Transmission Access Review

Delivering and Operating Infrastructure

16th November 2007

TAR Progress

- Terms of Reference
- Call for Evidence
- Stakeholder workshops – September & November
- STAG Report published
- UKERC International workshop
- Bi-lateral discussions

Delivering and Operating Infrastructure

Call for Evidence Questions:

- What approaches to improving the delivery of infrastructure should we consider?
- Which operational measures are likely to improve connection prospects?

Call for Evidence Responses - Delivering Infrastructure

- Discrepancy between time it takes to develop and construct new generation assets v. transmission assets.
- TO funding for planning costs before individual connection agreement are in place.
- Consider impact of public inquiry at outset (undergrounding)
- Strategic planning and pre-emptive consenting
- Ofgem and NGET more proactive in facilitating studies (TIRG v. mid-Wales)
- Formalise allowances for pre-construction.

Call for Evidence Responses - Operational measures

- Make sure SO has the right incentives
- NGET is best placed to develop operational measures.
- More use of intertrips
- Use real-time ratings.

The Transmission Access Review

- We believe that there is a consensus that we are right to be carrying out the review.
- We now need to be clear about what changes may be needed and how they will be delivered.
- We need to see:
  - More renewable generation connected
  - Continued investment certainty
  - Reliable energy supplies
  - Value for consumers

Delivering Infrastructure

DEPARTMENT FOR BUSINESS
ENTERPRISE & REGULATORY REFORM

What do we want to achieve?

- Access to the transmission system no longer a barrier to delivering our renewable targets
- The right amount of infrastructure delivered in a timely fashion
  - How much?
  - When?
- Maximise the utilisation of assets

How much infrastructure?

- SQSS converts aspiration to connect into physical transmission requirements
  - Reliability criteria
  - Cost benefit
- Also defines how transmission assets are exploited
  - Utilisation
  - Curtailment

SQSS Review - Intermittency

- Review to report in March
- Desired outcomes
  - Efficient & timely investment
  - Transparent process
  - Different technologies dealt with equitably and transparently
  - Utilisation of existing assets maximised
  - Appropriate level of reliability

SQSS – What might change

- In delivering an appropriate level of reliability, what might change?
- Major change, i.e. N-1?
- Investment timescales (increased access)
  - Fault type
  - Take account of intertripping
- Operational timescales
  - Greater use of weather-related ratings
  - Weather-related relaxation

When to invest – how do we trigger?

- Renewable targets defined
- Development areas known
- Combination of user commitment and maximum preparation
  - Robust investment signals
  - Recognise ability of customers to commit
  - Delivery in time
- Can we streamline consenting process?
  - Addressing concerns, anticipating outcomes

Summary

- Aim is to remove transmission access as a barrier to our renewable targets. Requires;
  - An SQSS that
    - Defines levels of investment consistent with appropriate levels of reliability
    - Recognises the different demands that different generating technologies place on the system
    - Is transparent to customers
  - An investment methodology that
    - Delivers timely investment

Transmission Planning

Application of Security Standards

Andrew Hiorns

16 November 2007

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Transmission Planning
Introduction

- SQSS contains operational and planning criteria
- Consequences of relaxation to operational criteria will include demand loss
  - Localised with demand inter-trip, otherwise widespread
- National Grid already has:
  - Discretion to relax op criteria when risk levels permit
  - Incentives to seek appropriate risk management solutions
    - Reaching agreements for demand inter-trips
    - Developing generator controls
- This presentation focuses on planning criteria

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Transmission Planning

Agenda

- Requirements of SQSS planning criteria
- How are the planning criteria applied?
- What do planning criteria provide?
- Major issues as seen by the TOs
- Potential areas for future analysis

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Transmission Planning

Requirements of SQSS planning criteria

- Connection criteria
  - Deterministic
  - Based on all-year-round analysis (N-2)
    - Against all reasonably foreseeable generation backgrounds
  - Design variations based on user request allowed
- Main Interconnected Trans System (MITS) criteria
  - Deterministic
  - Peak assessment (N-2) with allowance for uncertainty
  - Ability to undertake maintenance
- Standards allow for investment above deterministic minimum if economically justified
- TOs could apply for derogation if investment is not economic

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Transmission Planning

How are the planning criteria applied?

- Based on contracted generation background
- Generation ranking order produced
  - Conventional plant scaled to 83% and wind to 60% (discussed later)
  - Generation in excess of demand is assumed to be non-contributory
- Sensitivity studies performed

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What do planning criteria provide?

Connection planning criteria

- Limits generation infeed loss for credible contingencies
  - 1000MW for frequent loss
  - 1320MW for infrequent loss
    - Defines number of local circuits
- Provides generation access to MITS
- Design variations based on user request (e.g. single circuit connection or inter-trip) allowed provided they do not:
  - Reduce security of MITS below minimum planning criteria
  - Result in additional investment or operational costs to any particular customer or overall

