

# Connection Charging Policy

Rules, Terms and Conditions for the provision of  
**OPEN ACCESS TRANSMISSION SERVICE**

Energy

Regulatory Commission  
(ERC Case No. 2002 - 253)

CORPORATE PLANNING  
NATIONAL TRANSMISSION CORPORATION  
December 2003

# **Proposed Policy on Connection Charges for Transmission Service Customers**

National Transmission Corporation

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**Proposed Policy on Connection Charges for  
Transmission Service Customers**  
National Transmission Corporation

**1.0 General Provision**

1.1 As the operator of the nationwide electrical transmission and sub-transmission system, TransCo adopts this Policy on Connection Charges for Transmission Service Customers consistent with Section 36 of the Republic Act No. 9136, otherwise known as the Electric Power Industry Reform Act of 2001 (EPIRA), and Rule 10 (Procedures for the Structural Unbundling of Business Activities) and Rule 15 (Unbundling of Rates) of the Implementing Rules and Regulations (IRR), stating that electric power industry participants shall functionally and structurally unbundle their rates and business activities according to each major functions.

Objectives

1.2 Consistent with the Declaration of Policies stated in the Section 2 of the EPIRA, TransCo adopts the following objectives in the design of the Policy on Connection Charges.

- a. *Efficiency.* The Policy on Connection Charges is designed to ensure that charges reflect, as far as reasonably practicable, the true costs incurred by TransCo in connecting customers to the grid. The Policy also aims to minimize, if not completely remove, subsidies between customers and services.
- b. *Simplicity.* As far as reasonably practicable, the Policy intends to keep administrative costs to the minimum required to run an effective system. This is to avoid undue complexity and promote ease in implementation and administration.
- c. *Transparency.* The Policy aims to set clear definition of charges so as to minimize disputes and be understandable to customers where different costs result in different charges.
- d. *Fair and Non-discriminatory.* The Policy aims to develop charges determined on a rational and objective basis and levied equally on customers in equal situations.

1.3 TransCo must keep the Policy under review at all times and make modifications to the Policy for the purpose of ensuring that the objectives are met.

1.4 Before making any modifications, unless it has been agreed otherwise with the Energy Regulatory Commission (ERC), TransCo will consult with all OATS

Customers and stakeholders for a period of at least 28 days within which written representations can be made.

- 1.5 A report will then be issued to the ERC by TransCo setting out the terms of the modification, representations made, any change to the terms of the modification, how the modification better meets the relevant objectives, and a time table and date for implementation of the modification.
- 1.6 Unless the ERC has, for a period of at least 28 days, given a direction that the modification may not be made, TransCo will make the modification to the Policy. And once a modification is made, TransCo will issue a revised statement showing the changed Policy. The revised Policy will supersede all previous statements from the date of its issue.

### Contractual Framework

- 1.7 Existing customers being served by TransCo will, in the absence of a Transmission Supply Agreement (TSA), be governed by the Rules on the Transmission Service as indicated in the Transition Supply Contract (TSC) and/or any existing contract recognized by NPC and TransCo.
- 1.8 New customers served by TransCo will still be subject to the terms and conditions of the TSA in so far as it is consistent with the latest approved Open Access Transmission Service Rules, Terms, and Conditions (OATS Rules).
- 1.9 Interested customers and customers whose TSC and other existing contract already expired will be required to comply with OATS Rules and the Grid Code and enter into a TSA with TransCo.
- 1.10 All interested customers are requested to make a formal application to TransCo as provided for in the OATS Rules. TransCo can then assess the potential impact on the transmission system and consider what form of agreement, if any, may be required.
- 1.11 The connection agreement between TransCo and the transmission customer(s) forms part of the TSA. However, TransCo will entertain proposals for connection agreements in so far as consistent with the OATS Rules.
- 1.12 The OATS Rules and the individual customer bilateral agreement set out the terms and conditions applicable for the use of and/or connections to the transmission system.
- 1.13 If a transmission customer fails to fulfill their obligations, their entitlement to use and/or be connected to the transmission system will cease, as consistent with the OATS Rules. Furthermore, the customer will be liable for all charges that may arise as indicated in the TSA and, for connection, the appropriate termination sum.

- 1.14 If a transmission customer is applying for new connections to the system or to modify an existing connection, then Section II, Module B of the OATS Rules will apply.

## **2.0 Connection Principles**

### Connection Assets Definition

- 2.1 Connection assets are defined in terms of the asset allocation determined through ownership boundaries, the assets' primary function, the allocation prepared by NPC and TransCo for existing generation customers, and the Energy Regulatory Commission's (ERC) Order on the Guidelines to the Sale of TransCo's Sub-Transmission Assets and Franchising of Qualified Consortiums (17 October 2003). Relative to the imposition of connection charges, connection assets are those assets owned, and/or operated, by TransCo for the purpose of connecting a customer, or group of customers at lower voltages, to the system.
- 2.2 Asset allocation through ownership boundaries provides that the connection assets are defined as those relevant facilities that lie between TransCo's assets performing grid functions and the customers' ownership boundary.
- 2.3 In cases where ownership of connection assets cannot be clearly established, the connection points and boundaries shall be defined by the assets' function.
- 2.4 For existing generation customers, connection assets will be based on the Boundary Asset Schedule jointly prepared by TransCo and NPC.
- 2.5 Transco will also consider the inclusion of those assets defined as Sub-Transmission Assets by the ERC in its Order of 17 October 2003. To the extent possible, Transco shall treat all Sub-Transmission Assets covered by the ERC Order as Connection Assets.

### Connection Charging Principles

- 2.6 Consistent with the latest approved OATS Rules, connection charges will allow TransCo to recover the portion of its maximum allowable revenue that is associated with the cost of connecting the customers to the grid. Connection charges shall be payable by all Load and Generation Customers.
- 2.7 The connection charges are designed to recover the following costs:
  - a. Operation and maintenance of the connection assets;
  - b. Depreciation costs associated with the connection assets;
  - c. An appropriate share of the TransCo's overheads; and

- d. A reasonable return on the connection assets owned by TransCo based on the latest weighted average cost of capital (WACC) approved by ERC.
- 2.8 If the connection assets have been installed or retained for a customer's specific requirement(s) or specialized need(s), then the associated connection charges related to the connection assets will be fully charged to that particular customer.
- 2.9 Where two or more customers are sharing in the connection assets, the associated costs and the connection charges payable shall be equitably allocated, based on the percentage of the capacity contracted by the transmission customer at the connection point compared with the total contracted capacity at that connection point (the average of the highest 12 demand peaks, measured in kW aggregated over the period, at the transmission customer's Point of Connection, over the past 12 months, as consistent with C4.0 of the OATS Rule).
- 2.10 Lastly, in cases where customers own both the assets (used to connect to the grid) and the respective substation or switchyard where the connection assets are located, the connection charges will only apply to the costs, incurred by TransCo, necessary to operate and maintain those connection assets.

#### Allocation Process of Connection Assets

- 2.11 The Transmission Network and Connection Assets are operated in an integrated manner and the asset allocation process described herein was derived to take into account the most widespread configuration of connection installations for load and generation customers.

#### *Allocation by Ownership*

- 2.12 Consistent with Section 2.2 of this Policy, connection assets can further be define through the boundaries of load customers connected to the transmission and sub-transmission system.

#### Load Customers Connected to the Transmission System

- 2.13 As a general rule, customers who require connections to the transmission system are expected to provide the *last mile* connections. As such, all connection assets are paid for by the connecting customer. However, the safe and reliable operations of the assets are critical to the integrity of the grid and, thus, cannot be turned over to the customer for control. Some control operations may be assigned to the customer, however, on a case-to-case basis.

