Wind Generation Offer Review

Background and problem definition

15 September 2015

Contents

Purpose of this presentation

- What areas of wind generation arrangements will the WAG focus on as part of this project? What elements of market design will be taken as given?
    - Key issue: Should wind generation be able to be withdrawn for economic reasons before gate closure? What about after gate closure?
- What is the problem definition?
    - Will be linked with the Authority's statutory objective: to promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers
    - Ensure that an identified subset of market arrangements (e.g. wind generation scheduling, dispatch and pricing arrangements) is maximally contributing to the statutory objective?
- The WAG has previously indicated that *efficient operation of the industry* should be the focus
    - Some reliability (security) issues (e.g. notice required of any large wind withdrawal) will be covered within the efficiency heading, e.g. when we deal with efficient scheduling we may resolve the security problem of wind being withdrawn with no notice

Existing wind generation offer regime

- wind generation offers use similar offer regime structure as for conventional generation (e.g. offers are P-Q pairs submitted by the generator)
    - Key differences discussed on next slide
- Single offered quantity doesn't distinguish between elements that:
    - can be controlled (e.g. making turbines available, feathering blades)
    - cannot be controlled (e.g. wind conditions) but can be forecast
- Code provisions are complex
    - principles guiding the design of the arrangements are not always clear
    - sometimes drafting seems quite imprecise

wind generation offer regime differences

Conventional generation	Intermittent generation
Up to 5 price bands	Only 1 price band. Must be either $0.00 or $0.01/MWh.
No revisions allowed to offer quantities after gate closure (normally 2 hours), except for: • Bona fide physical reason • end of bona fide physical reason • Grid emergency, or • significant change to ability to generate	Differences: • Must revise offers in the last 2 hours based on a persistence model using actual contemporaneous output • Can cancel offer prior to 30 minutes before the trading period
Must comply with dispatch instructions	Receive dispatch instructions, but do not have to comply with them, unless (1) GE or (2) a system constraint

wind generation in schedules

- What inputs do the different schedules use for wind generation?
- **PRS and NRS** use the latest wind generation offers. For each wind farm a single offer band (at $0.00 or $0.01) with the wind farm's latest forecast
- **RTD and RTP** use dummy wind offers
  - A single-band dummy offer is created for each offered wind generation. The offered quantity for each wind generation is set at 9999MW (!) but the maximum upward ramp rate is set to zero so the wind generation will never be scheduled above its initial MW reading. The initial MW reading is obtained from a recent SCADA observation.
  - The price attached to the offer is the $0.00 or $0.01 from the latest wind generation offer
- **Pricing** (interim, provisional, final pricing)
  - wind generation is modelled as negative load (provided through MV90 data), so no wind generation offers are used as inputs into final pricing

How regime is operationalised – offer revisions

- **Meridian** usually revises their forecasts every 6 hours, then 4 times each hour during the last 4 hours before the beginning of the trading period
- **NZWF** revises their forecasts 2 or 3 times prior to 2 hours before the trading period, then every 5 minutes during those 2 hours
- **Trustpower**
  - **Tararua Wind Farm:** revisions occur between 4 and 11 times until 2 hours ahead. Then half-hourly persistence based offers are made until the beginning of the trading period
  - **Mahinerangi:** Revisions occur between 2 and 8 times until 2 hours ahead, then half-hourly over the last 2 hours

How regime is operationalised – withdrawal

- Meridian does not normally withdraw wind farms for economic reasons, even before gate closure
  - Have started to occasionally do “wind capping” to cap wind output at the persistence-based forecast level. This may be an economic withdrawal of sorts.
- Trustpower has been economically withdrawing since 2004
  - Agreed procedure with SO: Trustpower gives 5 minutes notice to SO. Limits up/down ramp to 30MW every 5 minutes
  - The ability to economically withdraw was always intended
  - Justification for 5 minutes notice: A hydro plant can offer at its SRMC and get dispatched off immediately when prices go below that. It would be a non-level playing field to require wind to give much more notice (e.g. by requiring this to be signalled prior to gate closure).
- NZWF does not do economic withdrawal of Te Rere Hau
  - Although SRMC is real
  - Does withdraw turbines when a weather front is coming (to allow wind farm to come back on line faster after the front has passed). May try to give some notice, but will withdraw farm with no notice if necessary.

