Balancing at the Southern Hub

DWGM Stakeholder Working Group 3, 10 August 2016

AUSTRALIAN ENERGY MARKET COMMISSION

Agenda

1. **Balancing**
- Cost to cause versus complexity
- Balancing proposal
- Timing of monitoring
2. **Capacity follow-up**
- Short term capacity release
- Examples

Subsequent working group meeting in late **August** to discuss issues around transition

Cost to cause versus complexity

Virtual hub vs. reality

- Treating the DTS as a virtual hub has limitations
  - Physical constraints are being ignored
- The system operator must manage the system to overcome any binding limitations at the lowest cost
  - While maintaining predictability and transparency
  - Using same capacity and commodity trading options as available to the market
  - Emergency powers
- Costs of SO managing system need to be recovered
- Cost recovery can be targeted or socialised
  - Cost to cause is preferable as it provides an incentive for efficiency

Cost to cause vs. complexity

- Trade off between assigning cost to cause and complexity
- Complexity is not always the answer
  - Unintended or unforeseen consequences
  - Interaction between competing scenarios
- Where possible, the market design should tend to simplicity in order to encourage trading activity by allowing participants to fully understand their risk
- Recognise that there is imperfect cost to cause allocation
- Simplicity should not allow gaming
- Design should encourage accurate nominations under changing conditions
  - Allows best use of system
  - Minimises need for operator actions (e.g. LNG)

Detailed discussion: balancing

Balancing

- Continuous balancing model means MPs need to manage their own balancing by obtaining sufficient gas to achieve a reasonable balance with withdrawals over a gas day
- DTS has limited useable linepack, which is affected by:
  - System demand (the higher demand, the less useable linepack)
  - Beginning of day (BOD) linepack
  - Accuracy of forecast exit flows (particularly temperature sensitive load)
  - Any imbalance between hourly entry & exit flows
  - Pipeline flow direction changes (can trap linepack in a sector)
  - Actual linepack distribution

Nominations

- System operator must know each MP’s flow intentions to operate the system and maintain system security
- MP must nominate injections at entry points and withdrawals at exit points
  - MP nominate entry quantities by hour by entry point
  - MP nominate exit quantities by hour by exit point/zone
  - May be updated prospectively
  - Nominations endure until updated
  - Are validated against capacity rights
- MP responsible for delivery/receipt of gas at entry/exit points to match nominations. MP can source gas for entry points from:
  - GSA / GTA they hold
  - OTC or bilateral trades with those holding a GSA / GTA
- System Operator manages delivery of nominations from entry points to exit points

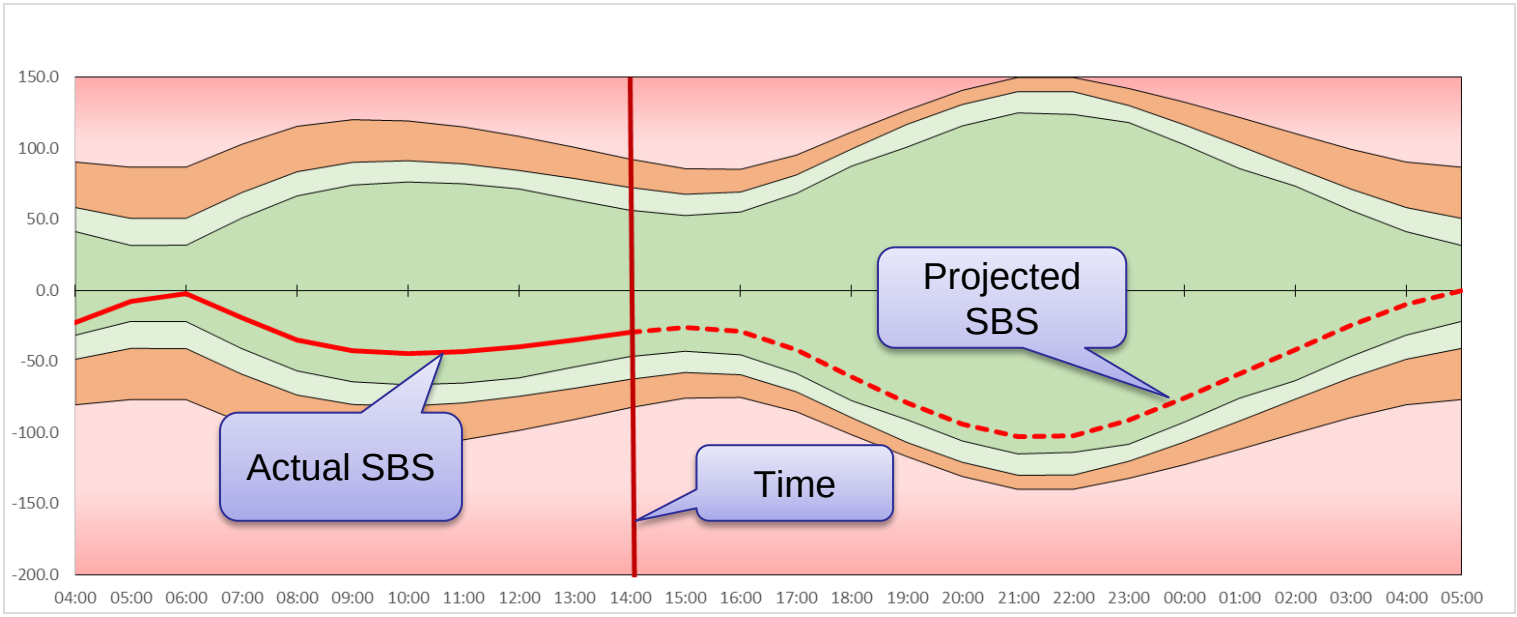
Updating trading results

- Trades on the trading platform and notifications of bilateral trades within the hub are sent to the system operator
  - Purchases increase an MP's linepack position at the time of title transfer
  - Sales decrease an MP's linepack position at the time of title transfer
- Net trade updates are sent at regular intervals prior to gas day
- On the gas day, updates are sent either:
  - Immediately following completion of trade; OR
  - At hourly intervals showing net trades
- System operator uses these to update MP POS and to track trades against nominations

Maintaining system security through residual balancing

- Trade off between maintaining system security and allowing MP to manage their own balancing
- Proposed solution is to define residual balancing bands as follows:
  - Green: no action
  - Light Green: balance of day action
  - Amber: next hour action
  - Red: system operator makes directions (including curtailment)
- Bands relate to System Balancing Signal (SBS)
  - Actual SBS using actual linepack in system (i.e. retrospective)
  - Projected SBS using current actual linepack and entry / exit nominations as at that time (i.e. prospective)
- SBS calculated hourly