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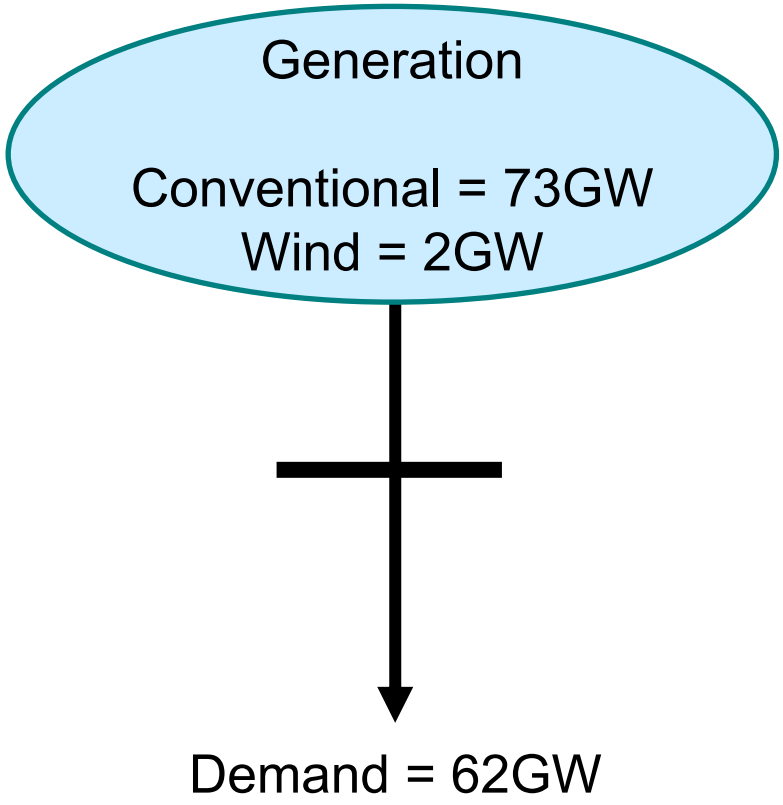
What do planning criteria provide?

MITS planning criteria



- For a single bus equivalent GB system
- Assume infinite transmission
- Plant margin ≈ 20%

- Reliability measured by LOLP = 0.07

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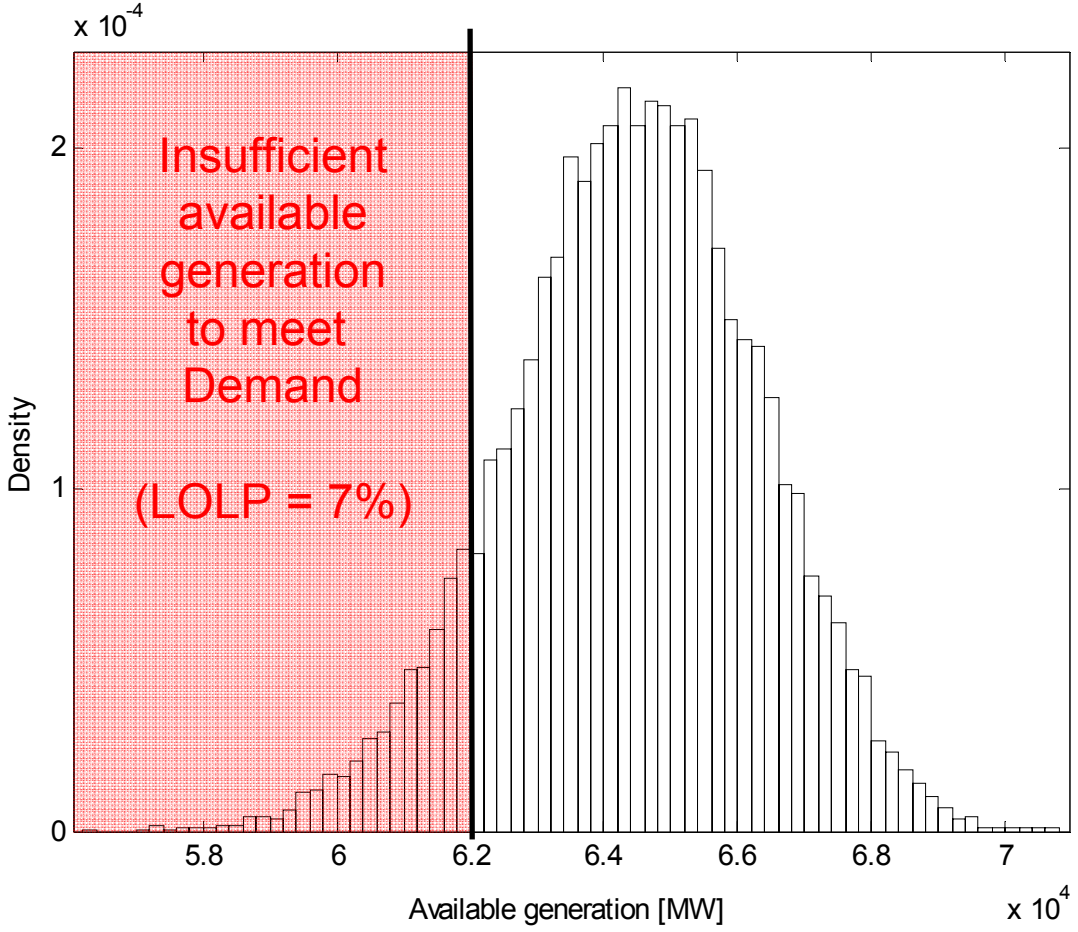
What do planning criteria provide?