2.14 In the event that a customer is connected to the transmission line via *bus-in* (Diagram 1, Illustrative Examples), *cut-in* (Diagram 2) or *radial* (Diagram 3), the customer may turn over the connection facilities, subject to the payment arrangements, to TransCo. The portion of the connection charge that is based on a reasonable return on assets, or on recovering depreciation of assets, shall be based only on the value of the connection assets paid for by TransCo. Operation, maintenance and overhead costs related to the connection assets, including those parts not initially provided or paid for by the TransCo, shall be recovered in the connection charges, except where a customer chooses, and is allowed, to maintain and operate the assets in accordance with the OATS.

#### Load Customers Connected to the Sub-Transmission System

2.15 As a general rule, connection assets for use of load customers include the land occupied by the substation, the building and other structures therein, the transformers and its associated facilities, the substation facilities on the secondary side (i.e., where the voltages are lower) of the transformer, and the sub-transmission lines including the towers/poles feeding the distribution system substation(s).

2.16 Customers connected to the sub-transmission system are generally connected via dedicated feeder circuits for each customer or set of customers. These circuits are further connected to the transmission system through the transformer feeder circuits intended for the connected customer(s).

2.16.1 The transformer feeder circuits are connection assets common to all customers. These *common assets* include, but is not limited to, the following equipment and structures. (refer to Diagrams 4 and 5, Illustrative Examples):

- a. circuit breakers, current transformers, and disconnect and earthing switches at the transmission bay (equipment at the high voltage side of the transformer);
- b. transformer;
- c. lightning arresters;
- d. circuit breakers, disconnect and earthing switches, and current and voltage transformers at the low voltage side of the transformer;
- e. transformer protection; and
- f. switchyard gantry where the dedicated feeder circuits of the customers are connected.

2.16.2 Dedicated feeder circuits assets include the following:

- a. circuit breakers;
- b. disconnect and earthing switches;
- c. current transformers;
- d. voltage transformers;
- e. lightning arresters; and
- f. line protection.

#### Generation Customers

2.17 Connection assets of generation customers will be based on the Boundary Asset Schedule jointly prepared by TransCo and NPC.

2.18 These connection assets can also be identified based on the following schemes:

- a. in the general case wherein the substations uses the *radial scheme* for generating plants, the outgoing /radial lines feeding from the generation customer common transmission voltage bus bar, the corresponding single power circuit breaker bound on both sides by disconnecting switches and the earthing switches, and all other equipment, including protection equipment, located on the load side of the switches but before the metering and telecommunications equipment are connection assets (refer to Diagram 6, Illustrative Examples);
- b. in the case of generating plants using the *ring bus scheme*, the outgoing lines connected to the generator feeder lines, the single power circuit breaker providing a connection between the outgoing lines at the point of connection with the generator feeder lines, bound on both sides by disconnecting switches, and all other equipment, including protection equipment, located on the load side of the switches but before the metering and telecommunications equipment are connection assets (refer to Diagram 7 and 8, Illustrative Examples);
- c. In case of outgoing lines for generating plants with *two (2) bays* using the *1½ circuit-breaker scheme*, the outgoing lines, the corresponding single power circuit breaker bound on both sides by disconnecting switches inclusive of the earthing switches and the outermost bus bar with respect to the generator and all other equipment, including protection equipment, located on the load side of the generation

customer's disconnect switches, but before the metering, and telecommunications equipment are connection assets; for bays where no incoming lines are connected, the whole bay and all other equipment, including protection equipment, located on the load side of the generation customer's disconnect switches, but before the metering and telecommunications equipment are all considered as connection assets (refer to Diagram 9, Illustrative Examples); and

- d. In case of outgoing lines for generating plants with *three (3) bays* or more using the *1½ circuit-breaker scheme*, the outgoing lines, the outermost bus bar with respect to the generator, the adjacent single power circuit breaker bound on both sides by disconnecting switches inclusive of the earthing switches, and all other equipment, including protection equipment, located on the load side of the switches but before the metering and telecommunications equipment are connection facilities; for bays where no incoming lines are connected, the whole bay and all other equipment, including protection equipment, located after the switches but before the protection, metering, and telecommunications equipment are all considered as connection assets (refer to Diagram 10 and 11, Illustrative Examples).

#### *Allocation by Network Use of System*

- 2.19 In the event that the ownership of connection assets cannot be clearly established in terms of the above schemes, the connection points and boundaries shall be defined by the assets' function. And in such case, minimal connection charges shall be applied to customers directly connected to the grid where the primary function of the identified connection assets is grid-related.
- 2.20 TransCo recognizes that there are connection sites that are wholly owned by customers and that, within these sites, there are connection facilities performing grid functions. Operation of these assets is necessary to maintain the integrity, stability, and reliability of the grid. Consequently, TransCo shall assume responsibility for managing, operating and maintaining them. In such cases, Section 2.10 of this Policy will apply. Ownership of part of such assets may likewise be assumed by TransCo, subject to appropriate compensation, should the system require and subject to ERC approval. Cost responsibility for the recovery of operation, maintenance, and investment in the assets shall be consistent with this Policy.

Note: Under the Module B, OATS Rules, the Connected Transmission Customer is obliged to operate and maintain their connection facilities in a safe and efficient manner and in accordance with good industry practice. However, since these connection assets are critical in preserving the integrity of the grid, it is incumbent upon TransCo to assume the responsibility for operating and maintaining the connection assets that perform grid functions.

## Connection Assets Definition and Sub-Transmission Assets

- 2.21 Consistent with ERC's Guidelines to the Sale and Transfer of the Transco's Sub-Transmission Assets and Franchising of Qualified Consortiums, Transco is obliged to sell the relevant Sub-Transmission Assets to any connected distribution utility that meets the qualifications set therein. However, the sale process could take some time and it may also be possible that some distribution utilities may not immediately meet the required qualifications. In such event, Transco will be collecting the appropriate connection charges to recover the costs associated with ownership, operation, and maintenance of the sub-transmission assets in the interim period until such assets are sold.
- 2.22 In many but not all cases, the assets that Transco would consider appropriate for inclusion under its connection charging policy will be the same as those assets defined as Sub-Transmission Assets by the ERC in its 17 October 2003 Order. To the extent possible and practicable, Transco shall treat all Sub-Transmission Assets covered by the ERC Order as Connection Assets for the purposes of its Connection Assets Definition and, subsequently, the Connection Charges.
- 2.23 Consequently, Transco Connections Assets shall include *any other sub-transmission assets that would not otherwise meet the Connection Assets definition*. This will be reflected in the costs associated with the ownership, operation, and maintenance of all sub-transmission assets being recovered from the customers in the same manner as other connection assets (i.e., based on the cost of the specific equipment and maintenance of that equipment at the customers' specific points of connection). This will also mean that until such time that the sub-transmission assets are sold, Transco will not need to alter any of its other charges.

Note: Customers purchasing such sub-transmission assets will simply see their connection charges fall by *the* appropriate amount.

## Connection Agreement

- 2.24 The connection agreement between TransCo and the transmission customer(s) forms part of the TSA. However, TransCo will entertain proposal for connection agreements in so far as they are consistent with the OATS Rules and Grid Code and all their subsequent amendments as approved by the ERC.
- 2.25 TransCo will also entertain proposals to amend existing connection agreement from customers who wish to upgrade or augment the existing connection setup.