Residual Balancing Bands and SBS



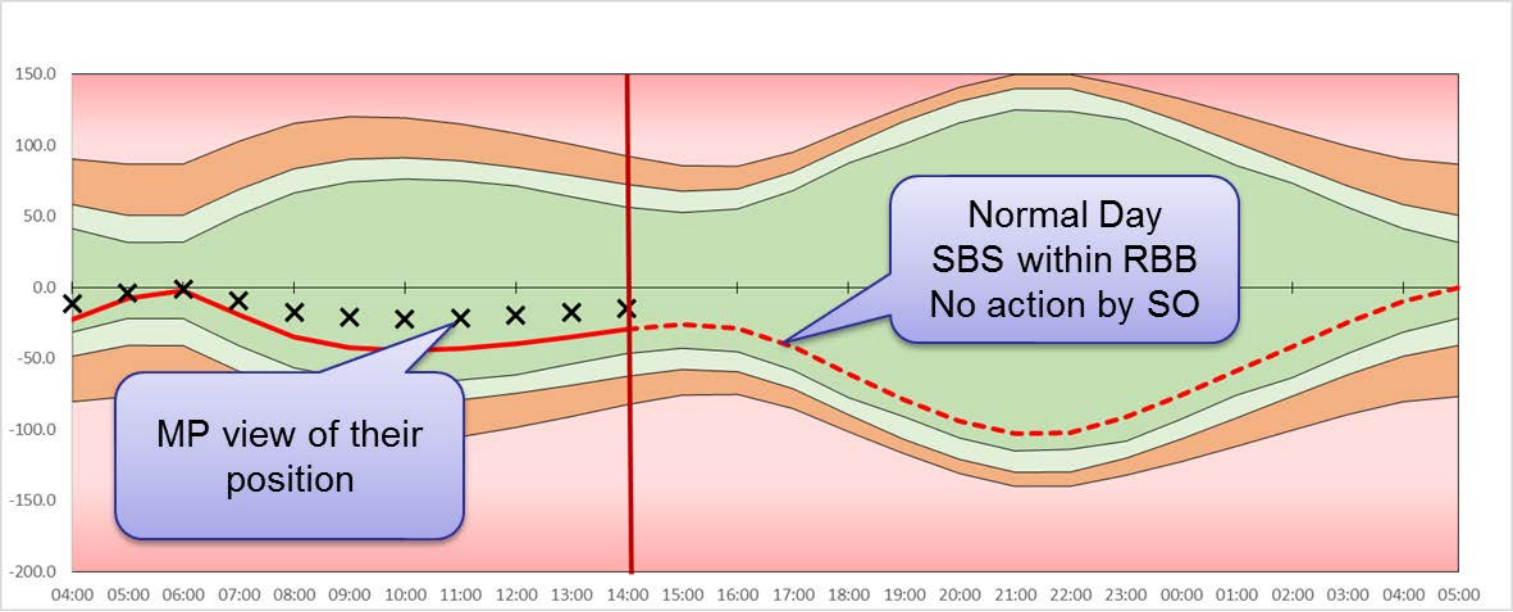
Note – Residual Balancing Bands indicative only

Defining the bands

- Many factors determine how the bands are set
- Methodology to be determined in detailed design phase
- Must balance needs to:
  - maintain system security
  - take action early enough to make an impact
  - not take action that is not needed
  - allow MP to identify they need to take action

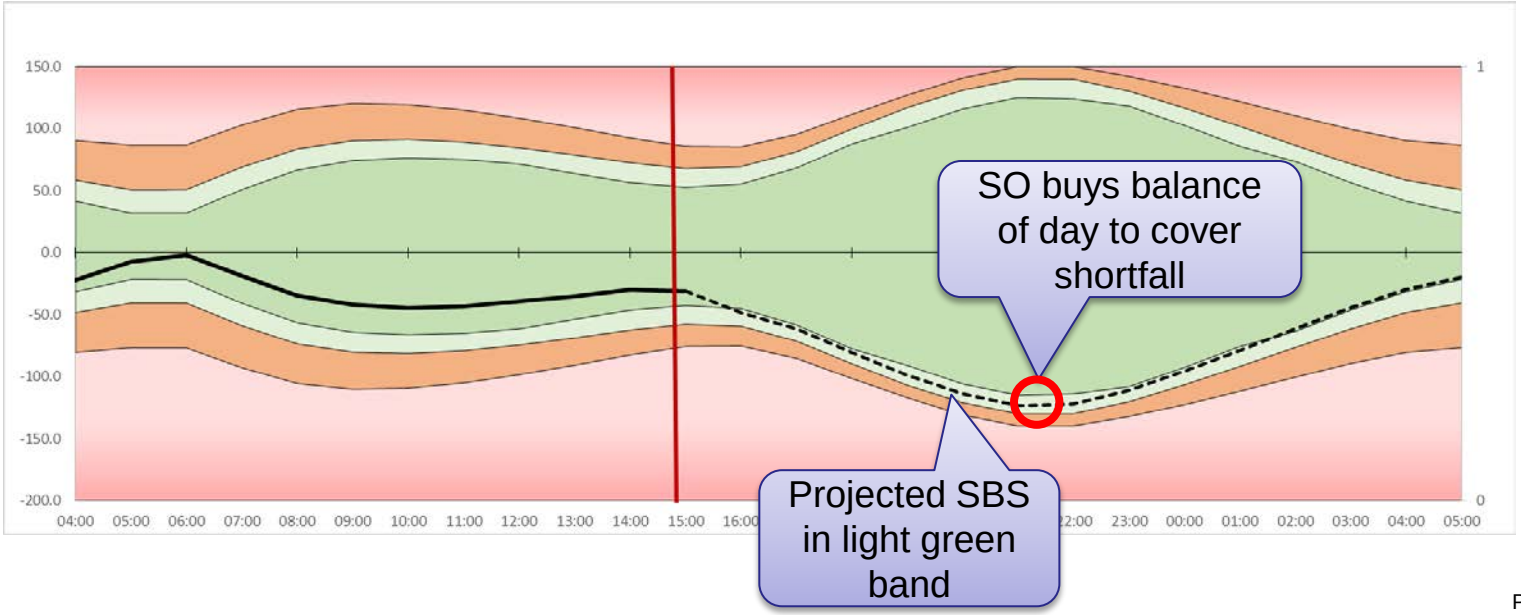
Using residual balancing – no action

- While the SBS remains in the green band:
  - MP manage their own entry & exit nominations
  - System operator will monitor and report only