Code changes already proposed

- Consultation paper published 7 July: "Shortened gate closure and revised bid and offer revision provisions". Submissions closed 19 August
- Proposals:
  - Reduce gate closure to 1 hour (this won't affect the requirement to make persistence-based forecasts in the last 2 hours)
  - Wind: require persistence-based offers to include information about the generator's intentions for plant availability
  - Wind: require a persistence-based offer at least once in every trading period during the final 2 hours
  - Clarify and somewhat simplify clauses about revising offers

wind generation offer rules – broad rationale

- Wind's capability
  - Can't respond to an instruction to generate above its resource availability
  - There are circumstances where, for security, SO wants a wind farm to operate below its resource availability
- Final pricing general principle: if your bid/offer is not dispatchable, you must be a price taker (some exceptions e.g. plant breakdown)
  - Otherwise the participant can manipulate price without having to "back up" their bid/offer
- Rationale: Wind doesn't (in general) have to comply with dispatch, but it can't set price
- Was there ever a suggestion that wind generators can't withdraw wind generation for commercial reasons even before gate closure?
- What about after gate closure? Code is not clear about the amount of notice required

Australia's NEM

- Wind is a semi-scheduled generator
- Wind offers contain up to 10 price bands
- Wind generators separately submit plant availability to AEMO (if >6MW below nameplate)
- AEMO prepares an unconstrained intermittent generation forecast using plant availability, SCADA, met forecasts, energy conversion model, & no network constraints
- AEMO's security-constrained economic dispatch model uses wind offers but also uses the unconstrained intermittent generation forecast as a constraint. So wind offers are "cut off" at UIGF
- Wind could withdraw generation immediately by changing turbine availability to 0% with immediate effect
  - However, economic offers allow wind to withdraw in a well-signaled way, so in practice wind farms have not been observed to withdraw without notice
- Wind receives dispatch instructions, but is not generally obliged to comply unless AEMO declares a semi-dispatch interval
  - where network constraints apply or where the wind generator is dispatched below its UIGF
  - in which case the wind generator must not exceed dispatch
- Wind offers may set price

USA

- US markets generally have day ahead and real time markets. Energy imbalances are the differences between scheduled quantities in the DAM and RTM. Management of energy imbalances important for wind
- A 1996 FERC order provided for transmission providers to offer energy imbalance service as one of six ancillary services. Penalties if energy deliveries varied from advance schedules.
- Wind couldn't compete. So a number of special provisions were introduced for wind by regional transmission organisations (and approved by FERC) e.g. greater tolerance, lower balancing penalties
- Most US wind generation is centrally forecast, with wind farms providing meteorological and turbine availability information
- Wind farms usually may, but are not required to, offer into the day ahead market. Usually "virtual bids" ensure prices in day ahead market and real time market are broadly equal over time. If wind provides a capacity resource to the capacity market, it must offer into the day ahead market.
- Trend towards allowing economic offers of wind into the regional transmission organisations and providing for wind to be dispatched down as part of security-constrained economic dispatch (c.f. manually) based on economic offers. E.g. In MISO, *Dispatchable Intermittent Resources* can participate in market-based solutions to congestion and low-demand-low-price events. (Sometimes wind offers will be at negative prices reflecting renewable subsidies)
- Trend towards shorter scheduling periods (15 minutes c.f. 1 hour), following a 2012 FERC rule, may allow changes in wind generation to be incorporated into schedules more quickly, reducing balancing resources required, and possibly reducing balancing penalties paid by wind
- C.f. NZ: Our settlement is based entirely on a real time market with no penalties for deviating from earlier schedules. Wind pays for its volatility entirely through lower price shape. Economic withholding and downwards dispatch is not incorporated into our security-constrained economic dispatch systems.

Related work in NZ

- Shortened gate closure and revised bid and offer provisions
  - Mentioned this in an earlier slide. Have received submissions on a proposal
- Fault ride through for wind generation
  - Out for consultation. Submissions due 6 October 2015.
  - The proposal is that asset owner performance obligations (AOPOs) would require that any new generating units (including wind) meet certain requirements about remaining stable and connected, maintaining power output, and providing reactive current injection, during a fault
- Wind offers in final pricing
  - A future piece of work
  - It has a degree of separation from the wind offer work

High level objective

- Ensure that scheduling, dispatch and pricing arrangements for wind generation maximally contribute to the Authority's statutory objective: to promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers
  - Expect that the primary focus will be on the efficiency criterion?

Towards a problem definition

- What are the pros and cons of allowing wind generation to withdraw for economic reasons before gate closure? After gate closure?
    - Pros and cons in terms of competition, reliability and efficiency
- If we want to clarify the circumstances in which wind generation can withdraw before or after gate closure, what implications would this have for:
    - wind generation offer obligations
        - What form should forecast information take? (Possible separation of resource forecast from intentions for turbine availability)
        - Multiple offer bands that allow different offer prices?
        - Who is responsible for different parts of the forecast?
        - What information flows are required to support forecasting?
        - Should different gate closure times apply for different parts of the forecast?
    - wind generation input information into schedules including pricing schedules
    - wind generation dispatch obligations
- If we make changes for wind generation, what other forms of generation could be included (e.g. solar, run-of-river, wave)?
- Are there other issues associated with wind generation that should be considered at the start of the project?