## **3.0 Calculation of Basic Connection Charges**

### Connection Asset Valuation

- 3.1 Initial total cost of all connection assets for TransCo includes the cost of bought in services, allocated equipment and direct engineering costs, and construction work in progress including interest during construction.
- 3.2 For the purpose of setting the connection charges prior to the start of the Second Regulatory Period, the method of Optimized Depreciated Replacement Cost (ODRC) will be used. The replacement cost of the connection assets will be based on the TransCo estimates, conducted by Engineering Design and Construction Group, and depreciated to account for the remaining useful life of the assets. A standard straight line depreciation will be used for all connection assets based on existing depreciation schedule as approved by the ERC.
- 3.3 For the Second Regulatory Period and Subsequent Regulatory Period, valuation of all connection assets will be based on the asset re-valuation consistent with Section 4.6 of the Guidelines on the Methodology for Setting Transmission Wheeling Rates (TWRG) and Section 5.6, respectively.

### Connection Charges

- 3.4 In so far as consistent with the latest approved Module F of the OATS Rules, the following shall apply:

The Connection Charge recovers that proportion of the TransCo's Maximum Annual Revenue cap that is associated with the cost of connecting the Customers' Facilities to the Grid and is payable by Generation Customers and Load Customers.

### Connection Charges Payable by Connected Customers

- 3.5 Where connection assets are used by one Transmission Customer only, the Connection Charge payable each month by the Transmission Customer for those assets shall be determined as follows:

$$\text{Connection Charge} = \frac{(\text{ODRC}_i * \text{WACC}) + D_i + M_i + O_i}{12}$$

Where:

ODRC<sub>i</sub> = Is the Optimised Depreciated Replacement Cost of the connection asset as determined under F(AII)3.1 of the OATS Rules

WACC = Is the Weighted Average Cost of Capital as determined under F(AII)3.2 of the OATS Rules

- $D_i$  = Is the depreciation cost expense of the connection asset for the current year, as determined under F(AII)3.3 of the OATS Rules
- $M_i$  = Is the maintenance cost attributable to the connection asset for the current year, as determined under F(AII)3.4 and F(AII)3.5 of the OATS Rules
- $O_i$  = Is the overhead cost attributable to the connection asset for the current year, as determined under F(AII)3.6 of the OATS Rules

3.6 Where connection assets are used by two or more customers, the Connection Charge payable by the customers for that those assets shall be determined as follows:

$$\text{Connection Charge} = \frac{((\text{ODRC}_i * \text{WACC}) + D_i + M_i + O_i) \times \text{TCA}}{12}$$

Where:

- $\text{TCA}$  = Is proportion of the connection charge allocated to the Transmission Customer for the shared connection asset as determined under F(AII)3.7 of the OATS Rules

All other components are the same as under F(AII)2.1 of the OATS Rules.

#### Components of the Connection Charge

- 3.7 TransCo shall maintain a register of the connection assets attributable to each Connected Transmission Customer. This register shall:
- a. Allocate to each Connected Transmission Customer the assets connecting that Customer's facilities to the Grid, as determined by applying a Connection Definition Method approved by ERC;
  - b. Record the current value of each connection asset using the Optimised Depreciated Replacement Cost method approved by ERC under the TWRG, or if the circumstances specified in Section 4.6.4 of the TWRG apply, the valuation methods specified in that Section.

- c. Record the Regulated Depreciation for the current Regulatory Year for each connection asset as determined by a method approved by the ERC under the TWRG.

3.8 The Weighted Average Cost of Capital shall be determined by the method approved by ERC under the TWRG, and for the purposes of determining the Connection Charge shall be expressed in pre-tax terms.

3.9 Depreciation costs ( $D_i$ ) for each connection asset for the current Regulatory Year shall be as specified in F(AII)3.1(c) of the OATS Rules.

3.10 The Connection Charge shall include an allocation ( $M_i$ ) of TransCo's total routine maintenance costs determined as follows:

$$M_i = \begin{cases} SMC_i & \text{where the connection asset is a substation asset;} \\ \text{or } LMC_i & \text{where the connection asset is a line asset} \end{cases}$$

Where

$$SMC_i = \text{Is the amount of the substation maintenance costs to be recovered in relation to each substation connection asset, as determined under F(AII)3.5(a) of the OATS Rules}$$

$$LMC_i = \text{Is the amount of the line maintenance costs to be recovered in relation to each line connection asset, as determined under F(AII)3.5(b) of the OATS Rules}$$

3.11 The amount of maintenance costs to be recovered in relation to each connection asset shall be determined as follows:

- a.  $SMC_i$  shall be determined by multiplying the Optimised Depreciated Replacement Cost of each substation connection asset by a substation maintenance recovery rate (SMRR) determined by the following formula:

$$SMRR = \frac{ASMC}{\sum SRC_i}$$

Where

$$ASMC = \text{Four year average of actual substation maintenance costs}$$

$$\sum SRC_i = \text{Total replacement cost value of substation Aggregated ODRC of all substation assets}$$

- b. LMC<sub>i</sub> shall be determined by multiplying the optimised line length for each connection line asset by a line maintenance recovery rate (LMRR) appropriate for the voltage and type of line determined by the following formula:

$$\text{LMRR} = \frac{\text{ALMC}}{\sum \text{LL}_i}$$

Where:

ALMC = Four year average of actual line maintenance costs for relevant line category

$\sum \text{LL}_i$  = Total actual length of lines in relevant category.

3.12 A contribution to overhead costs shall be included in the Connection Charge and determined as follows:

- a. The overhead cost (O<sub>i</sub>) to be included in the Connection Charge for each connection asset shall be determined as follows:

$$O_i = \frac{\text{RCCA}_i \times \text{COC}}{\sum \text{RCCA}_i}$$

Where:

RCCA<sub>i</sub> = Replacement cost of the connection asset

$\sum \text{RCCA}_i$  = Total Replacement Cost value of all connection assets

COC = Proportion of total overhead costs to be recovered through connection charges as determined under F(AII)3.6(b) of the OATS Rules

- b. The proportion of total overhead costs (COC) to be recovered through Connection Charges shall be determined by the following formula:

$$\text{COC} = \frac{\sum \text{RCCA}_i \times \text{OC}}{\text{RAB}}$$

Where:

$\sum \text{RCCA}_i$  = Total Replacement Cost value of all connection assets

RAB	=	Regulated Asset Base as determined under the TWRG
OC	=	Total overhead costs

3.13 Where a connection is shared by two or more customers, the proportion of the connection charge payable by each Transmission Customer (TCA) is determined as follows:

$$TCA = \frac{BD_i}{\sum BD_i}$$

Where:

$BD_i$  = Generator Billing Determinant as determined under F(AI)2.2 or the Load Billing Determinant as determined under F(AI)3.2 of the OATS Rules, as the case may be, for the customer at the respective Point of Connection

$\sum BD_i$  = Sum of the Billing Determinants of all customers at the respective Point of Connection

#### 4.0 Other Charges

4.1 In addition to the basic annual connection charges, customers may pay TransCo for certain other costs related to their connection. These will be set out in the TSA where appropriate and are described below:

##### Irregular Works

4.2 To provide a connection, TransCo may need to carry out works on the transmission system, which although are directly attributable to the connection, may not give rise to additional connection assets. Where the transmission customer or customers are liable for the irregular works, they will pay a charge equal to the cost of the work involved, including a reasonable return.

4.3 Payment for the irregular works shall be paid on an agreed date, which is usually upon completion of the works. However, arrangements may be agreed between TransCo and the transmission customer(s) to pay the charge over a longer period.

##### Land

- 4.4 A Land Charge Base Amount shall be calculated based upon a reasonable rate of return on the costs incurred by TransCo on purchase of the land used facilitate the connection. Valuation of the land for connection charges for the First Regulatory Period shall be based on the book value of the assets indicated in the Asset Register as of the end 2002.
- 4.5 As for the Second and Subsequent Regulatory Period, re-valuation of the land will be subject to the valuation of assets consistent with Section 4.6 of the Guidelines on the Methodology for Setting Transmission Wheeling Rates (TWRG) and Section 5.6, respectively.