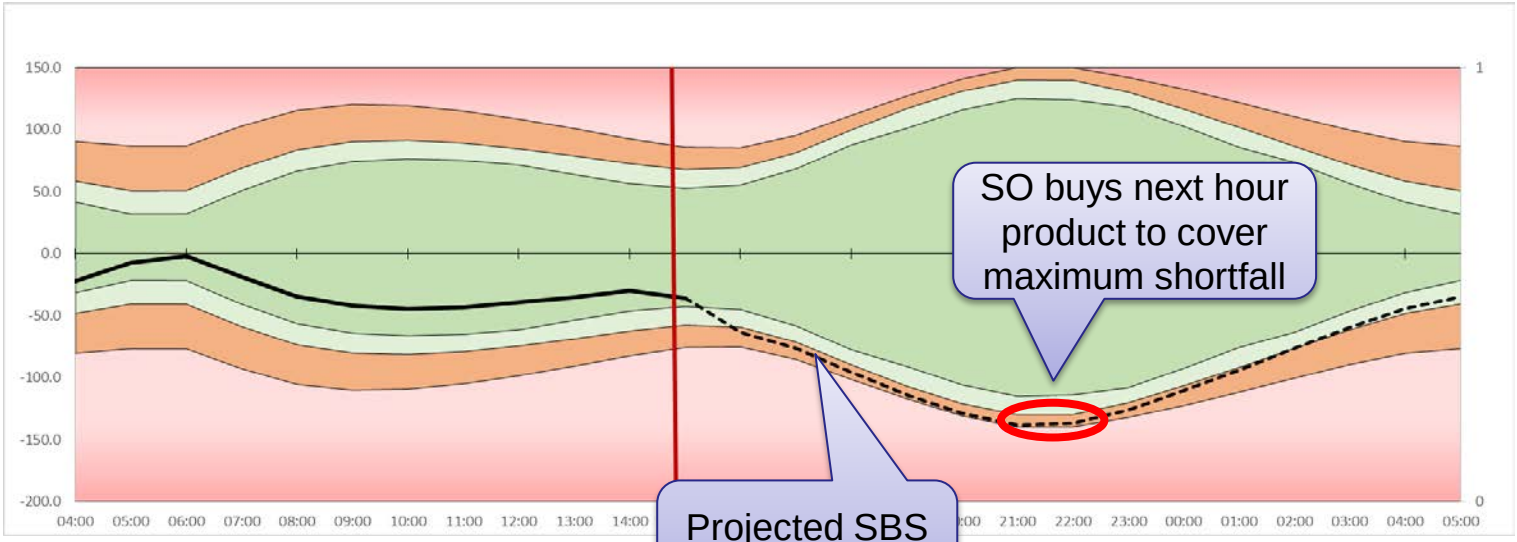
Using the bands – balance of day action

- Where actual or projected SBS moves into the light green band, action must be taken
- System Operator will buy (or sell) a balance of day product to keep projected SBS in green band



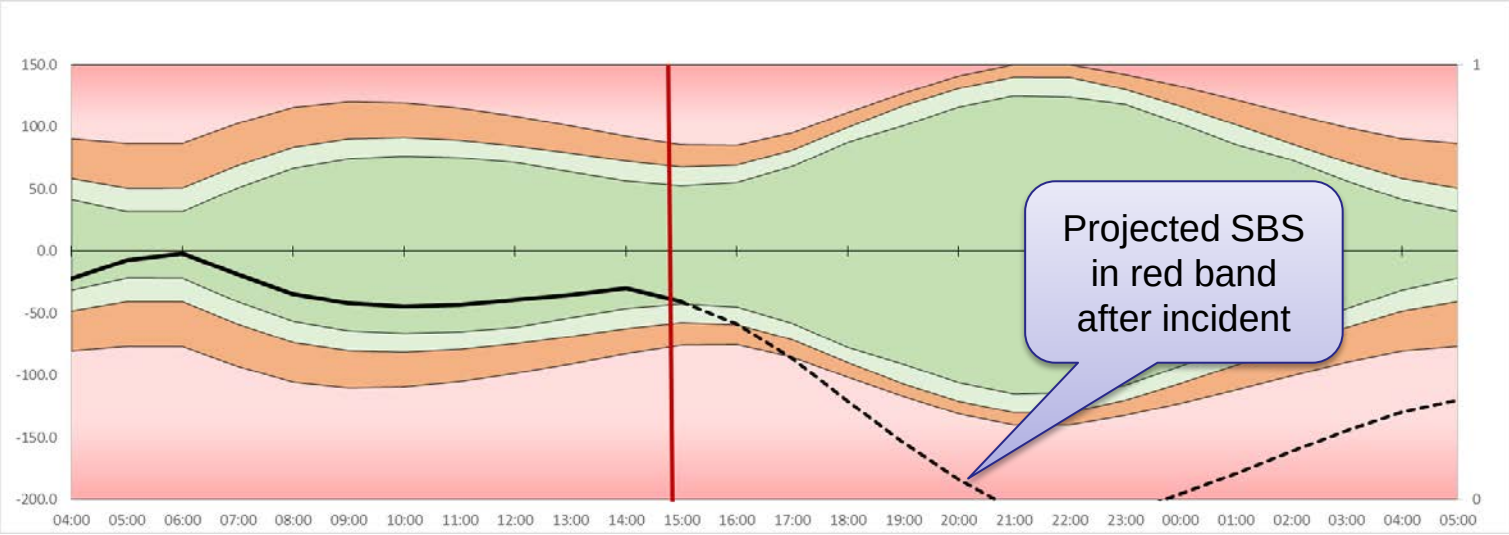
Using the bands – next hour action

- Actual SBS moves into amber band:
  - Weather colder / Peaky load / Injections constrained
- System operator purchases hourly product (likely to be LNG) to cover shortfall to light green boundary
- System operator would also need to purchase a balance of day product to cover shortfall to green boundary…



Emergencies

- System operator continues to provide emergency management as in DWGM (emergency levels, powers of direction)
- Residual Balancing Bands are also used to trigger directions
  - Outage or restriction at entry/exit point will require MP to adjust nominations (possible that SO could also do this)

