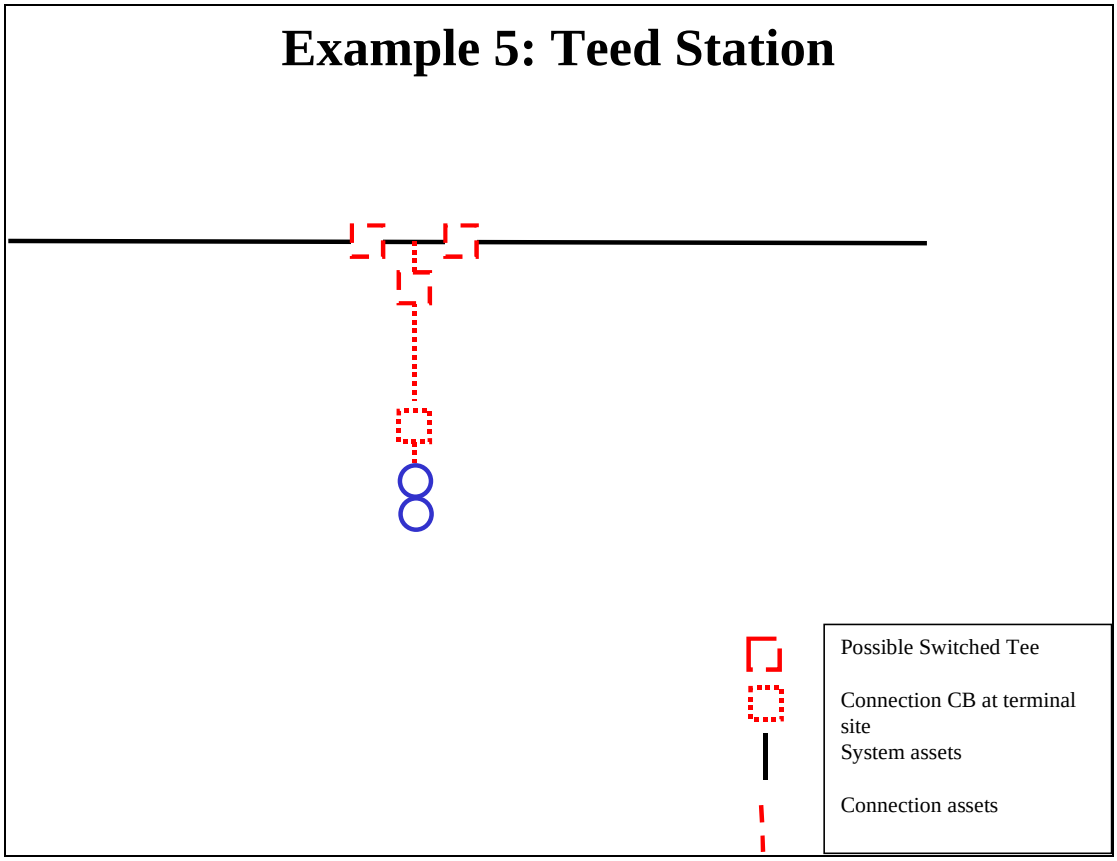
Example 5: Teed station

Description

A load or generator is connected to the transmission network by a teed station

Connection Costs:

- construction of solid tee or switched tee (dotted lines) at the circuit take off point .
- construction of line from tee to demand/generator site and associated metering and protection equipment.
- establishment of a terminal station at demand/generator site.
- any upgrading of line protection and communication equipment required as a direct result of the connection



