

Gas Insulated Switchgear

Working Group Options for Generation connections to the Transmission System

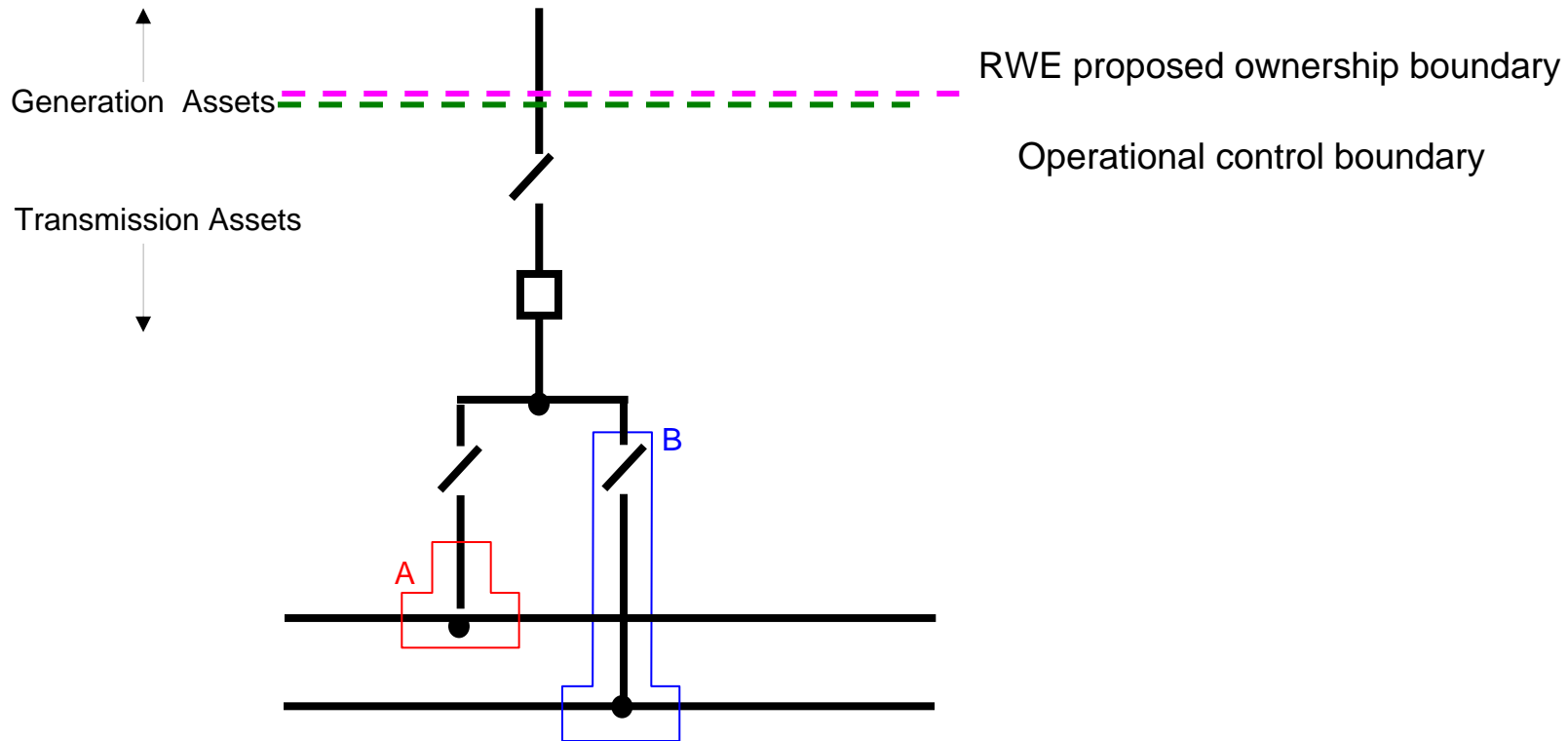
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Option Analysis Summary