#### Miscellaneous/Termination Charges

- 4.6 Other contract specific changes, including termination charges, may be payable by the transmission customer(s), these will be set out in the TSA.

### **5.0 Contestability**

- 5.1 Some connection activities may be undertaken by the customers. The activities are the provision or construction of connection assets, the financing of connection assets, and the on-going maintenance of those assets. These activities can be used as grounds for contestability. However, contestability should not prejudice the integrity and reliability of the grid.

#### Contestability in Construction and Maintenance Services

- 5.2 Customers wishing to provide and maintain their own connection assets may do so as long as it is consistent with the Grid Code and the OATS Rules.

#### Contestability Procedure and Connection Terms

- 5.3 Customers keen on see contestability wherever possible may do so as long as consistent with the OATS Rules.

### **6.0 Asset Replacement**

#### Early Asset Replacement

- 6.1 If in TransCo's reasonable opinion, a connection asset requires replacement before it reached its replacement period, TransCo will continue to charge for the original asset and make no changes to the existing customers for the new asset until the replacement period of the original asset.
- 6.2 Upon the expiration of the original replacement period, the transmission customer will then be charge the depreciated value of the new asset.

- 6.3 If the replacement asset is not commissioned until after the replacement period, then the customer's charges will solely cover ongoing site specific maintenance and overhead. Charges for the replacement assets will only begin on the notified charging date of the replacement asset.

#### Assets Operating after their Replacement Period

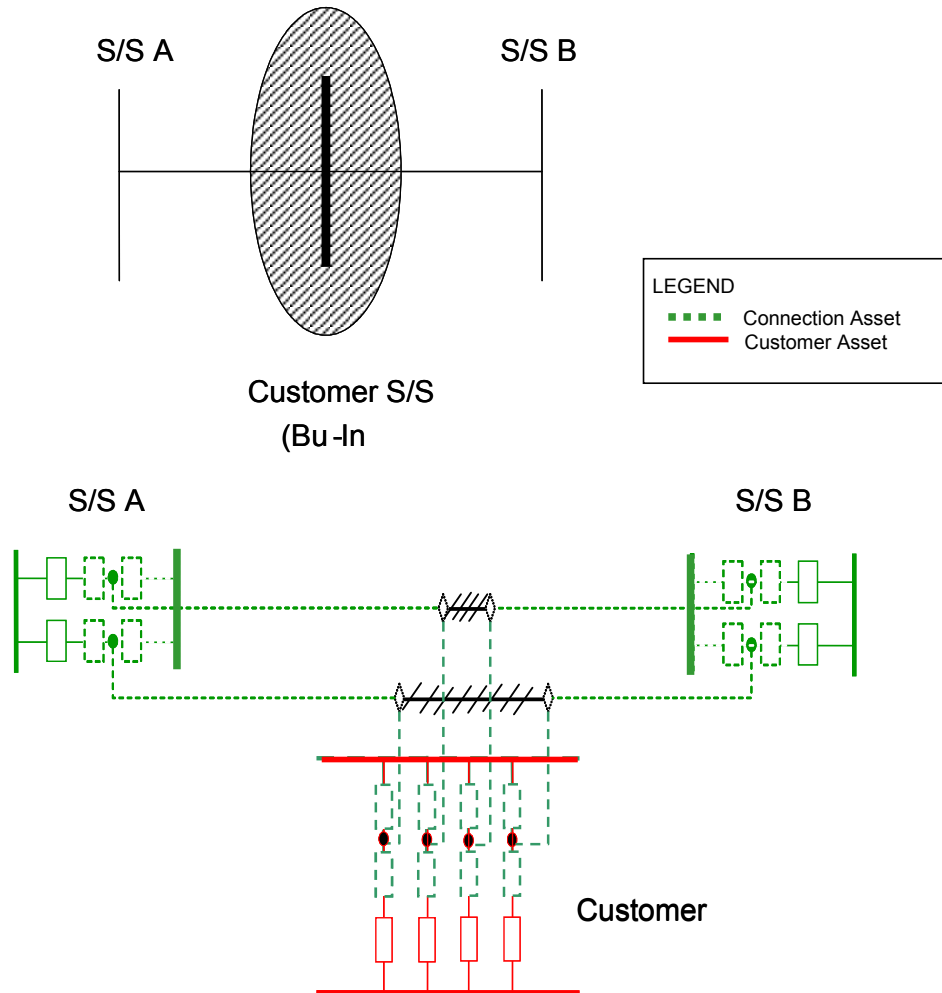
- 6.4 Once the connection assets have reached the end of the replacement period, there are a number of different types of agreement that may be reached between TransCo and the customers.
- 6.5 If TransCo has notified that assets will remain in service beyond their replacement period and no counter notice has been received from the customers, then the following alternative types of agreement are offered to the customers.
- a. TransCo and the customer will agree on a date beyond the replacement period on which the assets will be replaced and the customer accepts the obligation to pay for the charges of those new assets upon commissioning.
  - b. TransCo and the customer will agree on a firm price agreement for a set period of time covering the assets, which have remained in service beyond their replacement period.
  - c. Pending agreement as to enduring arrangement above, the customer agrees to sign an offer to vary the TSA for those assets currently or will be operating beyond their replacement period.

### **7.0 Data Requirements**

- 7.1 TransCo may require additional data not included from customers to calculate the connection charges payable.

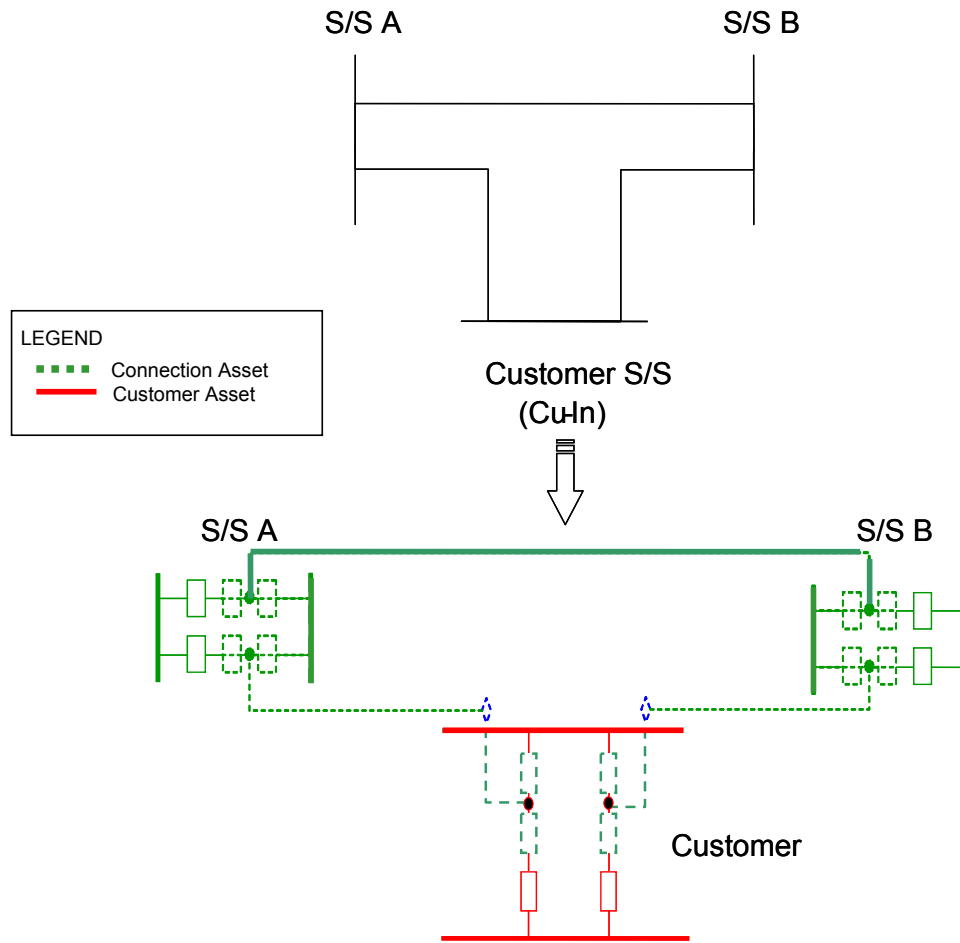
## Illustrative Examples

Diagram 1: Bus-In (230 kV or 138 kV)