MITS planning criteria

- Demand assumed fixed at 62GW

- Introduction of transmission on any part of the system increases the likelihood of failure to meet demand over and above the ‘single node’ LOLP



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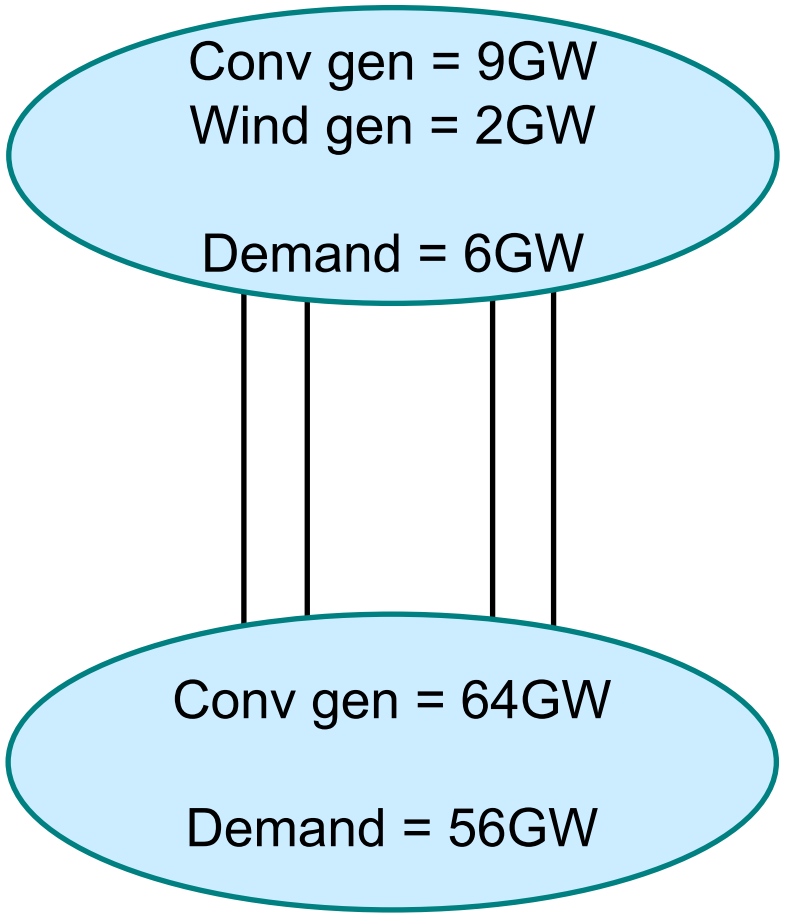
What do planning criteria provide?

MITS planning criteria – Scotland / England



- Finite transmission between the 2 areas
- SQSS (N–2) required capability: 3400MW
- System LOLP = 0.08
  - 2% LOLP increase
- Probability of exceeding boundary capability ≈ 10%

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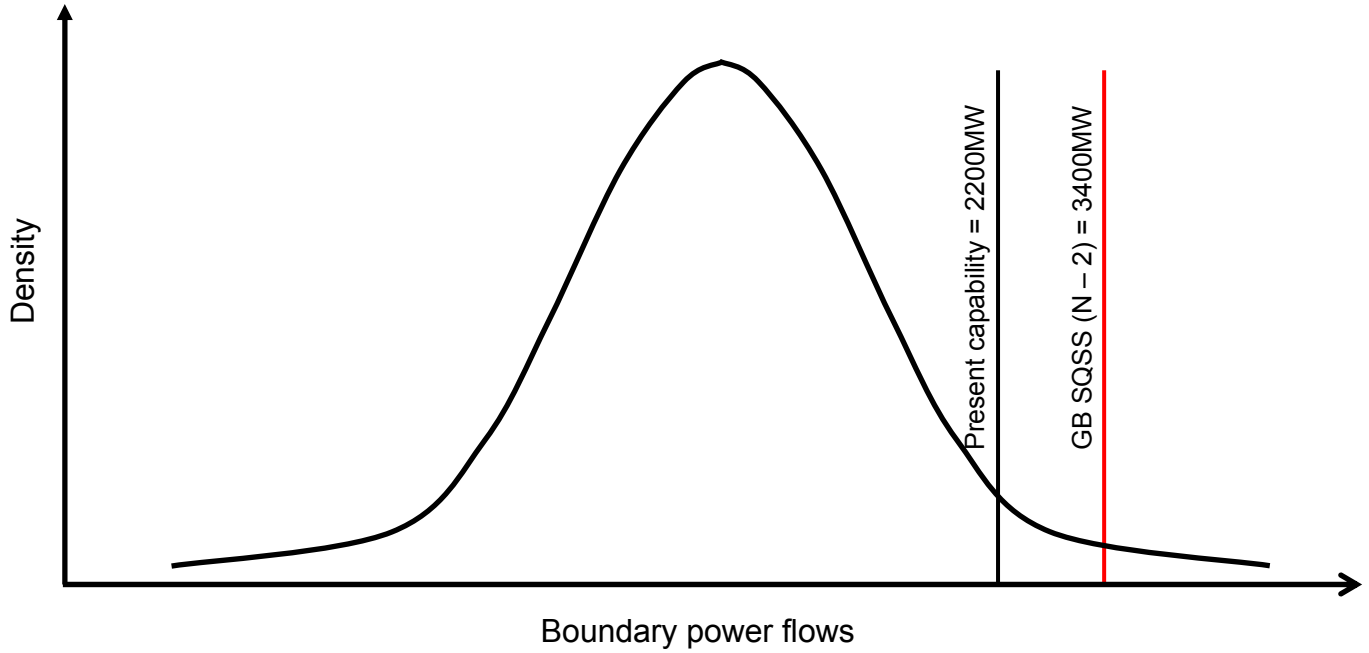
What do planning criteria provide?