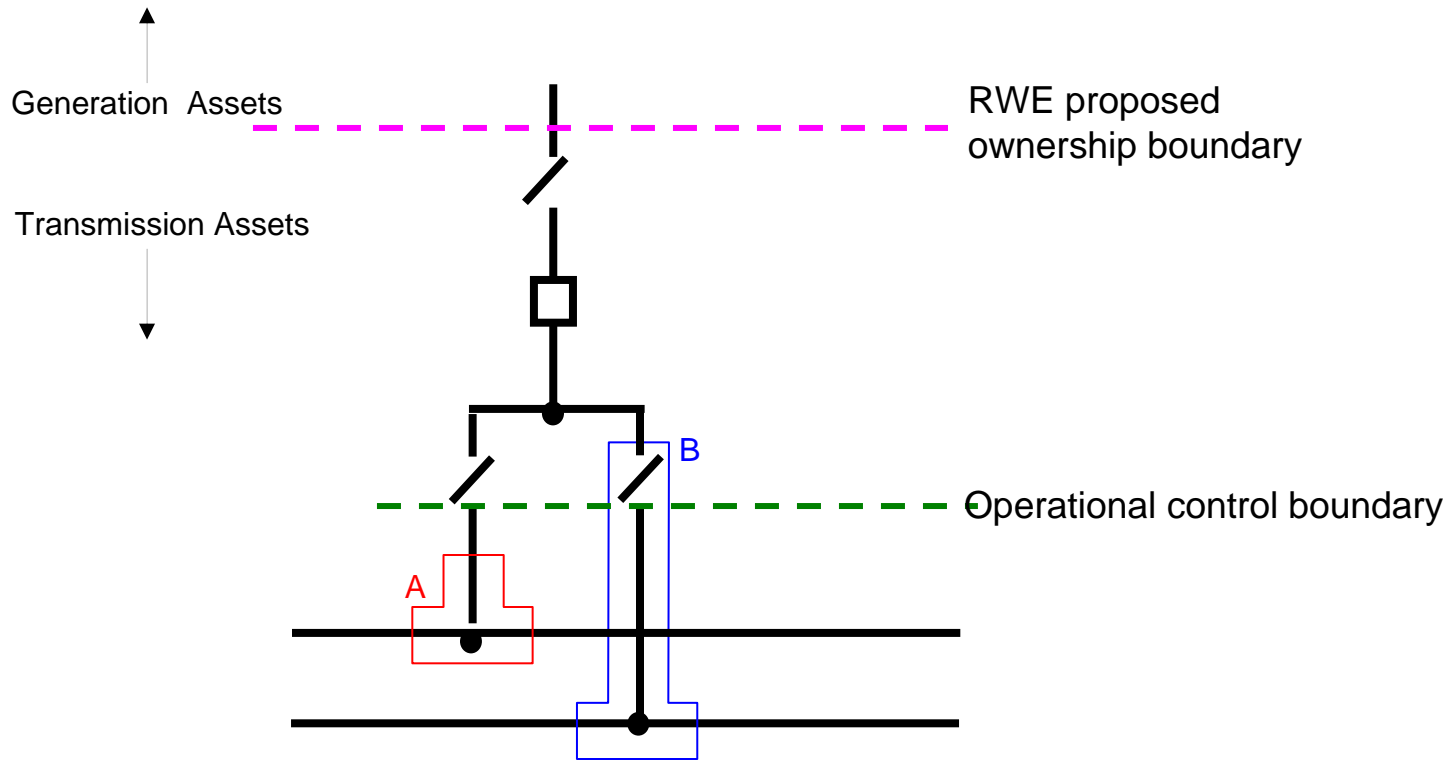
Option	Removes Lic/Unlic Construction issues	Simplifies maintenance	Scales of Construction Economy	Impact to SQSS/ Single circuit risk	Consistency with AIS	Consistency across sites/ types	Clear boundary	Gen Controls Sync Breaker
1	✓✓	✓✓	✓✓	✗	✗	✓✓	✓✓	✗
2	✗	✗	✗	✓✓	✓✓	✗	✗	✓✓
3	✗	✓	✓	✗	✗	✓✓	✓✓	✓✓
4	✗	✗	✓	✓✓	✗	✗	✓✓	✓✓
5	✗	✗	✗	✓✓	✓✓	✗	✗	✓✓
6	✓✓	✗	✓✓	✓✓	✓✓	✗	✗	✓✓

Option 1(a) – RWE's Proposal



Ownership and electrical is moved to include all connected GIS assets at a GIS Substation
e.g. up to the cable sealing/GIS to AIS termination

Option 1(b) – RWE's Proposal



Ownership and electrical is moved to include all connected GIS assets at a GIS Substation
e.g. up to the cable sealing/GIS to AIS termination

Option 1 – RWE model

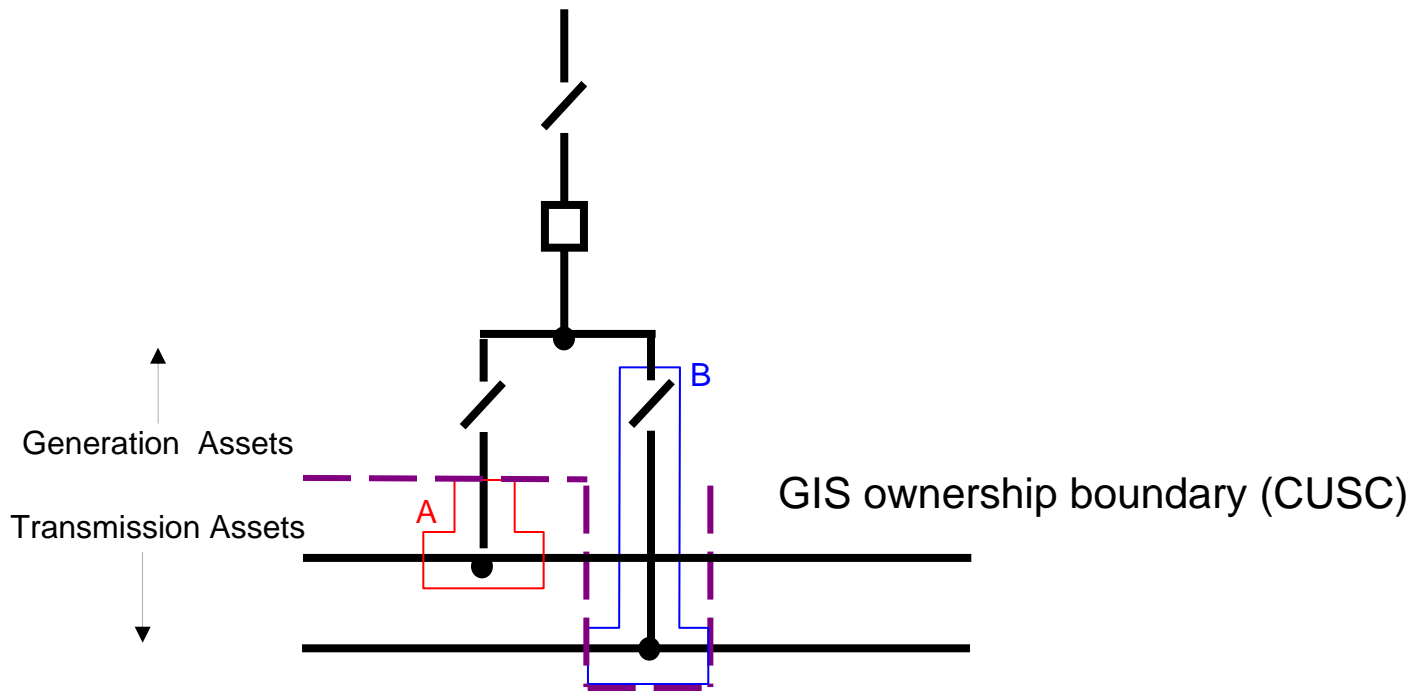
Benefits

- ◆ Addresses construction (complexity and safety) issues and interaction of licenced and unlicenced works
- ◆ Removes inconsistency for future GIS sites (regardless of manufacturer)
- ◆ Reduces complexity for safety management for maintenance
- ◆ Potentially economical solution for one party to build and maintain