Example 6: A third line is required in order to physically connect a user

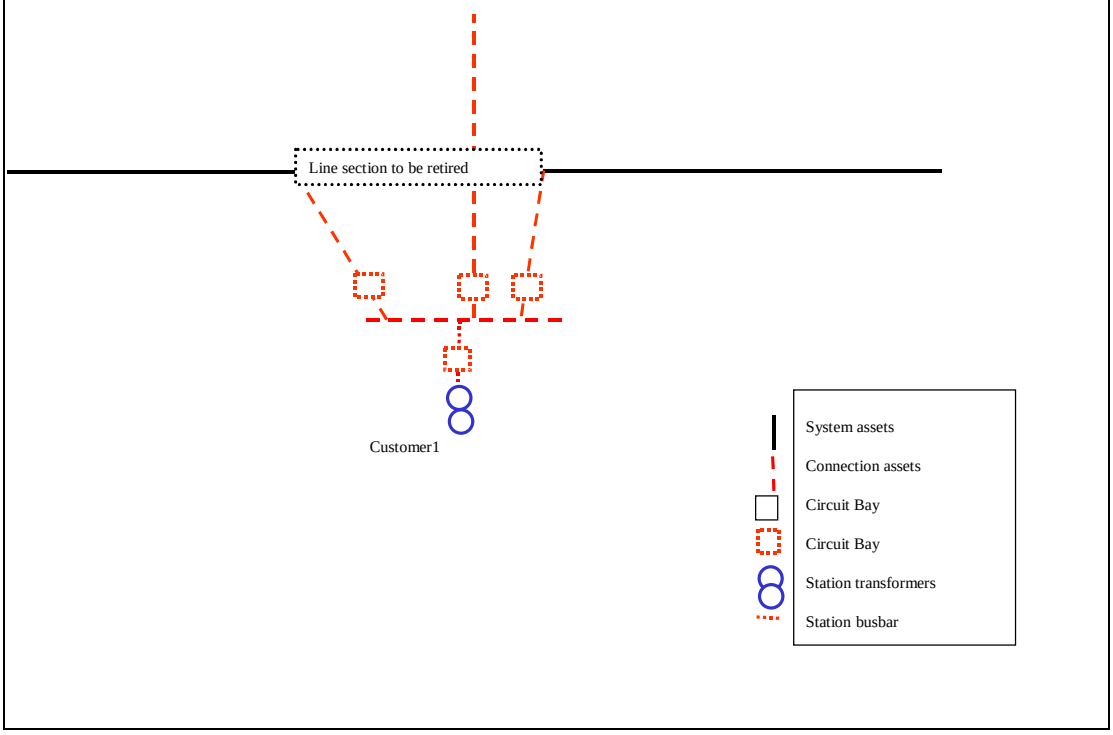
A new load or generator is connected to the transmission system via three lines. The third line is required at the time of connection as the size of the user is greater than the normal continuous rating of either of the two connecting circuits.

Connection Costs:

The connection costs consist of:

- the transformer bay connecting the user to the station and associated metering and protection equipment
- the station common costs
- the three new lines or line sections and line bays connecting the station to the adjacent National Grid circuit
- costs associated with the decommissioning of the section of the line to be retired
- any upgrading of line protection and communication equipment required as a direct result of the connection

Example 6: A third line is required to facilitate a new connection



Example 7: A third line is required for system reinforcement as a direct result of the user connecting

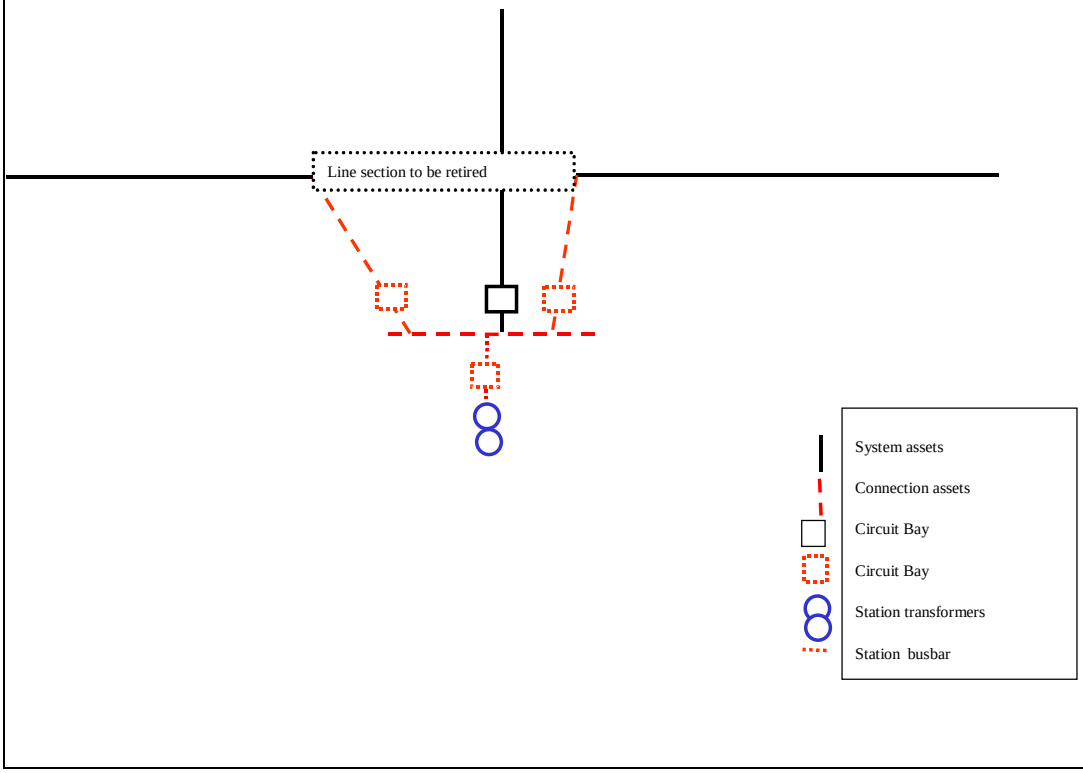
A new load or generator is connected to the transmission system via three lines. The third line is required at the time of connection.