MITS planning criteria – Scotland / England



- Limited transmission capability increases system LOLP
- Present capability at 2.2GW results in high constraint volumes

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What do planning criteria provide?

MITS planning criteria – Capacity sharing

	2007	2013	2020
Gen (GW)	11.0	16.0	21.0
Dem (GW)	6.0/5.0/3.0	3.0	6.5/5.0/3.0
Excess Gen	5.0/6.0/8.0	10.0/11.0/13.0	14.5/16.0/18.0
Wind Pen in Scotland	18%	44%	67%
Boundary capability (B6)	3.5/3.0/3.0	5.0/4.5/4.0	7.5/6.5/6.0
Sharing	1.4/2.0/2.7	2.0/2.4/3.3	1.9/2.5/3.0

Gen = installed generation in Scotland (MW)
Dem = peak demand in Scotland (MW)
Excess Gen = Gen – Dem (MW)
Sharing = (Excess Gen) / B6

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Transmission Planning

Major issues as seen by the TOs

- Integration of renewables
- Are we maximising utilisation of existing assets?
- Increased use of inter-trip
- Economic justification of local connections when accommodating renewables
- Integration of large nuclear units
- Implications of large queue

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Major issues as seen by the TOs
Integration of renewables

- Existing process:
  - Based on 60%
    - Maintains same risk of exceeding boundary capability
    - Supported by cost benefit analysis
      - Reviewed by 3 independent consultants on behalf of Ofgem
- However, analysis based on:
  - One boundary
  - Constraint cost of £25/MWh
  - Making use of “free” inter-trip

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Major issues as seen by the TOs
Integrating renewables

- The alternative approaches to reflecting wind requirements in planning criteria are:
  1. Modify (peak) deterministic rules to cover peak security and better approximate the economic year-round network capacity.
  2. Maintain deterministic rules for peak security test (reflecting limited peak security contribution of wind) and use central cost-benefit analysis for wind driven infrastructure.
  3. Maintain deterministic rules for peak security test (reflecting limited peak security contribution of wind) and discover from users their willingness to share capacity or sponsor expansion.

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Major issues as seen by the TOs
Integrating renewables

- The SQSS review group is presently developing proposals in line with approach 1), and is seeking to determine factors which provide transparency into investment decisions.

- However, depending on the nature of revisions to the transmission access arrangements, approach 3) may be more appropriate.
- In this approach, the developments to the security standards would be more modest and may not require the same assumptions about market behaviour and economics.

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Major issues as seen by the TOs

Are we maximising use of existing assets?

- Some of initiatives are already in use
  - Hotwiring
  - Use of dynamic ratings
  - Short-term ratings
  - Fair weather relaxation to (N-1)
- Some initiatives to be taken forward (but will only have incremental benefits)
  - Review of planning voltage limits
  - Review of planning stability criteria
  - Review of generation connection design
    - Review of use of inter-trip and/or “smart” control systems

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Major issues as seen by the TOs

Local connections

- Economic justification for local connections
  - Deterministic with design variations based on user requests
  - Can reduce requirements based on cost benefit analysis, but requires a derogation
- Proposal
  - To provide greater clarity in SQSS on basis for cost benefit
  - Investigate use of inter-trip (subject to commercial agreement)
  - Investigate development of economic solution without requirement for derogation.

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Major issues as seen by the TOs

Nuclear generating units, potentially < 1800MW

- 3 Options:
  1. Make connection “design variation based on user request”
     - User pay for additional reserve holding.
  2. Change GB SQSS to allow normal & infrequent infeed loss up to 1800MW
     - Costs of extra reserve socialised, wider design implications
  3. Change Electricity Act to allow greater frequency deviation for faults
     - Limited additional extra reserve holding required, significant ESI review required to establish viability

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Transmission Planning

Potential areas for future analysis

- Continue with work on integration of renewables
- Review of planning voltage limits
- Review of planning stability criteria
- Review design of generation connections
- Impact of 1800MW units on infeed loss risk
- Further R&D work on dynamic ratings

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Transmission Planning
SQSS Governance

- Voluntary process has been in place for 6 months
  - Significant change to previous arrangements
- Governance group consists of:
  - Representatives from the 3 Transmission Licensees (representing SO and TO interests)
  - Ofgem
- Change requests can be made by any party
  - Considered by governance group
  - Working groups will be established if necessary
    - Use will be made of industry workshops as appropriate (e.g. integration of renewables)
- NG consult prior to any changes