Impacts and issues

- ◆ No overall significant change to costs but a change to who funds the assets (CAPEX and OPEX implications that has not been included in the price control)
- ◆ Potential SQSS impact
- ◆ Creates inconsistency with AIS
- ◆ Liabilities, maintenance and compensation
- ◆ Secondary control systems

Option 2 as currently interrupted



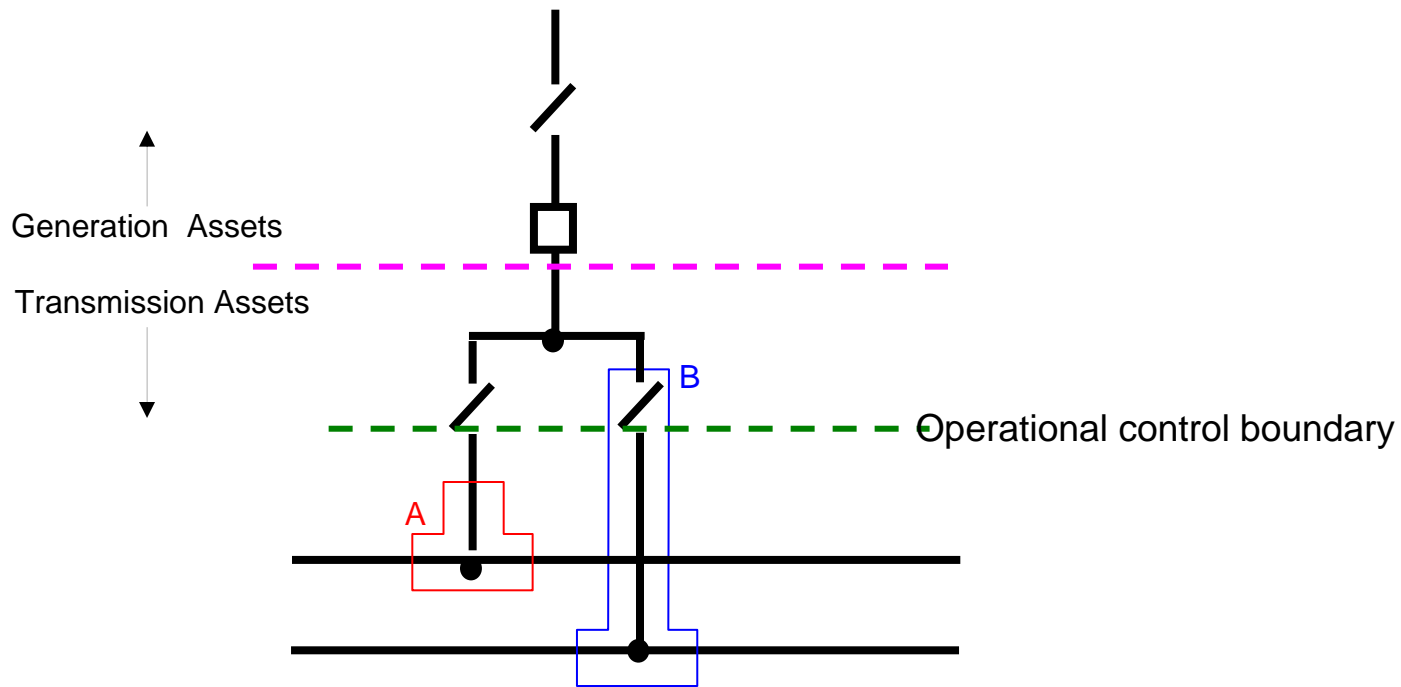
Option 2 as currently interrupted

Benefits

Impacts and issues

- ◆ Existing issues are not addressed
- ◆ Inconsistency across sites depending on manufactured design