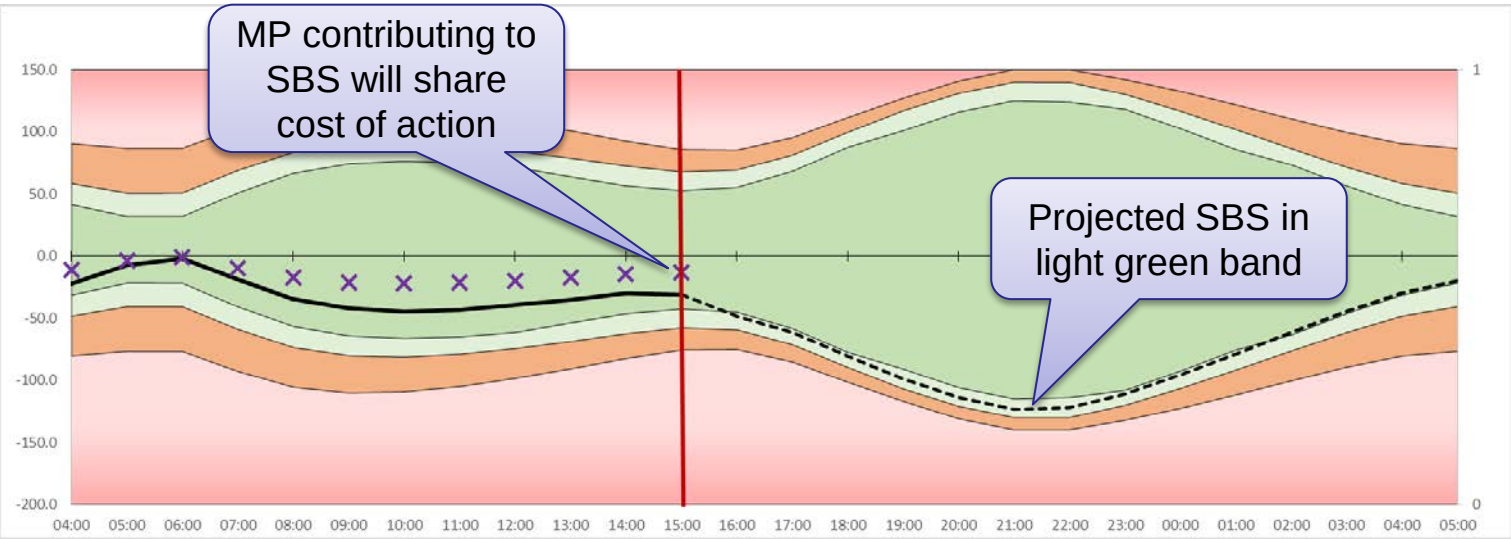


Paying for residual balancing actions

- Residual balancing actions are paid for those causing the action
- An MP causes the residual balancing action if their individual position (POS) is the same sign as the SBS.
  - A negative SBS/POS indicates more exit than entry
  - A positive SBS/POS indicates more entry than exit
- Entry/exit actuals based on near real time (NRT) allocation
  - Algorithm based allocation of custody transfer meter (CTM) data
  - Uses best available data and does not change once issued
- The POS for an MP is determined for hour h as:
  - POS_{h-1} + NRT injections $_h$ – NRT withdrawals $_h$ + Net Trade $_h$
- POS is cumulative

POS in action

- POS is updated hourly after transmission meter data obtained
- Reported with SBS so MP can determine likelihood of upcoming residual balancing action for which they are a causer



Causer pays

- Where residual balancing action is taken, all causers will pay a portion of the cost
- Methodology is a trade off between simplicity and accurate allocation of cost to cause
  - Simplest approach is that each causer will pay in the proportion of their POS to the total of all causer POS
  - Could also first charge those that have exceeded MHQ during the period leading up the residual balancing action, and then socialise balance between all causers
  - Others?
- Differences between near real time POS and actuals do not affect causer payments

Information for MP to make balancing decisions

- A full suite of reported information is required
- Interfaces for system information including
  - Actual SBS for last 3 days
  - Projected SBS for next 3 days
  - Individual POS by MP superimposed
  - Pressures
- Firm capacity allocated and available
  - By entry / exit points
  - By gas day
- Projected and actual interruptible available for auction
- Capacity prices
- Commodity ticker and index prices

Equivalent residual balancing action in DWGM

- At first schedule, AEMO buys any BOD target linepack shortfall (or sells surplus)
- At subsequent re-schedules, AEMO buys shortfalls in projected EOD linepack (or sells surplus)
  - Buy and sell is sourced from bid stacks
  - AEMO applies constraints to the operating schedule, which can result in injections from different sources and ancillary payments
    - Threat to system security
    - Nodal pressures are forecast to breach minimums
    - Operational capacity reached in part of DTS
  - Action can be combination of next hour (LNG) and balance of day
  - AEMO may also apply a demand forecast override

Paying for actions in DWGM

- All MP exposed to changes in market price for imbalances as AEMO buys or sells linepack
  - While quantities are relatively small, MP have limited information on which to base their bid strategies
  - Effectively socialises costs
- Any action that is not needed will impact the linepack account, and so be socialised
- MP demand forecast strategy is affected by AEMO actions in managing EOD linepack
  - High demand forecasts build linepack
  - AEMO ensures linepack does not get too high
  - Those who forecast high repaid at deviation prices
  - Offset by cheaper withdrawals later in the day

Reconciliation of NRT Position to actual position

- The NRT POS is used to determine if an MP is a causer of residual balancing actions
- Because this is an estimated share of actual flows, there is a reconciliation against actual entry & exit allocations
  - Entry points by allocation agents
  - Exit points by allocation agents or Retail Market Procedures
  - For Final and Revision settlement as is case for DWGM
- Differences between NRT and actual reconciled and settled at an index price for day
  - Payments will equal charges
  - Index price incorporates residual balancing actions

Other system security actions

- As overall linepack is not always a good indicator of system security, the System Operator will need to be able to take targeted system security action based on other factors:
  - Sectional linepack
  - Pressures approaching minimum levels
- Similar principles apply:
  - System security limits bands set, monitored and reported on
  - Same types of actions as for SBS
  - Costs shared by all MP (as likely to be small and too complex to target)