Connection Costs:

The connection costs consist of:

- the transformer bay connecting the user to the station and associated metering and protection equipment
- the station common costs
- the two line sections and line bays connecting the station to the adjacent National Grid circuit (dotted lines), but not the third connecting line
- costs associated with the decommissioning of the section of the line to be retired
- any upgrading of line protection and communication equipment required as a direct result of the connection

Example 7: A third line is required for system reinforcement in order to connect the customer



Example 8: National Grid connects an additional line to an existing station

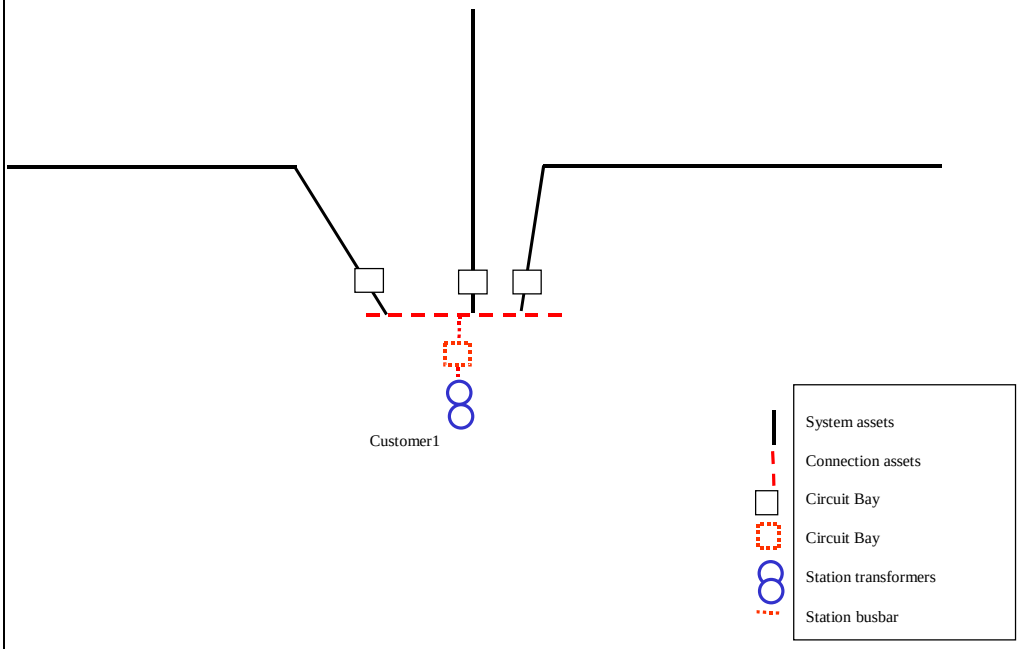
Description:

A load or generator is connected to the transmission system via two connecting lines, consistent with example 1. National Grid connects a third line to the station for system reasons.

Connection Costs for the connected User:

- the cost of the transformer bay connecting the user to the station and associated metering and protection equipment.
- the station common costs will be shared between the number of bays connected to the station (in this example user1 will be eligible to pay for 1/4 of the common costs).

Example 8: NG connects a third line to an existing station



User 1 will be eligible to receive a rebate on the original costs of his connection.

Example 9: Connection costs attributable when National Grid elects not to build the least cost option for system reasons

Description

A new user connecting to the transmission system can be connected by either a looped connection or a tail-fed station. The tail-fed station is the least cost option but for system reasons a looped connection is selected.

Connection Costs

- the connecting user will only be eligible to pay for the least cost option, which in this case is the cost of the tail-fed line, station common costs and tail fed station.