Option 3 before the CB



Option 3 before the CB

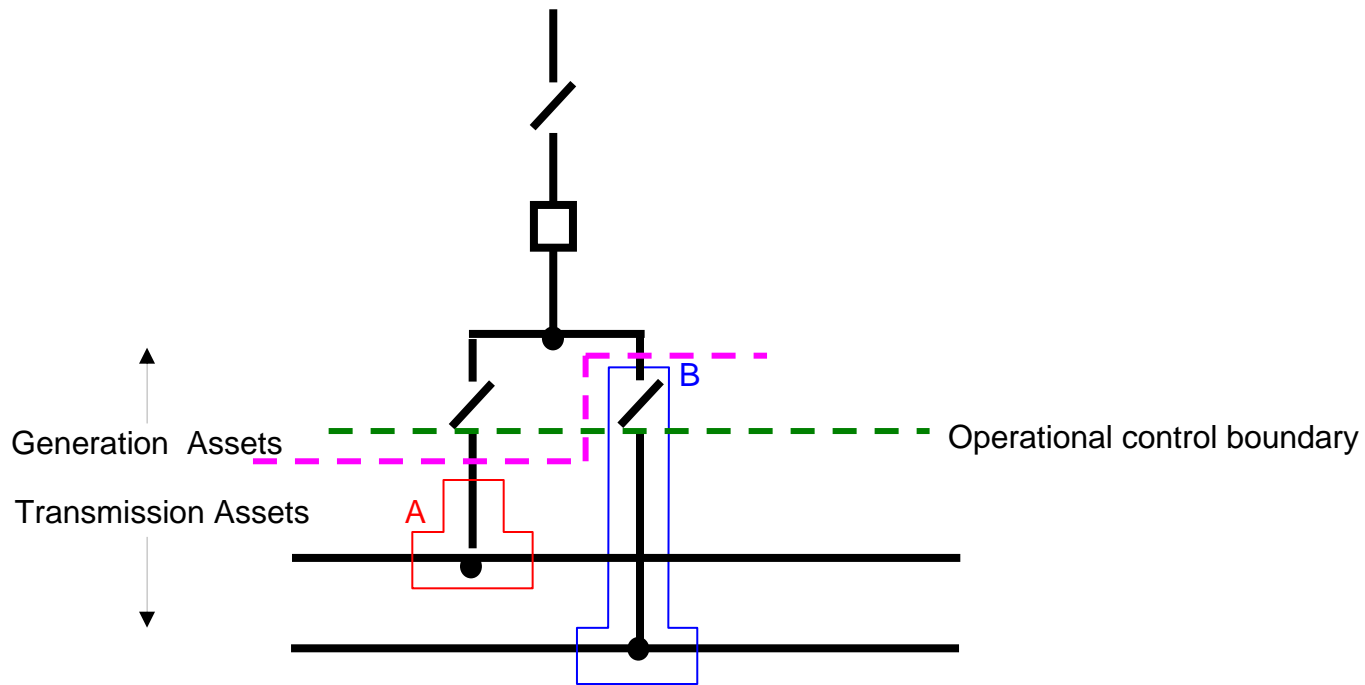
Benefits

- ◆ Visible boundary at the gas zone separator
- ◆ User would be able to remove their assets if they wished
- ◆ Generator has control over their synchronising circuit breaker and circuit disconnect

Impacts and issues

- ◆ Construction issues and licenced/unlicenced interaction not addressed
- ◆ Point of isolation owed by third party
- ◆ No overall significant change to costs but a change to who funds the assets (CAPEX and OPEX implications that has not been included in the price control)
- ◆ Potential SQSS impact
- ◆ Creates inconsistency with AIS
- ◆ Liabilities, maintenance and compensation
- ◆ Secondary control systems
- ◆ Not robust if manufacturers change designs

Option 4 gas separator nearest to busbar



Option 4 gas separator

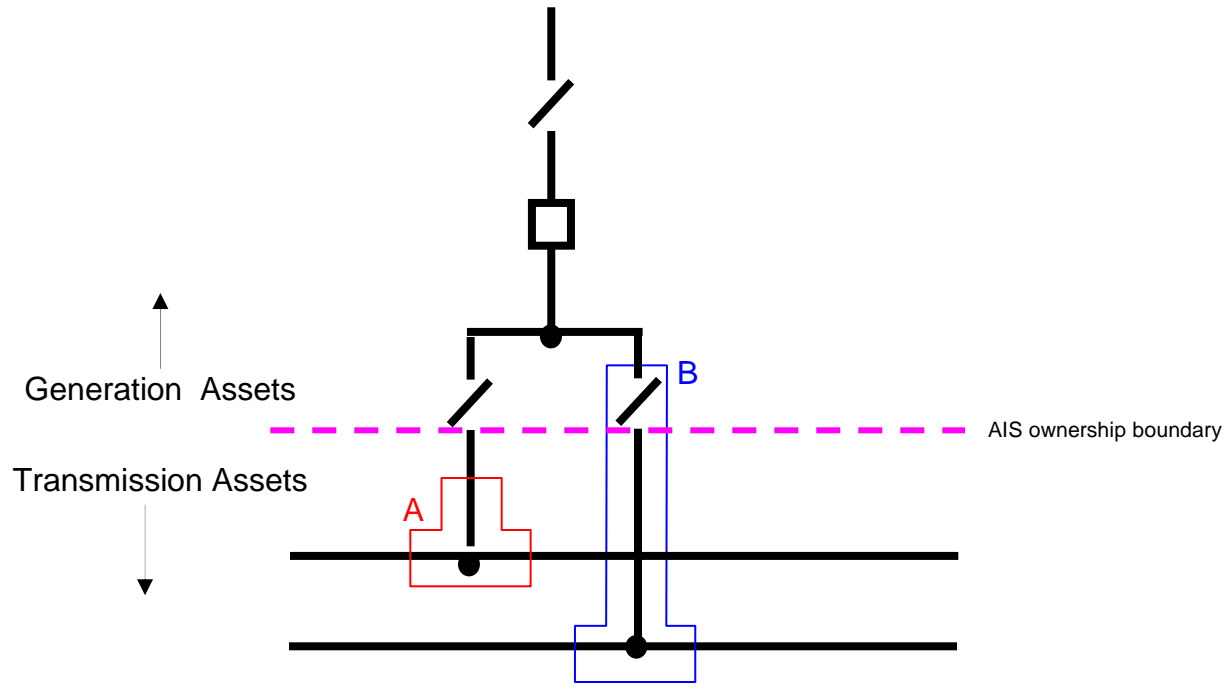
Benefits

- ◆ Visible boundary at the gas zone separator
- ◆ User would be able to remove their assets if they wished
- ◆ Generator has control over their synchronising circuit breaker and circuit disconnecter
- ◆ Double circuit connection – no liability and compensation issues (A only)

Impact and issues

- ◆ Construction issues and licensed unlicensed interaction not addressed
- ◆ Major inconsistency across sites depending on GIS type; at some sites generators own the bus selector disconnectors but not at others – Not a generator decision
- ◆ Not robust if manufacturers change designs