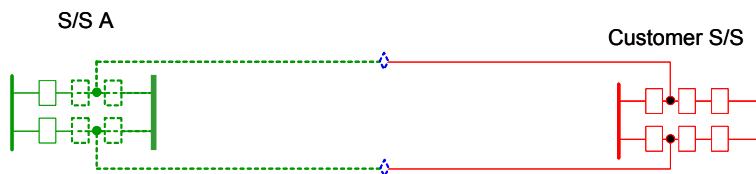
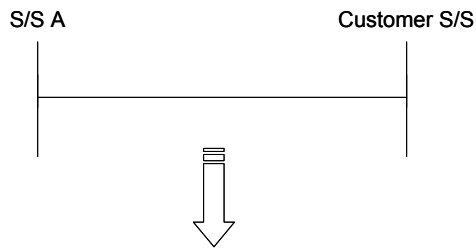
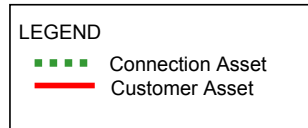
List of Equipment
Circuit Breakers
Disconnect Switches
Current Transformers
Lightning Arresters
Line Protection
Distance Protection
Line Differential
Bus, Conductors, Hardware
Power and Control Cables
Grounding
Structures
Towers/Poles

Diagram 2: Cut-In (230 kV or 138 kV)



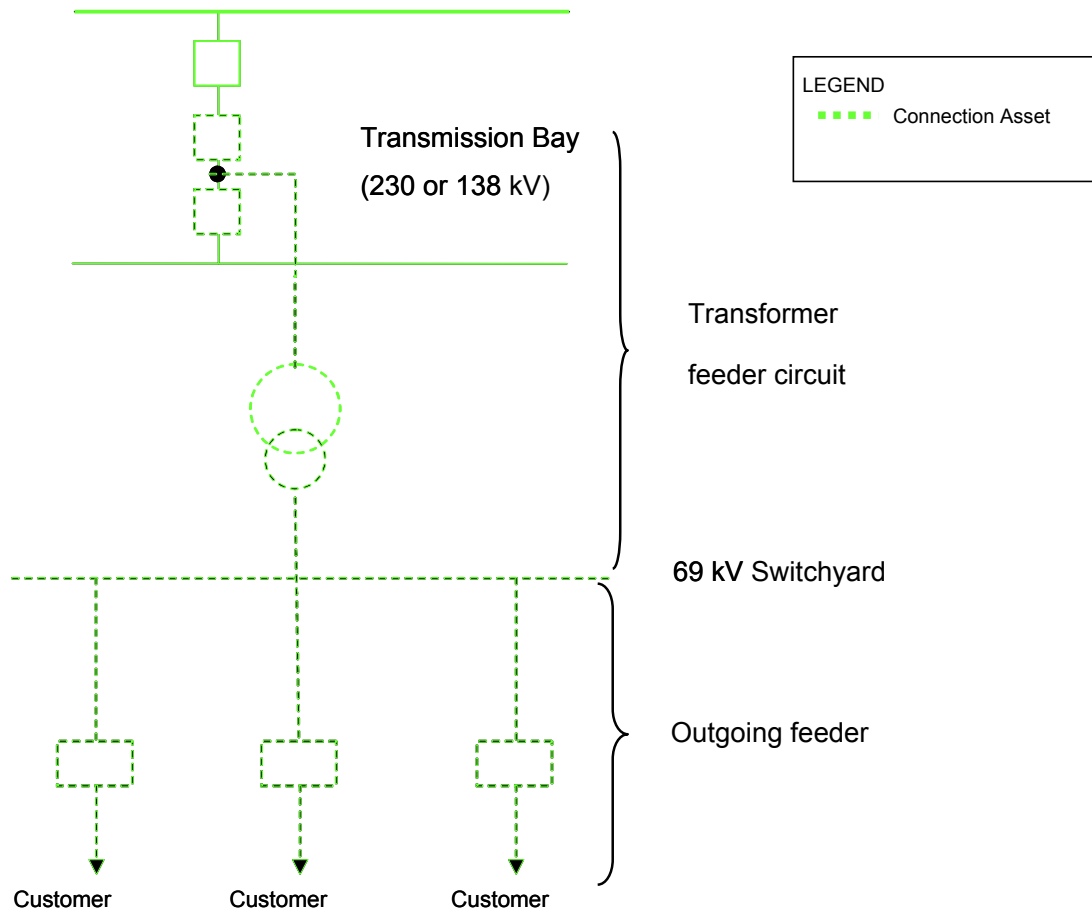
List of Equipment
Circuit Breakers
Disconnect Switches
Current Transformers
Lightning Arresters
Line Protection (2 lines)
Distance Protection
Line Differential
Bus, Conductors/Lines
Power and Control Cables
Hardware
Grounding
Structures
Towers/Poles

Diagram 3: Radial (230 kV or 138 kV)



List of Equipment
Circuit Breakers
Disconnect Switches
Current Transformers
Lightning Arresters
Line Protection
Distance Protection
Line Differential
Bus, Conductors/Lines
Power and Control Cables
Hardware
Grounding
Structures
Towers/Poles

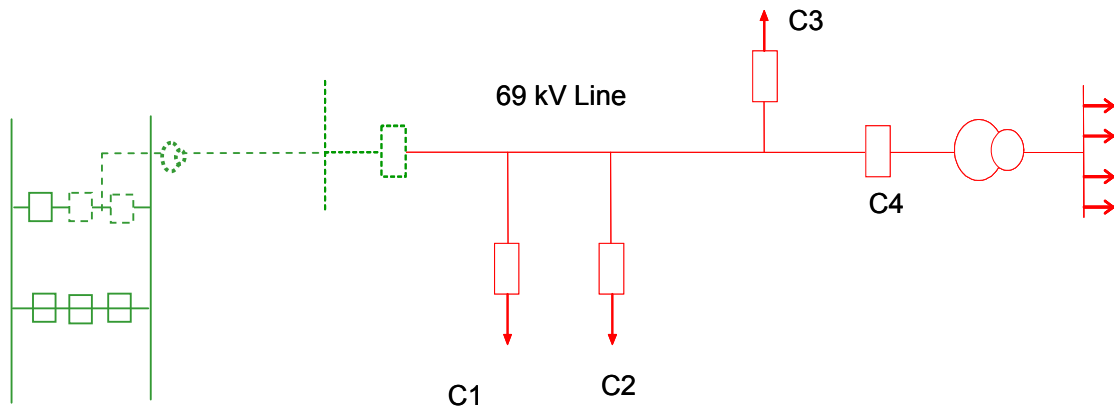
Diagram 4: Transformer Feeder Circuit (69 kV)