Options – residual balancing actions

- SO takes residual balancing action if the SBS:
  - is projected to enter an action band at any time in current day; OR
  - is projected to enter an action band in next ‘h’ hours; OR
  - has entered an action band in current hour
- The timing of the action can be varied, with system operator taking:
  - immediate residual balancing action; OR
  - giving notice of a definite residual balancing action in ‘h’ hours; OR
  - giving notice of a likely residual balancing action in ‘h’ hours, but only determining immediate residual balancing action based on situation at the time (allows MP to change their positions)
- The quantum of the residual balancing action can be varied:
  - recover only to relevant boundary for balance of day; OR
  - recover only for next ‘h’ hours (allows MP to change their positions)

SBS monitoring timing

SBS Monitoring

- The balancing model depends on the SO monitoring the SBS in relation to residual balancing bands (RBB)
  - May be more appropriate to monitor the prospective SBS in [6] hours
- This allows an RBA reaction in time to address the problem
- As the prospective SBS is less certain than the actual SBS, there is a case for urgent RBA (Next Hour or Directions) to be based on monitoring the actual SBS rather than the [+6] hour projected SBS
  - The issue may not occur anyway (e.g. weather changes more benign than expected)
- Initial proposal is that
  - ‘Balance of day’ based on [+6] hour prospective SBS
  - ‘Next Hour’ and ‘Directions’ based on actual SBS

Extent of residual balancing action

- In the event that the monitored SBS (whether current hour or hour + [6]) exceeds a RBB action must be taken
- The extent of the RBA is the minimum quantity of gas needed to restore the SBS (i.e. linepack) to the safe (green) zone
- With any RBA, the SBS may remain out of the safe zone for some time (particularly for balance of day RBA)
  - But this should not trigger a further RBA in a subsequent hour unless there was an additional change to the SBS being monitored.
- Alternative is to have an RBS recover the actual shortfall as at the time of monitored SBS
- Probably little difference, so choice would have to be made after analysis of scenarios

Short term capacity allocation follow-up

Recap of what we heard at the last workshop on short term capacity trading

- At the last working group meeting there were a number of questions raised around how capacity could be re-allocated on a day-ahead/intraday basis to assist participants' to manage their portfolios
- After the working group meeting the AEMC had conversations with stakeholders to understand in greater detail different scenarios to test the proposed market model against
- The following slides set out a proposed approach to establishing short term capacity trading at the Southern Hub
- They also set out a number of examples to illustrate strategies that could be used by participants in response to different scenarios

Proposed short term capacity release regime at the Southern Hub

Hierarchy	Day-ahead (MDQ)	Intra-day (Balance of MDQ)	Status	Cashflow
-	Secondary trading – bilateral/OTC		Firm	Counterparties
1	Unsold baseline	Unsold baseline	Firm	APA
2	Sold but un-nominated baseline	Sold but un-nominated baseline	2a) 75% firm 2b) 25% interruptible	AEMO
3	Above baseline	Above baseline, including counterflow	Interruptible	AEMO

Treatment of ‘Sold but not nominated’ capacity

- Firm capacity at a point sold but not nominated for day D may be sold late on D-1
  - Provided all firm capacity at that point has been sold
- This capacity will be sold as firm and interruptible components
  - Interruptible component only released when all firm sold
- The original owner of the firm capacity is not compensated but retains the right to increase existing nominations by an amount up to the interruptible component
  - Purchasers of interruptible component de-scheduled if insufficient interruptible capacity remains
  - May not pay for any unavailable capacity

Sold but not nominated: Setting firm and interruptible components

- In setting firm and interruptible components, market design must:
  - Discourage owners over-nominating to hoard capacity
  - Allow owner to still access some of the capacity as a re-nomination increase right
  - Minimise disruption to purchasers of interruptible components
- Firm component is ‘Sold but not nominated’ (SBNN) less interruptible
- Options for interruptible component include:
  1. [25%] of owner nomination (limited by SBNN) – but limits re-nominations where owner has only nominated small quantities
  2. [25%] of ‘Sold but not nominated’ quantity – allows more equitable access to capacity paid for by owner

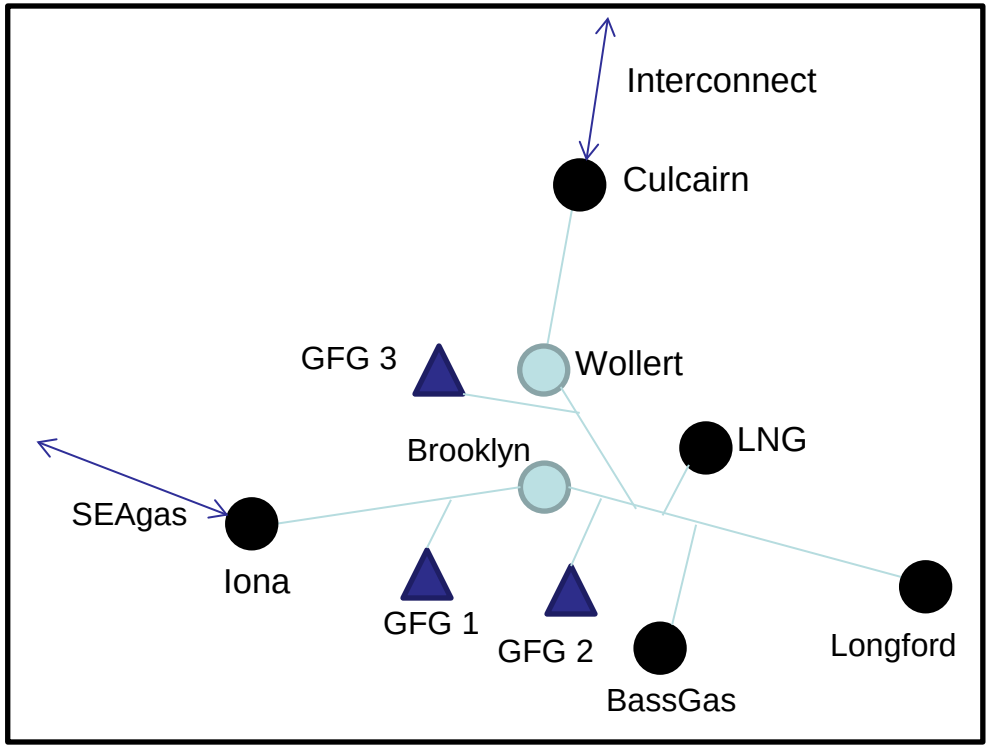
Sold but not nominated: example

- MP has firm entry capacity of 100TJ at Iona, but has nominated 60TJ at cut off time
  - Sold but not nominated: 100 – 60 = 40TJ
- Option 1
  - Interruptible component: 25% of 60 = 15TJ (< limit of 40TJ)
  - Firm component: 40 – 15 = 25TJ
  - Renomination increase right: = 15TJ
- Option 2
  - Interruptible component: 25% of 40 = 10TJ
  - Firm component: 40 – 10 = 30TJ
  - Renomination increase right: = 10TJ