Option 5 as AIS and jointly own the gas zone



Option 5 as AIS and jointly own the gas zone

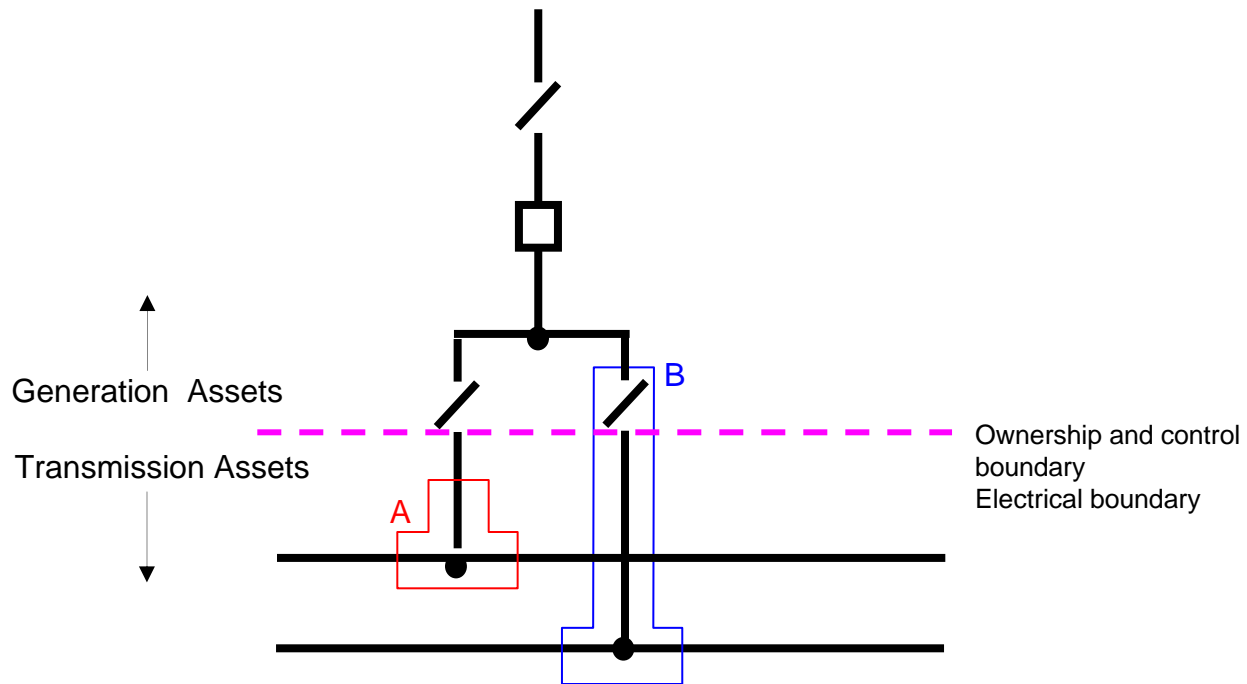
Advantages

- ◆ Generator has control over their synchronising circuit breaker and circuit disconnecter
- ◆ Double circuit connection – no liability and compensation issues

Disadvantages

- ◆ For some GIS types, no visible boundary (within gas zone)
- ◆ Users not able to physically remove the bus selector disconnectors (some GIS types)
- ◆ Construction issues and licenced unlicensed interaction not addressed
- ◆ Liability and access issues regarding the gas zone

Option 6 enduring as per AIS but one party builds all GIS assets



National Grid owns the gas zone and grants access rights for the generator to maintain the isolator

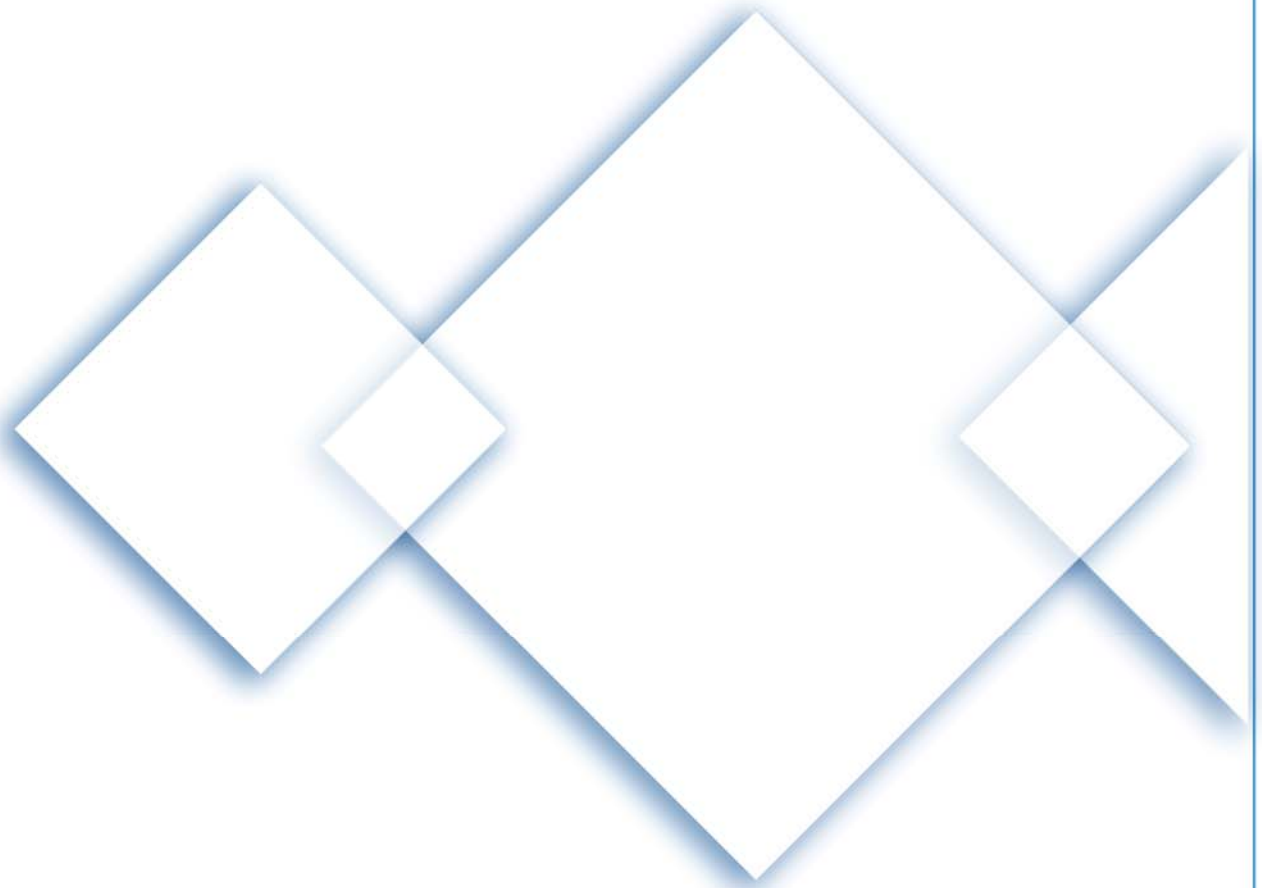
Option 6 enduring as per AIS but one party builds all GIS assets