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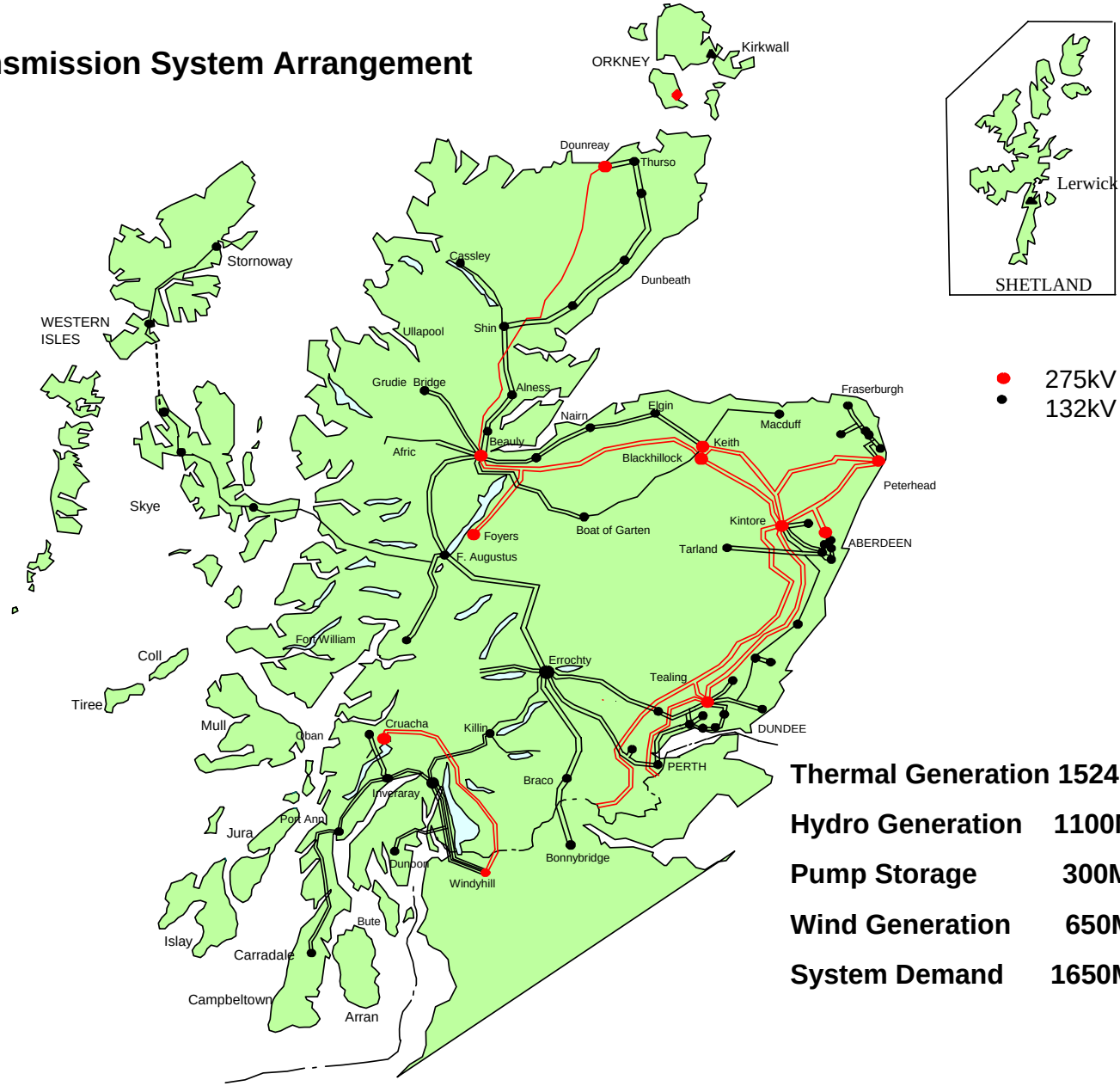
Scottish & Southern Energy