Scenario 1: For the following gas day, the MP wants to:

1. run GFG 1 above its firm exit right; and
2. inject from Iona above its firm entry right

Therefore the MP needs to purchase entry capacity at Iona and exit capacity at GFG 1



Options

Exit point (GFG1)

1. If firm unsold capacity available, purchase firm capacity from APA; or
2. If firm capacity no longer available, purchase interruptible above baseline

Entry point (Iona)

1. Bilateral trade from another MP holding firm capacity; or
2. If firm unsold baseline capacity available, purchase firm capacity from APA; or
3. If (2) not available, purchase sold but un-nominated baseline as firm
4. If (3) not available, purchase sold but un-nominated baseline as interruptible
5. If (4) not available, purchase interruptible above baseline

Example of actions required to execute strategy for Scenario 1

Scenario 1: For the following gas day, the MP wants to:

1. run GFG 1 above its firm exit right; and
2. inject from Iona above its firm entry right

Therefore the MP needs to purchase entry capacity at Iona and exit capacity at GFG 1

Capacity	Commodity	Balancing	DWGM
Purchase exit capacity at GPG1	Nominate increased flow at relevant Iona CPP entry point under contract	Nominate increased flow at relevant Iona CPP entry point	Increase GPG1 site specific demand forecast for relevant hours
Purchase entry capacity at Iona		Nominate increased flow at GPG1	Adjust bids at relevant SIP at Iona CPP

Potential automated scenario

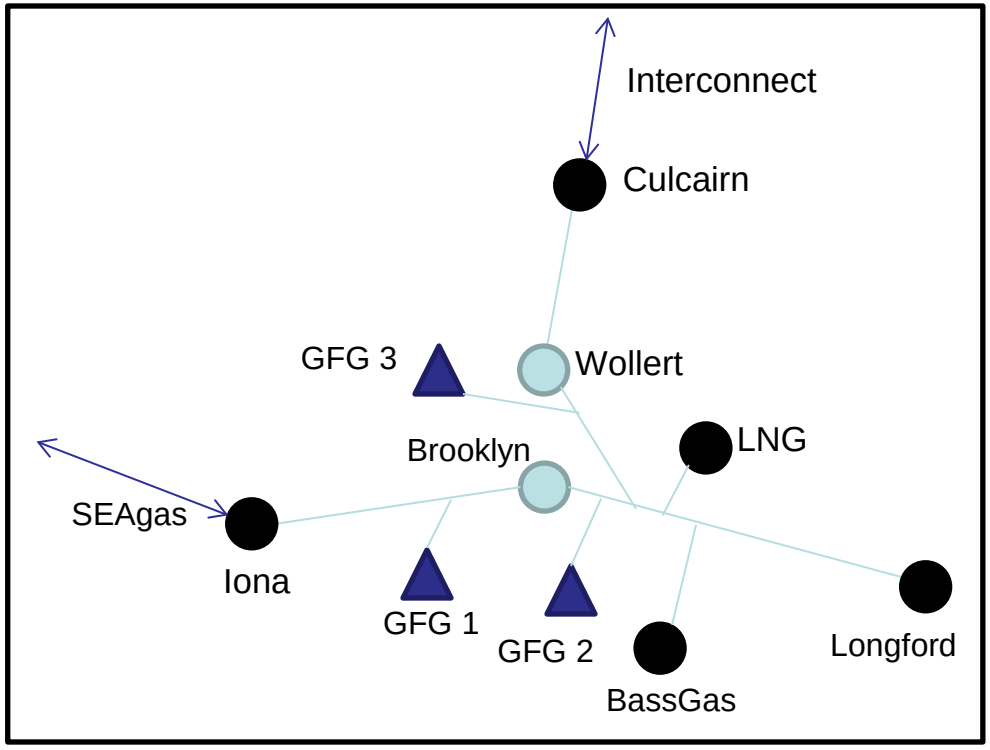
Select Exit: [GPG1 capacity]; enter [hourly quantities]; select '[purchase req'd capacity balance'] at [capacity price] (or market)
Select Entry: [Iona (UGS) capacity]; Enter [Qty]; select '[purchase req'd capacity balance'] at [capacity price] (or market)
Select commodity: [nomination], [Iona UGS], [nominate to supplier]

- System matches bids for capacity with cheapest offers under capacity price (any price if 'market' selected) and transacts to extent both entry and exit available, balance entered as bids at capacity price
- Transaction quantity nominated to supplier; entry & exit balancing nominations to system operator
- If capacity not available, message to MP.
    - Message may give other options (e.g. commodity at hub if entry capacity not available but exit capacity available and hub offers available)

Scenario 2: On the gas day, the MP wants to:

1. reduce Iona injections (as gas needs to be sent to SA); and
2. Increase injections at Culcairn above its firm entry right

Therefore the MP needs to purchase additional entry capacity at Culcairn



Options

Entry point (Culcairn)

1. Bilateral trade from another MP holding firm capacity; or
2. If firm unsold baseline capacity available, purchase firm capacity from APA; or
3. If (2) not available, purchase sold but un-nominated baseline as firm; or
4. If (3) not available, purchase sold but un-nominated baseline as interruptible; or
5. If (4) not available, purchase interruptible above baseline