Advantages

- ◆ Construction issues and licenced unlicenced interaction are addressed
- ◆ Enduring boundary consistent with AIS
- ◆ No change to proven methods of Operation
- ◆ Double circuit connection – no

Disadvantages

- ◆ For some GIS types, no visible boundary (within gas zone)
- ◆ Users not able to physically remove the bus selector disconnectors (some GIS types)
- ◆ Complications regarding asset transfer
- ◆ Ongoing maintenance
- ◆ Liability and access issues regarding the gas zone



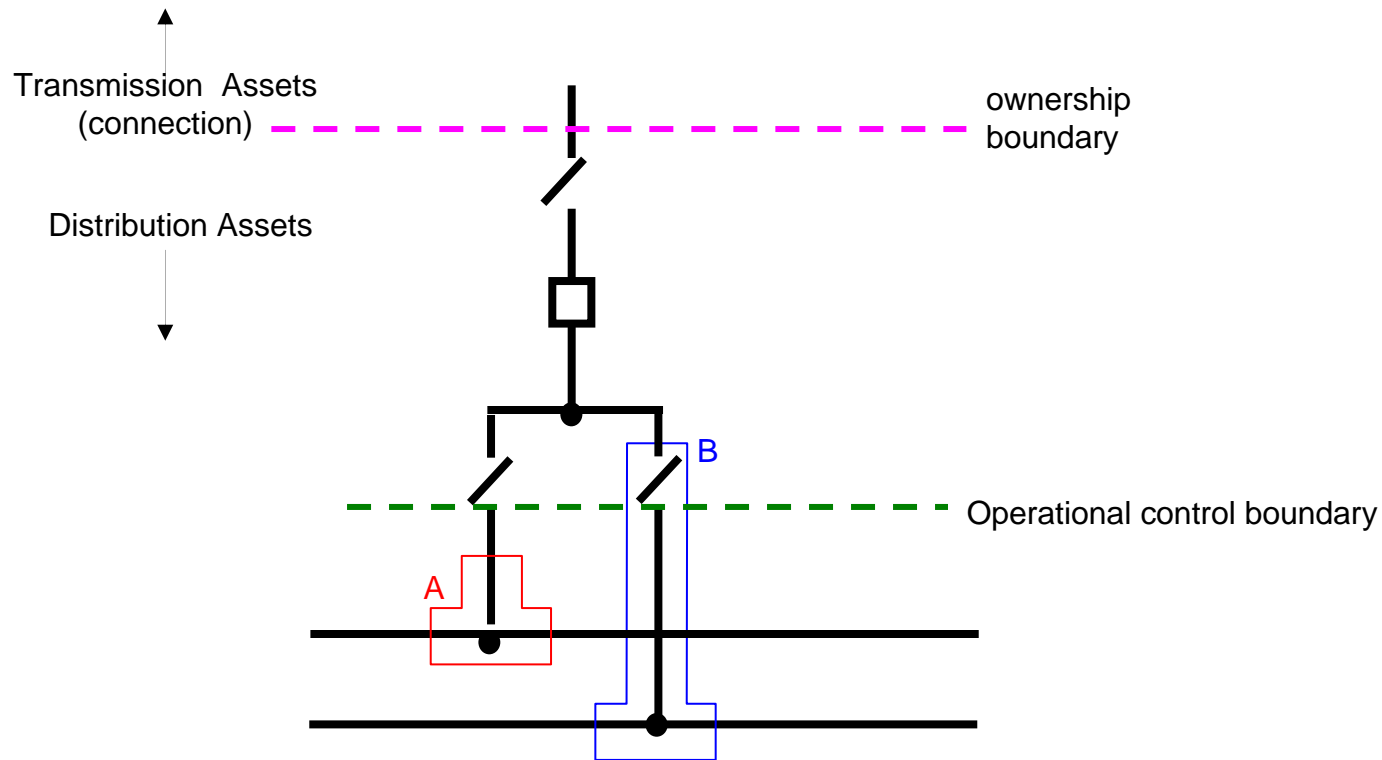
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Working Group Options for DNO connections
to the Transmission System

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Option 1 – A – DNO-Owned Substation



- ◆ Ownership and electrical is moved to include all connected GIS assets at a GIS Substation e.g. up to the cable sealing/GIS to AIS termination