Transmission Business
Scottish Hydro-Electric Transmission Ltd

Existing Transmission System Arrangement



Thermal Generation 1524MW

Hydro Generation 1100MW

Pump Storage 300MW

Wind Generation 650MW

System Demand 1650MW

Wind Generation Applications

Connected	650MW
Connected & Contracted	7200MW

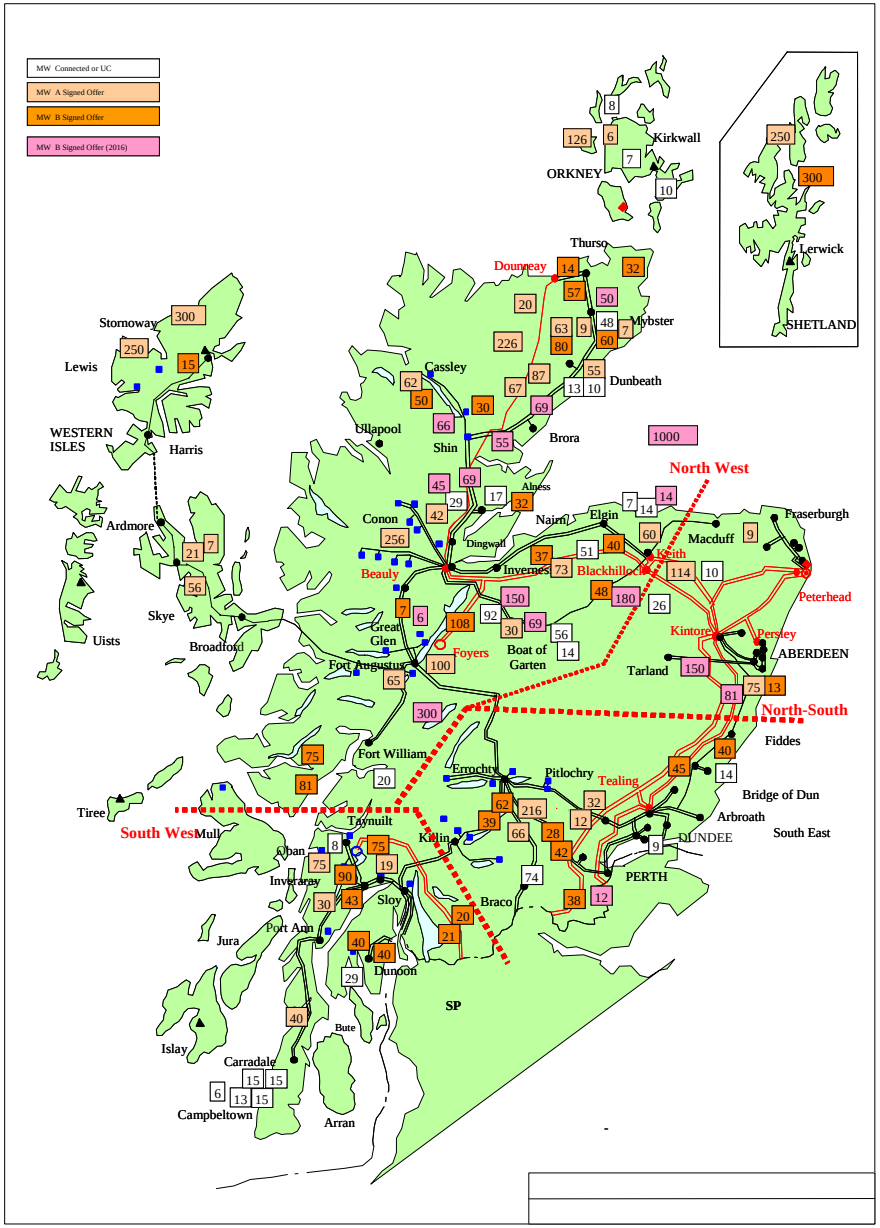
Existing Island Connections

132kV (33kV subsea) to Western Isles

33kV to Orkney

No link to Shetland

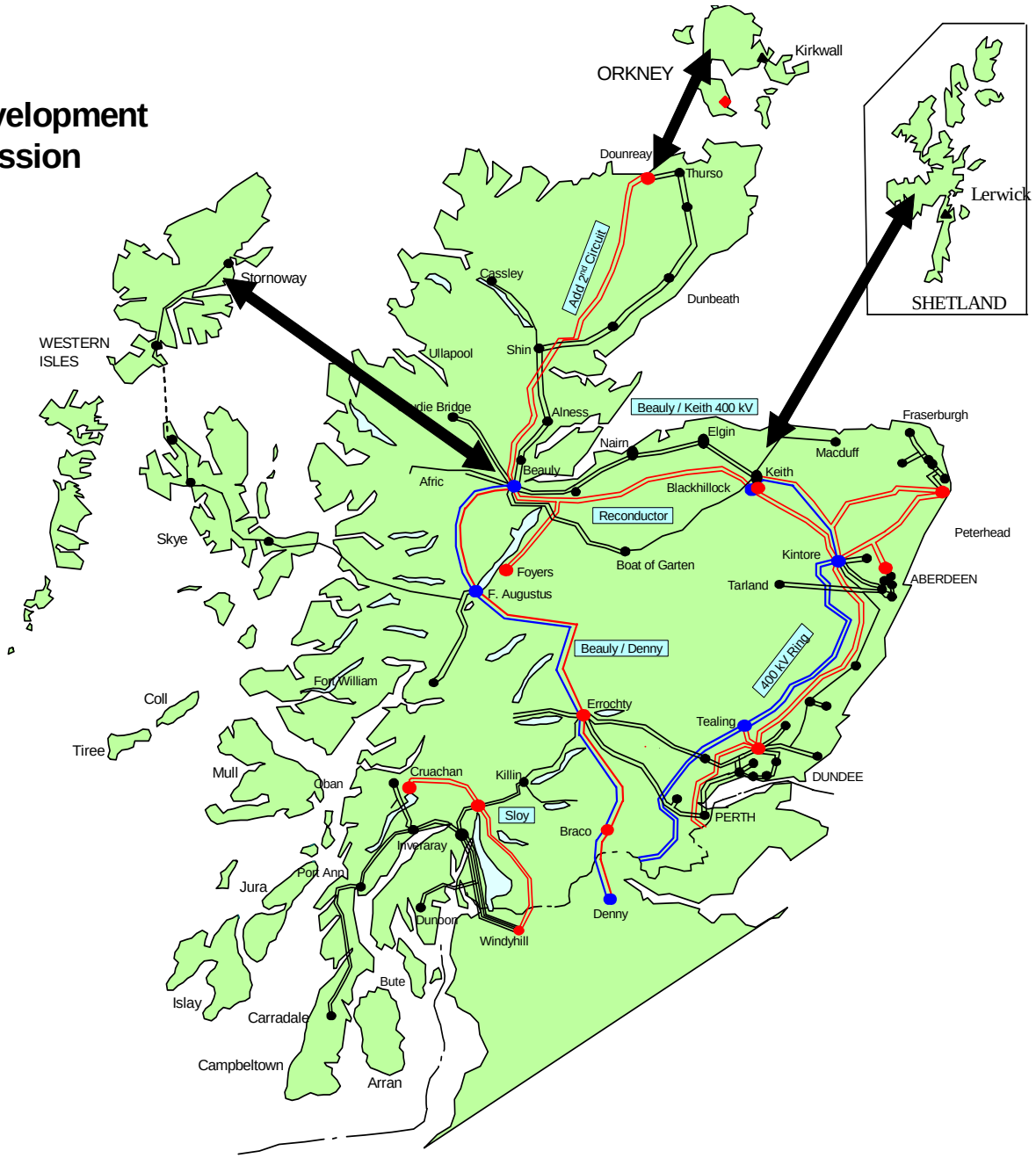
Major Transmission Reinforcement is Required



Challenge – Meeting expectations

- Accommodating renewables
  - 0.65 GW connected
  - 7.2 GW contracted to connect in SHETL
- Maintaining security of supply
  - against changes in generation background
  - against background of ageing asset base
- Maximising utilisation whilst maintaining
  - flexibility in the system.
  - future proofing
- Delivering projects
  - within constraints of regulatory and planning framework.
  - Scarcity of resources and increasing costs.