List of Equipment	
Transformer Feeder Circuit	
Transformer	
Circuit Breakers (230 or 138 kV)	
Disconnect Switches (230 or 138 kV)	
Current Transformers (230 or 138 kV)	
Lightning Arresters (230 or 138 kV)	
Disconnect Switch (230 or 138 kV)	
Disconnect Switches (69 kV – structure mounted)	
Circuit Breaker (69 kV)	
Current Transformer (69 kV)	
Voltage Transformer (69 kV)	
Outgoing Feeder Circuit	
Disconnect Switch (69 kV – Structure Mounted)	
Disconnect Switch (69 kV)	
Circuit Breaker (69 kV)	
Current Transformers (69 kV)	
Voltage Transformers (69 kV)	
Lightning Arresters (69 kV)	
Transformer Protection	
Protection 1	
Protection 2	
Line Protection	
Overcurrent Protection	

List of Equipment
Structures
Grounding
Bus, Conductors/Lines
Power and Control Cables

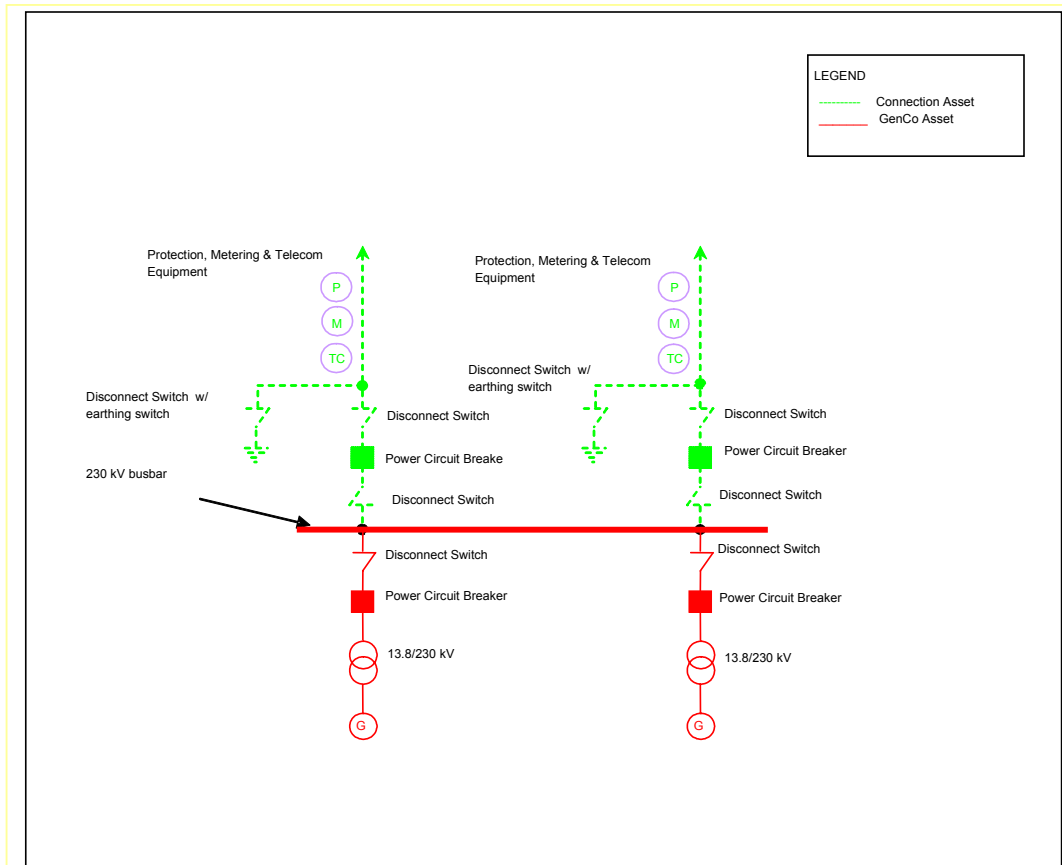
Diagram 5: Multiple Connection in One Feeder (69 kV)



LEGEND	
■ ■ ■ ■	Connection Asset
—	Customer Asset

List of Equipment
Transformer Feeder Circuit
Transformer
Circuit Breakers (230 or 138 kV)
Disconnect Switches (230 or 138 kV)
Current Transformers (230 or 138 kV)
Lightning Arresters (230 or 138 kV)
Disconnect Switch (230 or 138 kV)
Disconnect Switches (69 kV – structure mounted)
Circuit Breaker (69 kV)
Current Transformer (69 kV)
Voltage Transformer (69 kV)
Outgoing Feeder Circuit/customer
Disconnect Switch (69 kV – Structure Mounted)
Disconnect Switch (69 kV)
Circuit Breaker (69 kV)
Current Transformers (69 kV)
Voltage Transformers (69 kV)
Lightning Arresters (69 kV)
Line Protection
Over-current Protection
Structures
Grounding
Bus, Conductors/Lines
Power and Control Cables

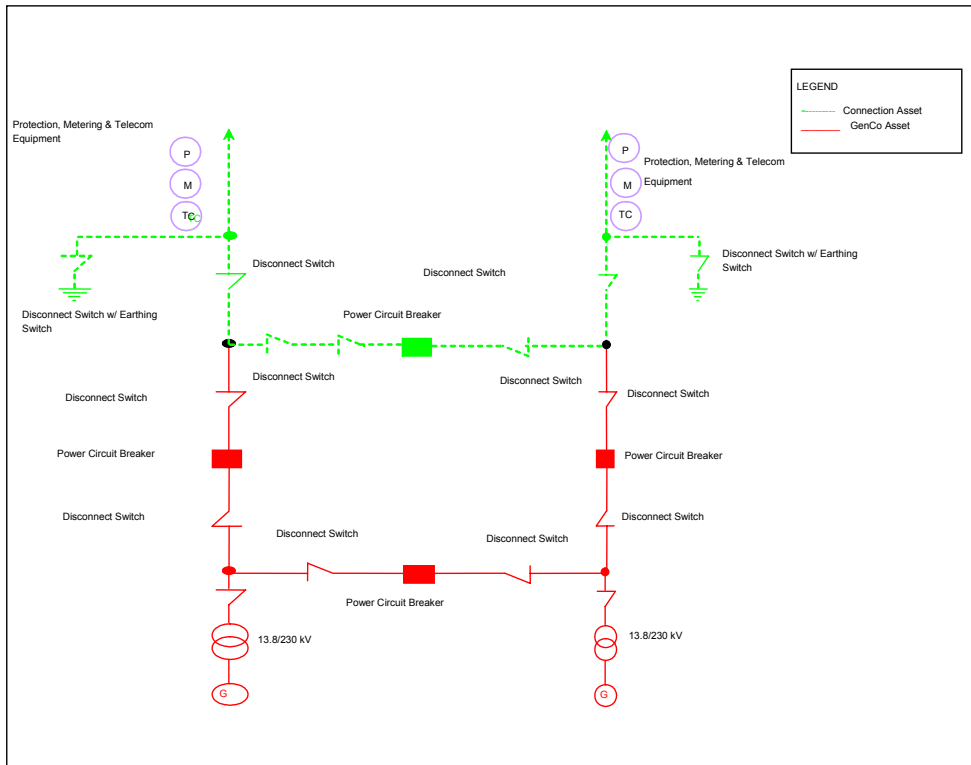
**Diagram 6: Connection Assets for Switchyards using the Radial scheme for Generation Customers**