Option 1 – A – DNO-Owned Substation

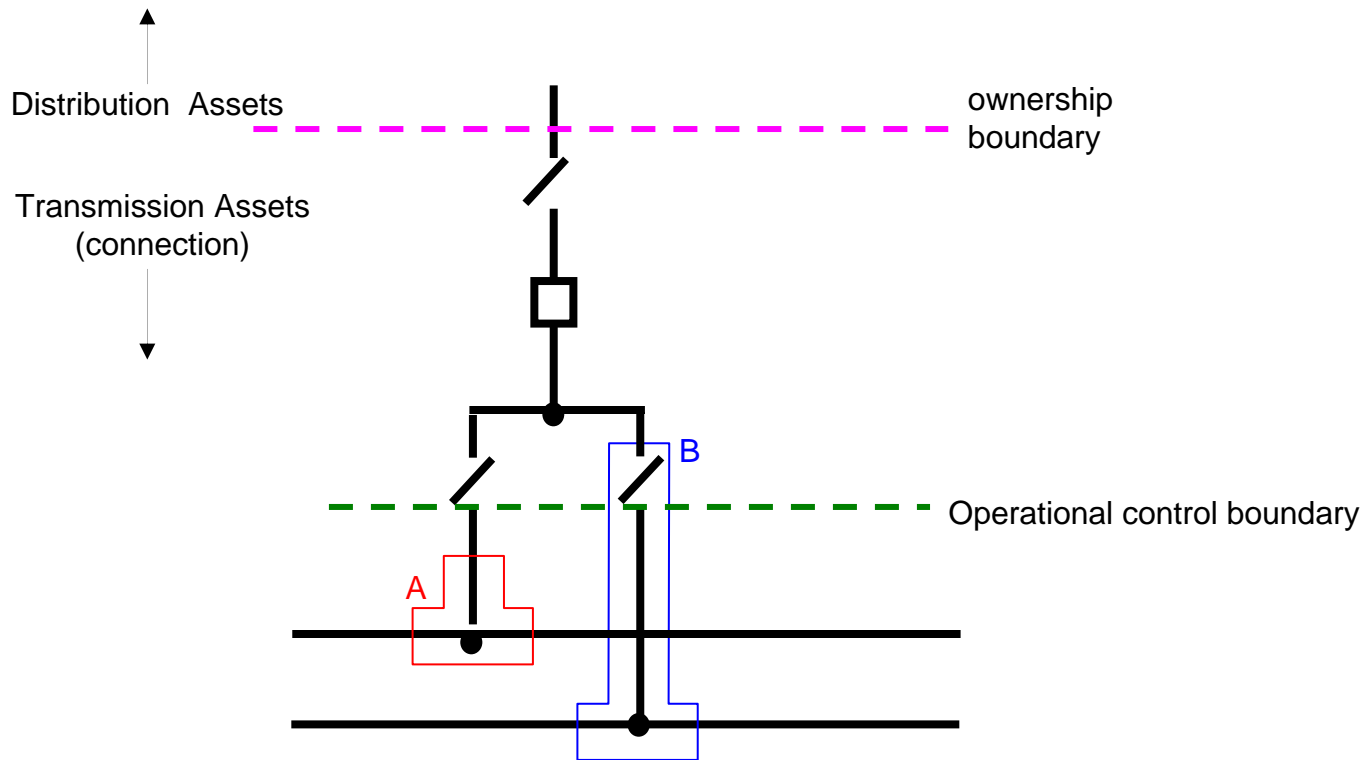
Benefits

- ◆ Addresses construction issues and interaction of licenced and unlicenced works
- ◆ Removes inconsistency for future GIS sites
- ◆ Reduces complexity for safety Management for maintenance although NG still owns transformer assets
- ◆ More economical solution for one party to build

Impacts and issues

- ◆ No overall significant change to costs but a change to who funds the assets (CAPEX and OPEX implications that has not been included in the price control)
- ◆ Creates inconsistency with AIS
- ◆ Liabilities and maintenance for transformer cct – SF6 and Customer Minutes Lost incentives
- ◆ Secondary control systems

Option 1 – B – NGET-Owned Substation



- ◆ Ownership and electrical is moved to include all connected GIS assets at a GIS Substation e.g. up to the cable sealing/GIS to AIS termination