Foreseeable Development of Main Transmission System



Challenge - Meeting Obligations

- The STC (Post BETTA)
- The GB SQSS (3 Pre – 1 Post BETTA)
- Economic and efficient system (same pre and post)
- No Discrimination (same pre and post)
- Competition in Generation and Supply (same pre and post)
- Coordinated GB Investment planning (Post BETTA)

Meeting the GB SQSS challenge

- The GB SQSS (primarily for “conventional” generation technologies but to accommodate “wind” is challenging)
- Deterministic standard for generation connection:
  - could result in uneconomic investment
  - may result in delaying connection.
- Stability of the system - a concern for the TOs (data exchange).

Meeting the GB SQSS challenge – More to be done

- A review of the planning and operational standard to accommodate “new generation technologies” is in place
- SHETL has requested a review of chapter 2 (“Design of Generation Connections”).
- Review of “bus coupler” faults as a MITS secured event.
- Review of Voltage and Stability standard.
- Use of active management of the system to create operational capacity

Transmission System Operation Review Group

- A representative group made of TOs, GBSO and OFGEM
- Review operational measures to:
  - consider if capacity and utilisation of the system can be increased.
  - Consider innovative approaches to manage and operate the system.
  - Opportunities where additional generation can be connected.
- TSORG report published in October 2007.

Transmission System Operation Review Group

Summary of TSORG findings

- Robust operational processes are in place to make full engineering use of the GB TS.
- Three main reasons (rather than barriers) delaying additional connections:
  - Comply with GB SQSS
  - Comply with agreed commercial arrangements for access and connection
  - Efficient and economic design and operation of the network
- Technically some capacity is not best used because of the commercial framework (queue for new connections)

Our Commitment

- SHETL is committed to achieve renewable targets.
- SHETL is committed to reinforce its transmission to connect more renewable.
- Project delivery is one of our top priorities.
- The planning system is the main factor delaying upgrades.
- SHETL will work with all parties to realise the objectives.

Transmission Access Seminar

Friday 16 November 2007

Presentation by SP Transmission Limited

ScottishPower EnergyNetworks

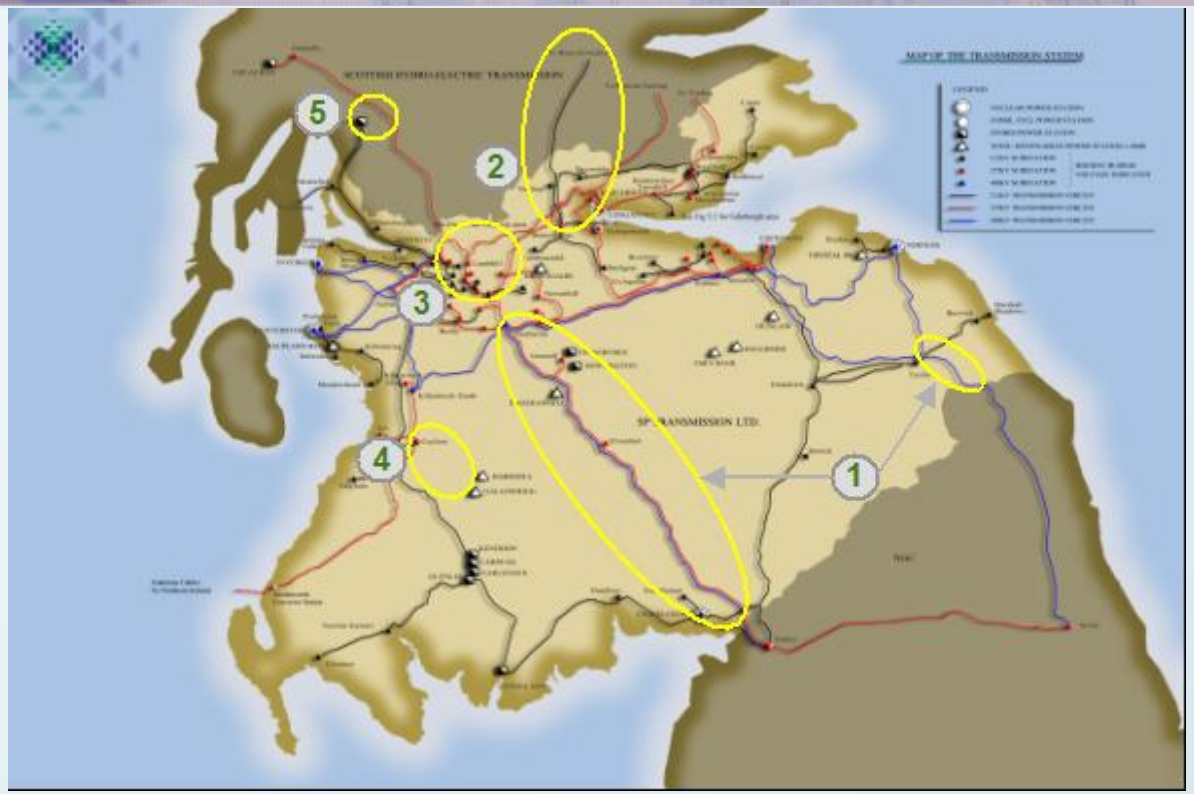
Key Obligations

- Compliance with STC
  - Coordinated GB investment planning
- Compliance with the GB SQSS
  - A review of the planning and operational standard to accommodate “new generation technologies” is in place
- Develop an economic and efficient system
- Facilitate competition
- No discrimination