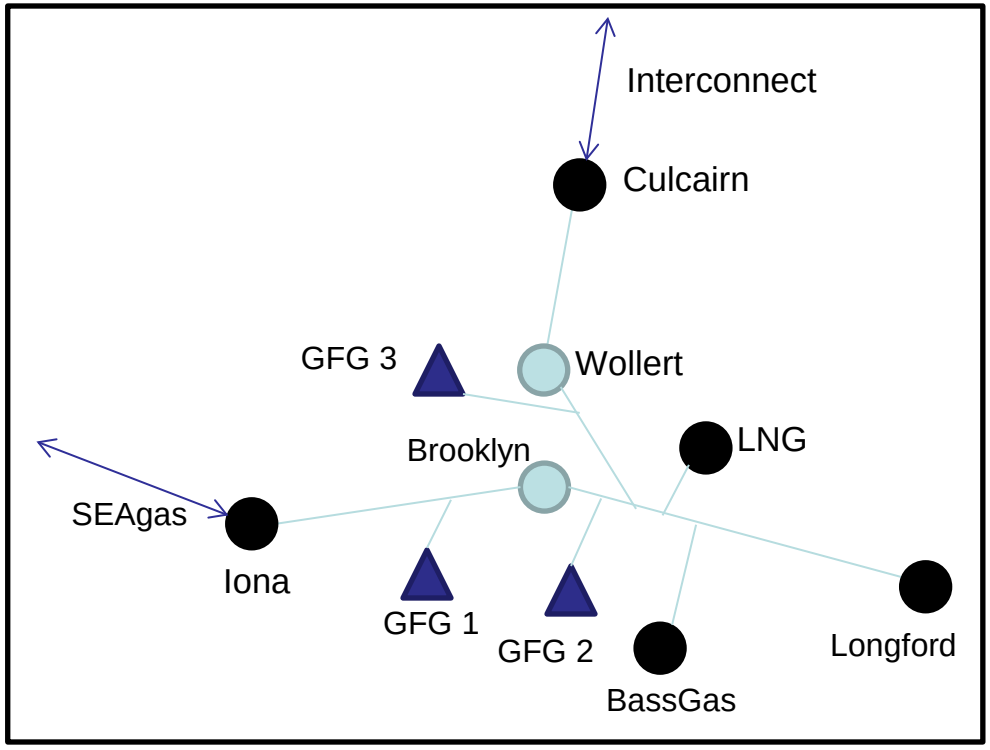
Entry point (Iona)

1. Bilateral trade to another MP wanting firm capacity at Iona;
2. If not sold, AEMO may sell firm un-nominated baseline

Scenario 3: On the gas day, the MP wants to:

1. Commence Iona injections within firm entry capacity rights; and
2. Commence withdrawals at GFG 2 (no firm exit rights)

Therefore the MP needs to purchase additional entry and exit rights



Comments

MP has sufficient entry rights at Iona but did not nominate any capacity day-ahead and therefore only retains 25% re-nomination rights.

Options

Exit point (GFG2)

1. If firm unsold capacity available, purchase firm capacity from APA; or
2. If firm capacity no longer available, purchase interruptible above baseline

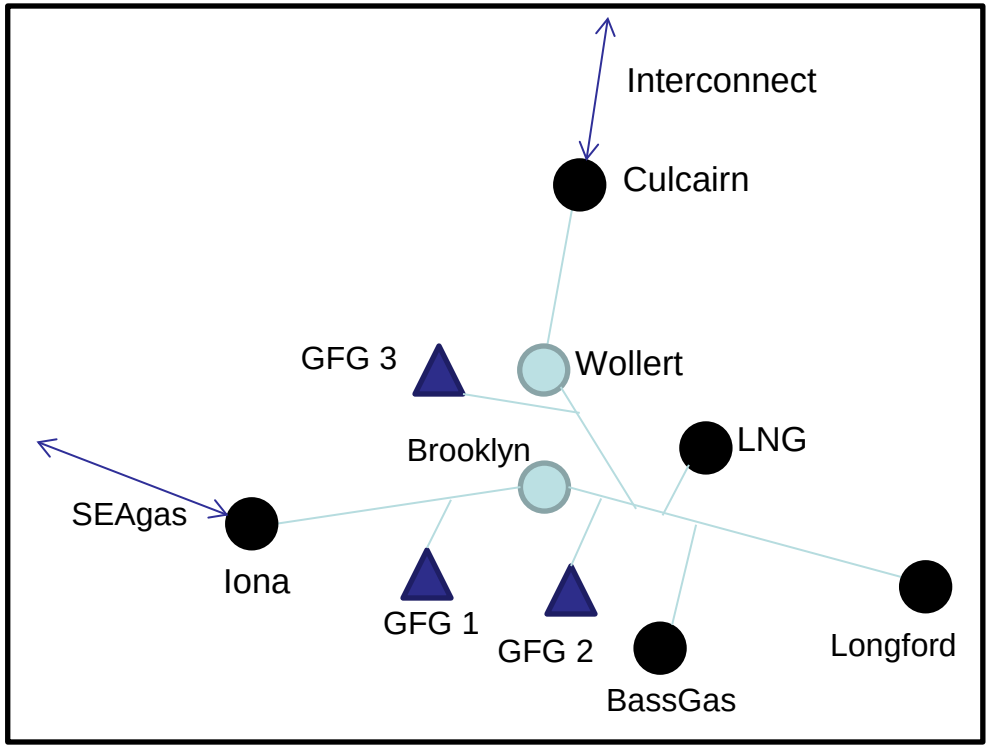
Entry point (Iona)

1. If required capacity is within the 25% re-nomination rights, then just re-nominate
2. If required capacity is above the 25% re-nomination rights, the extra should be purchased as per the hierarchy

Scenario 4: On the gas day, the MP wants to:

1. Cease injections at Iona; and
2. Withdraw gas at Iona

The MP needs to purchase counter flow exit rights at Iona



Comments

Requirement to remain reasonably in balance means that MP must seek to match withdrawals with injections or be exposed to residual balancing costs.

Options

Exit point (Iona)

1. MP seeks to purchase exit capacity at Iona using the hierarchy, which will include at a minimum interruptible counter flow capacity

Entry point (Iona)

1. Bilateral trade to another MP wanting firm capacity at Iona;
2. If not sold, AEMO may sell firm un-nominated baseline

Example of actions a small participant may need to take to purchase gas on the hub

Small Participant Scenario
- Distribution customer capacity allocated
- Purchase commodity on hub at market

Capacity	Commodity	Balancing	DWGM
Capacity allocated according to customers. If insufficient to meet demand forecast, must buy additional capacity.	Purchase commodity at hub before day / on day. Adjust commodity requirements by buying/ selling as required during day	Nominate hourly demand by zone and update during day.	Submit and update hourly demand forecast

Potential automated scenario

Select Exit: [Distribution Customer – My load]; enter [Total daily demand forecast]; select '[purchase req'd capacity balance'] at [capacity price] (or market)

Select commodity: [purchase at hub], at [commodity price] (or market)

- System determines if new or update – if update will buy shortfall and sell surplus
- System determines if additional exit capacity required, matches any requirement with cheapest offers under capacity price (any price if 'market' selected) and transacts if exit capacity available, any remaining balance bid at capacity price
- System matches minimum (exit capacity available, total daily demand forecast) with commodity offer at hub at or below commodity price and transacts, any remaining balance bid at commodity price
- Commodity nomination transaction to seller's supplier [if specified by seller]
- Transfer balancing nominations to system operator for seller and MP; MP exit nominations profiled to intraday profile for NRT allocations and profiled across system according to NRT allocations for MP.
- Message to MP with outcomes.