Option 1 – B – NGET-Owned Substation

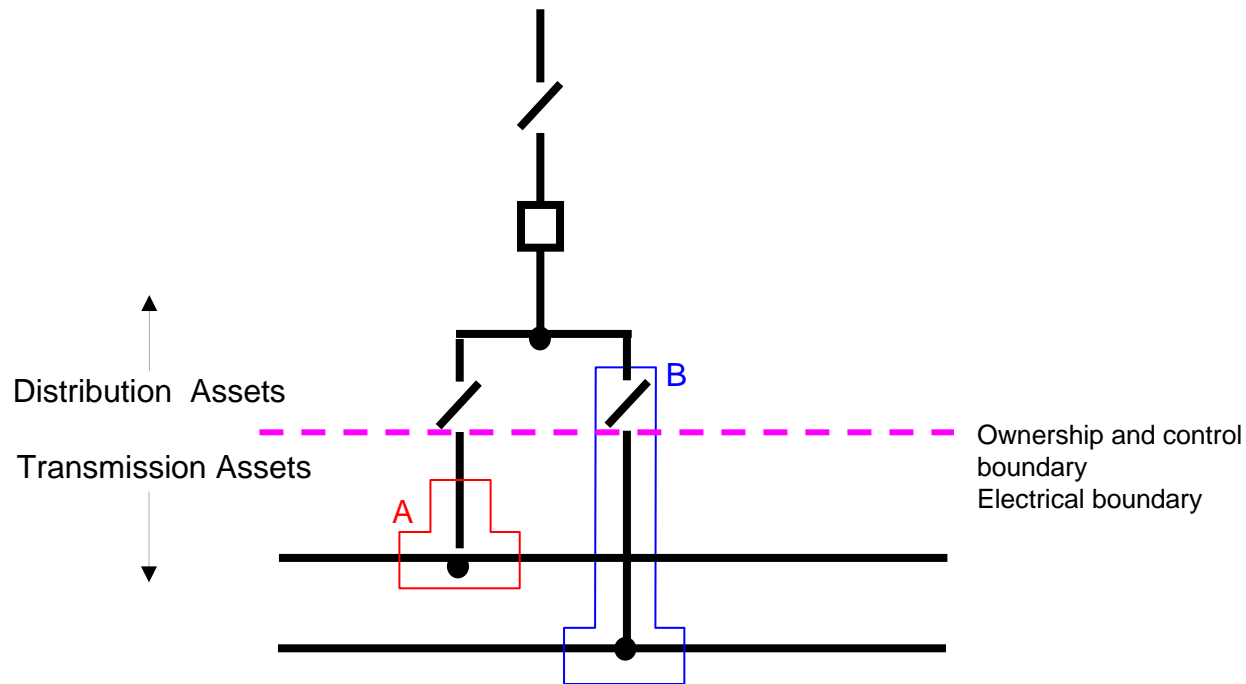
Benefits

- ◆ Addresses construction issues and interaction of licenced and unlicenced works
- ◆ Removes inconsistency for future GIS sites
- ◆ Removes complexity for safety Management for maintenance
- ◆ More economical solution for one party to build and maintain

Impacts and issues

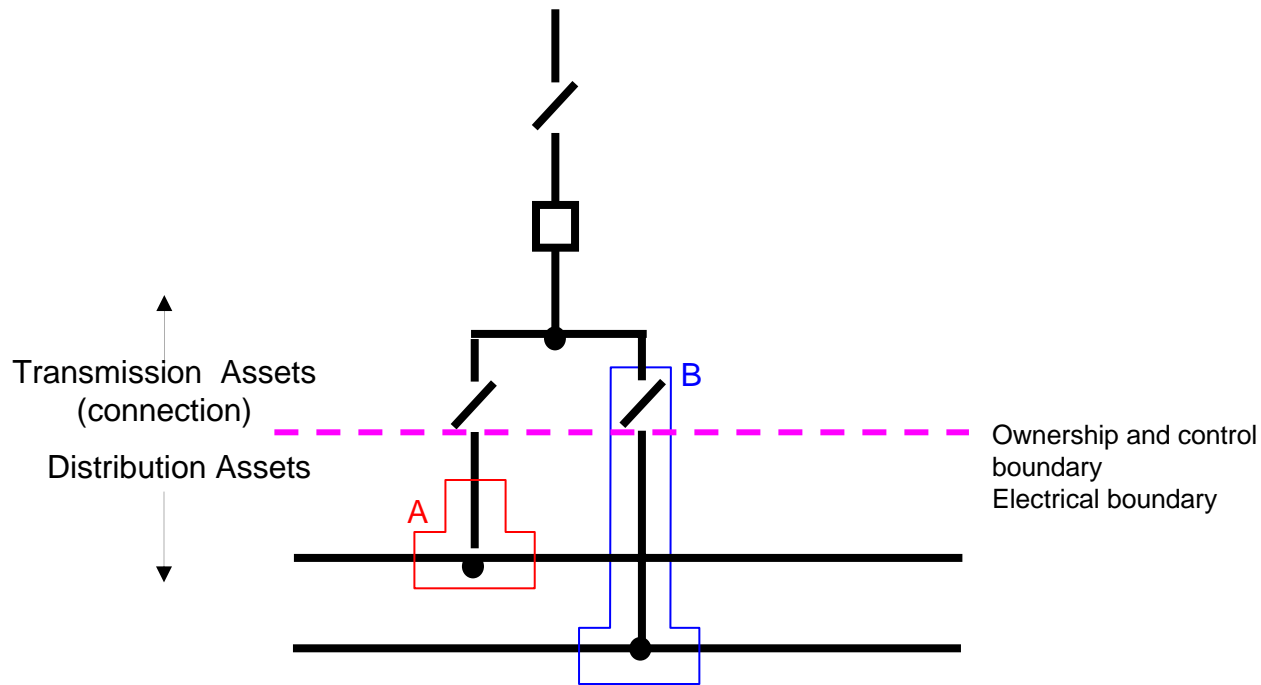
- ◆ No overall significant change to costs but a change to who funds the assets (CAPEX and OPEX implications that has not been included in the price control)
- ◆ Creates inconsistency with AIS
- ◆ Liabilities and maintenance for distrib. cct
- ◆ Secondary control systems
- ◆ Lack of DNO control

Option 6 – A – NGET-Owned substation enduring as per AIS but one party builds all GIS assets



National Grid owns the gas zone and grants access rights for the DNO to maintain the isolator

Option 6 – B – DNO -Owned substation enduring as per AIS but one party builds all GIS assets



DNO owns the gas zone and grants access rights for NG to maintain the isolator

Option 6 enduring as per AIS but one party builds all GIS assets

Benefits

- ◆ Construction issues and licenced unlicenced interaction are addressed
- ◆ Enduring boundary consistent with AIS
- ◆ No change to proven methods of Operation
- ◆ Similar situation already exists for “self-build” contracts
- ◆ No transfer of CAPEX and OPEX costs
- ◆ No impact on charging

Impacts and Issues

- ◆ For some GIS types, no visible boundary (within gas zone)
- ◆ Users not able to physically remove the bus selector disconnectors (some GIS types)
- ◆ Secondary systems issues
- ◆ Liability and access issues regarding the gas zone
- ◆ Increased complexity of ongoing maintenance