**List of Equipment (per outgoing feeder line)**

All Power Circuit Breaker (PCB) bound by Disconnect Switches for outgoing lines with respect to the generator
All Disconnect Switches (DS) for outgoing lines with respect to the generator
All DS with Earthing Switch (if present) with respect to the generator
All associated Current Transformers, Potential Transformers, Arresters and other equipment inclusive in the presented diagram deemed as connection assets (equipment for Metering and Telecommunications are excluded from being connection assets)
Protection equipment for outgoing lines with respect to the generator
Outgoing feeder lines with respect to the generator

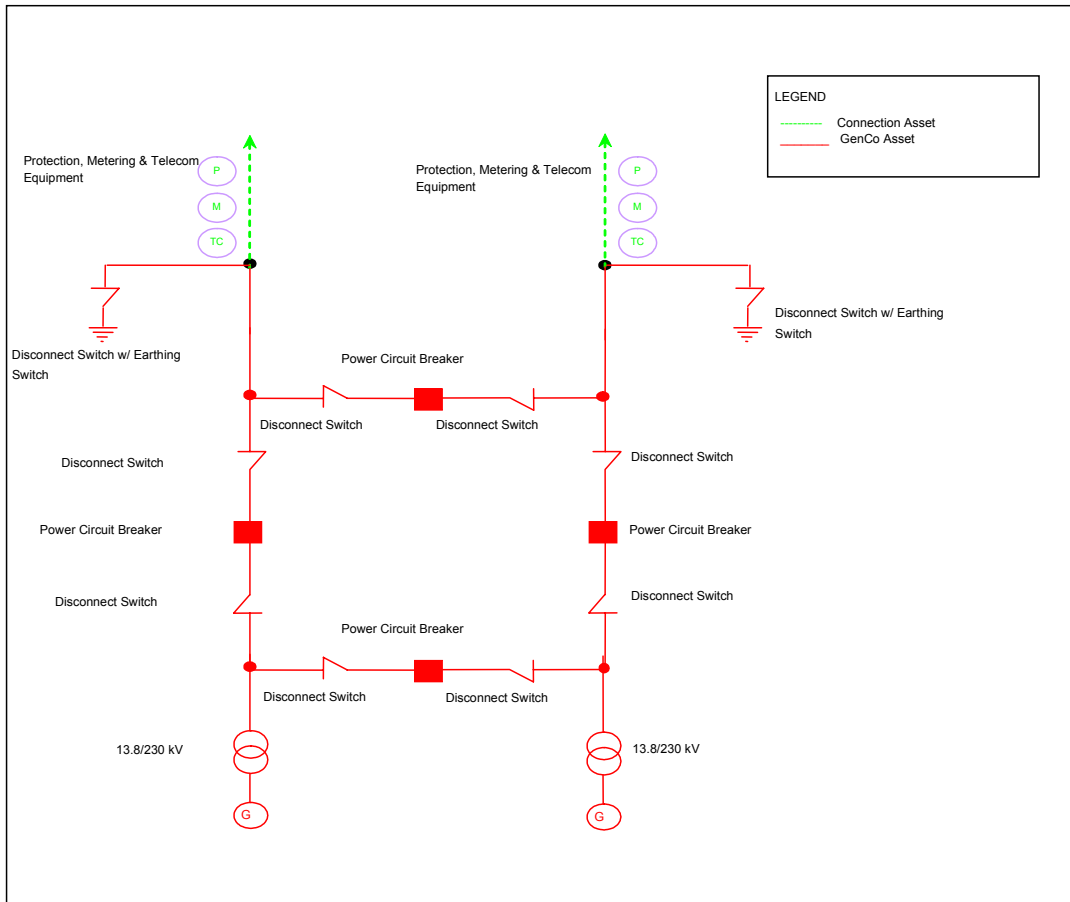
**Diagram 7: Connection Assets for Switchyards using the Ring Bus scheme for NPC Generating Plants.**



**List of Equipment (per scheme)**

The whole bay non-adjacent to the incoming lines from the generator inclusive of the Power Circuit Breaker (PCB) and the Disconnecting Switches (DS)
All Disconnect Switches (DS) for outgoing lines with respect to the generator
All DS with Earthing Switch (if present) for outgoing lines with respect to the generator
All associated Current Transformers, Potential Transformers, Arresters and other equipment inclusive in the presented diagram deemed as connection assets (equipment for Metering and Telecommunications are excluded from being connection assets)
Protection equipment for outgoing lines with respect to the generator
Outgoing feeder lines with respect to the generator

**Diagram 8: Connection Assets for Switchyards using the Ring Bus scheme for NPC-IPP Plants**



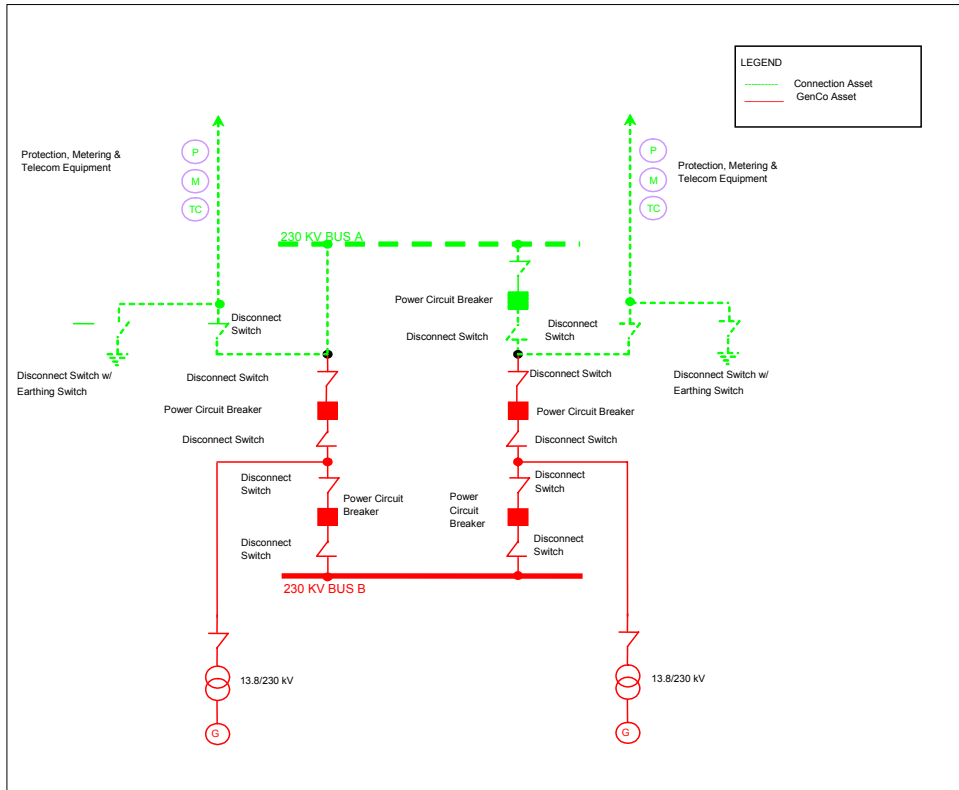
**List of Equipment**

Outgoing feeder lines

All associated Current Transformers, Potential Transformers, Arresters and other equipment inclusive in the presented diagram deemed as connection assets (equipment for Metering and Telecommunications are excluded from being connection assets)