Next steps

Next steps

- Fourth working group meeting in late August to focus on options around **transition** to a potential new market design
- AEMC to publish a Draft Final Report on **14 October** for consultation
- Consultation period and process for finalising the report and recommendations yet to be determined

Additional reference material

Options to improve cost to cause

- A way of improving cost to cause allocation in event of RBA to not rely on just an MP's POS to determine their participation in RBA costs
- The POS remains important, as it shows the extent to which an MP is maintaining a balance between entry and exit
- For the purposes of determining participation in RBA only, an MP's POS could be adjusted by the following factors:
  - Late nominations
  - Deviations between nominations and NRT allocations
  - MHQ setting allowable linepack usage
- The ADJ_POS = POS + sum of adjustments
- Each is described in sections following

Late nomination adjustments

Late nominations

- The SO role is to manage the system to deliver entry nominations to nominated exit points in most cost effective manner
  - While maintaining system security
- The tools that are available to do this include:
  - System modeling tools
  - Releasing interruptible capacity
  - Restricting unavailable firm capacity
  - Managing pressures and linepack in different sections of pipeline
- In DWGM, AEMO reschedules at 4 hourly intervals during peak times. This is equivalent to acting on nominations up to 5 hours ahead

Late nominations

- As in DWGM, SO should be able to manage the system if:
  - MP are reasonably balancing their entry and exit nominations
  - SO receives enough notice of their intentions
- Residual balancing action (RBA) still available to maintain system security
  - Similar to way that AEMO buys and sells linepack in DWGM to achieve EOD linepack targets

Adjustments for late nominations

- Without sufficient notice for nominations:
  - MP may remain in balance over day; but
  - Local depletion of linepack / pressure; and
  - Potential that RBA is needed to maintain system security
- Range of options to deal with this include:
  - Nominations close [6] hours before start of hour
  - Additional participation in RBA cost recovery for all late nominations (i.e. received within [6] hours)
  - Nomination changes within [6] hours subject to acceptance by SO
  - Sliding scale payment for late nominations offset RBA costs
- Best approach to be determined during detailed design phase

Issues

- Setting what ‘enough time’ is
  - Six hours used in examples
  - Could vary between summer and winter
  - Could vary by extent of change
  - DWGM effectively 1 to 5 hours
- Not discouraging updated nomination to account for changing conditions
- Late nominations should not include those resulting from RBA
- Potential exemption of some locations from late nomination changes (LNG)
- Sufficiently encourage cost to cause
  - Without overlapping with other potential adjustments (e.g. deviation adjustments)

NRT Deviation Adjustment

Deviation from nominations

- The SO will be managing the system to deliver entry and exit nominations
- There may be incentives (Late Nomination adjustments) to provide timely nominations
  - However, this provides incentive NOT to change nominations as conditions change
  - Need to provide incentive to make nomination changes where needed
- Where NRT allocations are different to nominations, impact on system may result in RBA by system operator
- MP who have not made accurate nominations should participate in cost recovery to greater extent than those MP who were accurate
  - To the extent that their inaccurate nomination did not help SBS

Adjustments for deviations

- Options to allow for deviations of NRT allocations from nominations include:
  - Additional participation in RBA cost recovery based on extent that deviation has contributed to RBA (cost reflective)
  - Sliding scale causer deviation charge offset RBA costs (penalty but not cost reflective)

Issues

- Needs to be consistent with late nomination adjustment
  - MP may have incentive for deviation rather than late nomination
  - Retain incentive to nominate as accurately as possible
- Deviation of NRT from nominations may cause unbalanced position (POS) in commodity market
  - MP should maintain reasonable balance between entry and exit over gas day
  - Must be recovered through trading / carried over to following day
- Adjustment does not include overrun charges if NRT exceeds capacity rights
  - Overrun charges may be payable in addition to increased participation in RBA costs

MHQ Usage Adjustment

Allocation of MHQ

- An MP with entry capacity (EMDQ) / exit capacity (XMDQ) must allocate this as hourly capacity
  - Capacity relates to portfolio holdings, whether firm or interruptible
- Most entry capacity will be uniform (or uniform for balance of day)
- ‘Export’ & Industrial exit capacity will be mostly uniform
- GPG exit capacity will be peaky and less predictable
- Uncontrollable withdrawals in distribution networks a combination of
  - More uniform industrial (tariff D)
  - Morning / evening peak (tariff V)
  - Each MP will have a different combination
- In DWGM basic meters allocated to total hourly system load profile

Entry / Exit point flexibility

- Daily capacity is allocated between hours in the gas day
- The most that can be allocated to an hour as a proportion of a uniform allocation is the Entry / Exit load factor (ELF / XLF)
  - An XLF of 1.42 would mean that for every 24 TJ of daily exit capacity, no more than 1.42 TJ could be allocated to an hour (24/24 * 1.42)
- The ELF/ XLF could be allocated or auctioned
  - The MDQ would come with a ELF/ XLF of 1
  - ELF/ XLF would be needed to allocate more than 1/24 to an hour

Adjustments for MHQ usage

- If enough NRT allocations exceed available MHQ, the linepack depletion may cause the SBS to exceed a residual balancing band (RBB) and trigger a residual balancing action (RBA)
- Where RBA has been triggered as result of a MP exceeding their available MHQ, they should pay a proportion of the costs of the RBA. Options include:
  - Participation in RBA cost recovery based on extent that NRT exceeds MHQ and has contributed to RBA; or
  - Sliding scale causer excess MHQ usage charges that offset RBA costs

Issues

- Needs to take into account that the difference between MHQ and NRT allocation could be beneficial
- Needs to be consistent with other adjustments and overrun charges
- Setting limits to how much can be allocated to an hour / other portion of gas day
  - Similar to current AMIQ limits in DWGM
  - Need to be consistent with basic meter allocation methodology
- Changing MHQ allocations prospectively within day adds complexity
- Changing MDQ retrospectively adds significant complexity to MHQ allocation, but improves economic use of system
- Determining ELF/ XLF limits based on modelling and scenarios
- Pricing and allocation methodology for ELF/XELF