Key Challenges for Transmission

- Accommodating renewables
  - 3.2GW is transmission price control baseline assumption to connect
- Prompt delivery of investment
  - within constraints of regulatory and planning framework and global marketplace for materials and services
- Maintaining security of supply
  - against changes in generation background
  - against background of ageing asset base
- Getting the most out of the existing network
  - more flexible operation and planning of the system

SP Transmission Upgrades



1. **Scotland-England Interconnector.** Consents received, work underway, west coast works scheduled to complete by 2009, full upgrade scheduled for completion by 2010.
2. **Beauly-Denny.** (for works in SPT area). Ongoing public inquiry; earliest completion (assuming consent granted in early 2009) is 2013.
3. **Boundary B5.** Consents received, construction contracts let, completion scheduled for summer 2009.
4. **South-West Scotland.** Pre-planning works underway, S37 planning application due to be submitted in spring 2008.
5. **Sloy area.** Planning consent for the required transmission substation refused by the National Park Authority, appeal is due to be lodged in the near future, earliest completion 2009, depending on planning.

ScottishPower EnergyNetworks

Network Outages

- Very challenging network outage programme required to deliver capex and maintenance requirements
- Outages may be cancelled by the GBSO at short notice
- Going forward we should consider:
  - earlier assessment and optimisation of outages (TSORG)
  - the use of the Winter period for major outages?

A Constructive Approach

- In the medium term, upgrades will help resolve transmission access

- In the shorter term, a less conservative approach is required including:

  - Limited connect and manage
  - Flexible approach to allocating transmission capacity
  - Enable trading of capacity between generation sites
  - Temperature related circuit capacity enhancements (TSORG)
  - Earlier assessment and optimisation of outages (TSORG)

ScottishPower EnergyNetworks

Conclusions

- The primary focus should be on progressing purposefully on the necessary upgrades to resolve constraints
  - Prompt and efficient delivery is one of our top priorities
- TOs devoting significant resources to progressing upgrades as quickly as possible within constraints of planning system
- In the shorter term measures should be taken to improve the utilisation of the transmission assets

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Review of system operation

16 November 2007

Min Zhu, Ofgem

Transmission access & system operation

- Transmission capacity available in real time determines the physical location and amount of generation output that can be accepted onto the system
- Apart from making timely and efficient investments in new transmission assets, it is also important that the existing assets are used to their full potential
- Work has been taken forward by the industry with Ofgem's input
  - Ofgem's key role is to ensure that the regulatory regime encourages efficient operational measures to free up all transmission capacity

Transmission System Operation Review Group (TSORG) Background

- TSORG was an advisory body established by Ofgem to carry out a review of GB transmission system operation
- TSORG consisted of:
  - One representative from NGET specialising in transmission system operation
  - Three representatives (one from each of NGET, SPT and SHETL) specialising in determining transmission system capability limits
  - Ofgem (supported by an independent consultant)
- Review was initiated in June 2007
- TSORG submitted its final report to Ofgem in September 2007

Purpose of TSORG

- Improve industry understanding of current framework
  - Identify transmission system capability limits used when operating and planning the GB transmission system
  - Establish the basis of transmission system capability limits
  - Understand the range of operational measures used by NGET
- Evaluate scope for improving utilisation of the GB transmission system in terms of:
  - Effectiveness in releasing additional capacity
  - Ease of implementation
  - Commercial implications (for transmission licensees and other industry participants)
  - Impact on security of supply

TSORG Findings

- In general, robust processes are in place to make use of GB transmission system
  - Within confines of current frameworks

- Some measures identified to marginally improve available capacity during operational timescales
  - May reduce constraint volumes
  - Unlikely to release additional capacity for new generation connections

Short Term Access Governance (STAG) report

- Ofgem submitted the STAG report to the Secretary of State in October 2007, and published it on our website for informal consultation
- The STAG report summarises progress to date on short term initiatives, including the TSORG work, and where further efforts should be concentrated
- We welcomed the TSORG work and set out issues for further investigation, including better understanding of short/medium term measures and review of certain aspects of GBSQSS
- Responses to the STAG report in relation to review of system operation:
  - Network investment more effective than operational measures
  - Scope for improvement including: more extensive use of enhanced ratings over GB & better coordination in transmission outage planning
  - Need to consider effectiveness & consequences in consideration of changing certain aspects of GBSQSS

Further work

- We will ask the transmission licensees to:
  - Improve understanding of transmission system capability
    - Extend use of enhanced ratings
    - Improve information available about transmission system utilisation e.g. extent and cause of active constraints
  - Report on relevant research and development activities
  - Consider effectiveness and implications (in terms of costs and security of supply) of changing relevant aspects of the GBSQSS


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TAR – Delivering & Operating Infrastructure Workshop
Next Steps & Conclusions

TAR – Next Steps

- Report in December.
- Further consultation expected early 2008.
- Conclusions in May 2008