Protection equipment for outgoing lines with respect to the generator

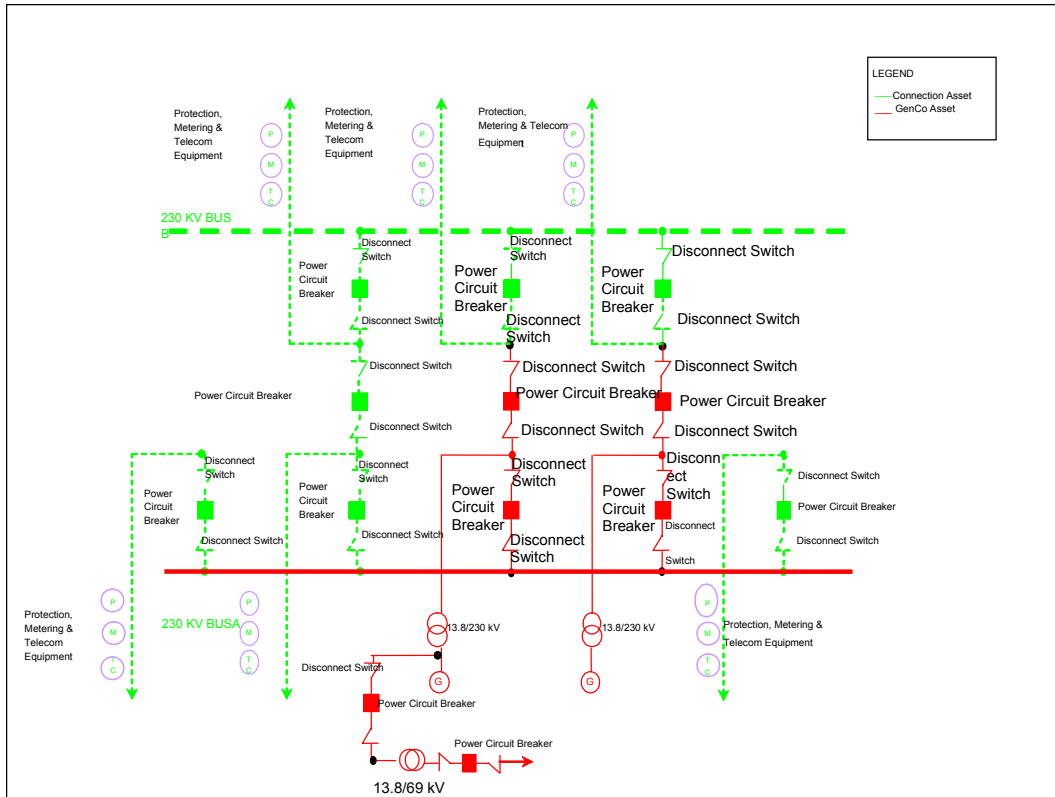
**Diagram 9: Connection Assets for Switchyards using the 1 ½ Circuit-Breaker Scheme under NPC Generating Plants**



**List of Equipment**

One (1) Power Circuit Breaker (PCB) bounded by two (2) Disconnect Switches if the bay has an incoming line from the generator
All Disconnect Switches (DS) for outgoing lines with respect to the generator
All DS with Earthing Switch (if present) with respect to the generator
All associated Current Transformers, Potential Transformers, Arresters and other equipment inclusive in the presented diagram deemed as connection assets (equipment for Metering and Telecommunications are excluded from being connection assets)
Protection equipment for outgoing lines with respect to the generator
Outgoing feeder lines with respect to the generator
Outermost busbar with respect to the generator

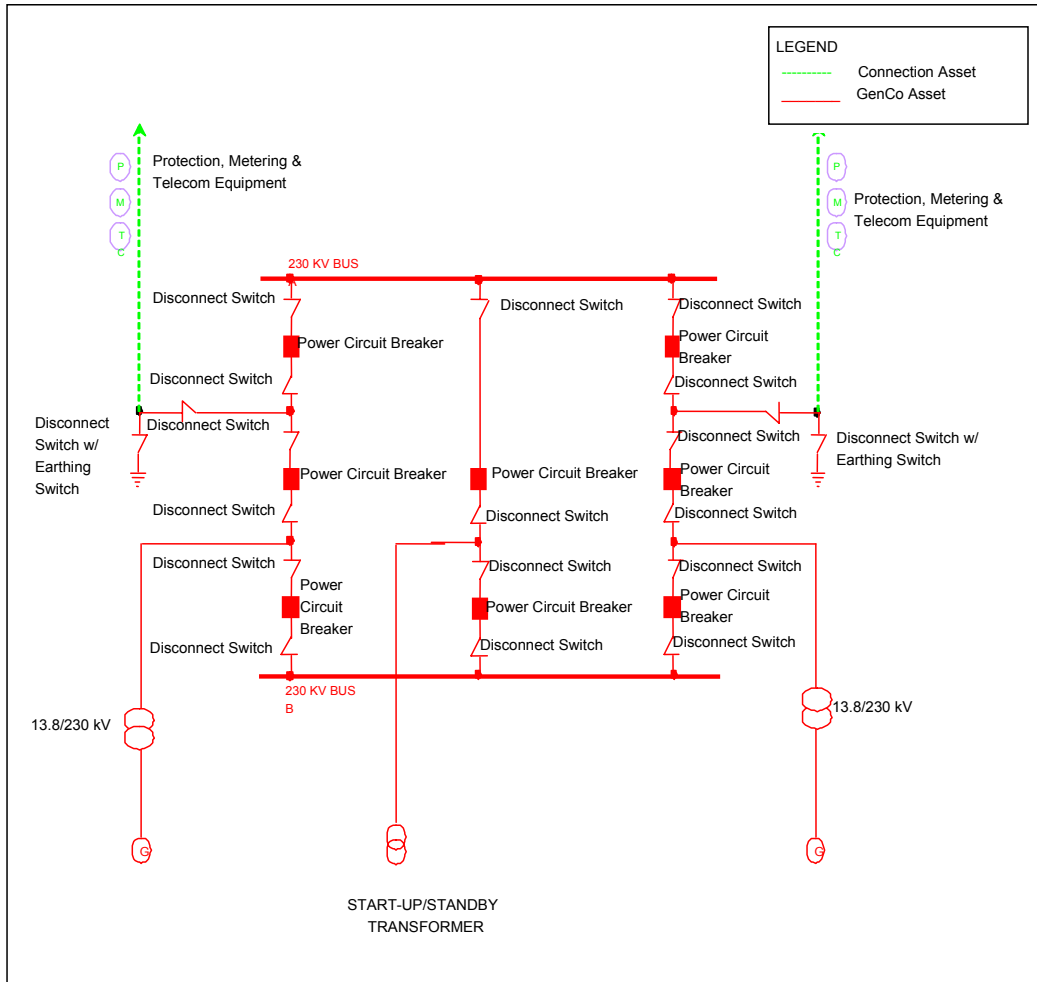
**Diagram 10: Connection Assets for Switchyards using the 1 ½ Circuit Breaker scheme for NPC-Generating Plants**



**List of Equipment**

One (1) Power Circuit Breaker (PCB) bounded by two (2) Disconnect Switches (DS) if the bay has an incoming line from the generator
The whole bay including the PCB's and DS's if there's no incoming line from the generator
Outgoing feeder lines with respect to the generator
All associated Current Transformers, Potential Transformers, Arresters and other equipment inclusive in the presented diagram deemed as connection assets (equipment for Metering and Telecommunications are excluded from being connection assets).
Protection equipment for outgoing lines with respect to the generator
Outermost busbar with respect to the generator
DS with Earthing Switch/es of outgoing feeder lines (if present) with respect to the generator

**Diagram 11: Connection Assets for Switchyards using the 1 ½ Circuit Breaker scheme for NPC-IPP generating plants.**



**List of Equipment**

Outgoing feeder Lines

All associated Current Transformers, Potential Transformers, Arresters and other equipment inclusive in the presented diagram deemed as connection assets (equipment for Metering and Telecommunications are excluded from being connection assets)

Protection equipment for outgoing lines with respect to the generator