Meeting record

Meeting:	Goldwind and AEMO meeting, RE: Power System Model Guidelines consultation submission.
Date:	1 March 2023
Time:	1:30pm – 2:30pm (AEDT)
Location:	Microsoft Teams meeting

Attendees:

Name	Company Department
Nilesh Modi	AEMO - Lead Specialist, Operational Analysis & Engineering, Operations.
Marina Delac	AEMO - Specialist Engineer, Systems Performance, Operations.
Jingwei Lu	AEMO - Principal Engineer, Operations.
James Guest	AEMO - Senior Engineer, Operations.
Hayley Gilbert	AEMO – Stakeholder Engagement Advisor, Government & Stakeholder.
Priank Cangy	Goldwind – Grid and SCADA, Grid Connection Manager.
Amin Mahdizadeh	Goldwind – Power System Engineer.

Disclaimer

This document provides an overview of the main points of discussion at a meeting convened by AEMO, at the request of Goldwind, on 1 March 2023 to provide information and facilitate further discussion on matters relating to Goldwind's submission to the Power System Model Guidelines which AEMO is currently consulting on. Readers please note that:

- This document is a summary only and is not a complete record of discussion at the meeting.
- For presentation purposes, some points have been grouped together by theme and do not necessarily appear in the order they were discussed.
- The views expressed at the meeting and reflected here are not necessarily those of AEMO.

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Meeting Notes

- This meeting was noted as a follow up to a previous discussion held prior to Goldwind making their submitting to the Power System Model Guidelines (PSMG) consultation.

  – The focus of Goldwind's request for a follow up meeting was to have their SME Amin Mahdizadeh share feedback and information with AEMO, as he was not involved in the previous discussion.

  – In recapping the previous discussion, the focus was on small signal stability models, noting;

    o AEMO's preference is seen to be detailed block diagrams developed by generators as per the existing requirements.

    o AEMO's concern of only having block diagrams of PSSE models, noting that in most models there is no information on what PLL models look like.

    o Goldwind would like to find a balance between AEMO requesting everything in detail, which may not be possible for OEMs, and what can be provided just for small signal stability models.

- Discussion explored AEMO concerns around providing transfer functions, being; when issues arise these might help identify the issues, but not necessarily identify which area of the control system they are coming from.

  – Goldwind suggest providing a transfer function of the plant instead of block diagram. This can then be used for small-signal assessment. AEMO noted this could increase workload for plant and that AEMO would need to reply on further information from OEMs and may not be a viable option.

  – Whether a transfer function approach could be appropriate for all operating conditions, or just specific conditions.

  – Goldwind proposal is a set of transfer functions (not in the form of frequency response in CSV file format, but developed based upon the frequency response data), which can be used for small signal studies at operation points of interest by AEMO.

  – How to deal with artifacts of curve fitting was raised, with Goldwind suggesting it would depend on the method used however, AEMO could choose the desired order and look at residual or use other metrics.

- Discussion around supporting software for Goldwind's suggestions.

  – Currently small signal software AEMO utilises does not accept look up tables for transfer functions, but may be able to be worked out with software provider.

  – The transfer function will likely not resemble the detailed block diagram however will give the same frequency response.

  – Minimum realisation methods could be used to find the transfer function with minimum order. Goldwind explained transfer functions are all about the input and output, with the process inside being unknown.

- AEMO questioned if the output data is not in line with what AEMO expected, would AEMO be able to go back to Goldwind to analyse the issue.

  o Goldwind suggest that if there are large discrepancies AEMO can go back to them as no one else can analyse what was inside the model.

  o Goldwind maintain there is no way to verify if the provided block diagrams by OEMs are exactly what is in the hardware. But comparisons and benchmarking are possible between the PSCAD model and the estimated transfer function. AEMO emphasized that transfer functions developed through curve

fitting would not provide any additional information regarding the cause of oscillation. AEMO can only rely on OEMs to develop solutions should the small signal studies reveal any potential oscillation.

- In practice, a complete model could be put into PSCAD, with perturbation injecting current or voltage at various frequencies starting from 0Hz to several hundred Hz, at PQ control mode. Then a small look up table could give all the information required, including critical functions in transfer function. AEMO raised that this could be highly complex and need a number of entries into look up table to capture wide range of operating conditions.

- Goldwind would like to develop the software tool with perturbation injection at various frequencies. Amin has created a prototype of this which only requires two runs per operating condition.
    - Noting if utilised, this would have to be identical for all participants, and would need to be available and adopted by all participants. It should be an open-source program.
    - The amount of work for all participants to adapt to this function was discussed.
        - Goldwind suggest it is possible to benchmark this transfer function.
        - AEMO requested an example or demonstration of the proposed method at other IBR operating conditions. Goldwind agree to this but require some time, noting they propose the method, not the code itself that Amin has developed.

- Goldwind suggests that no OEM could agree to Option 2 listed in AEMO's consultation paper, as;
    - All participants would have to agree on every bit of data to provide.
    - Generators do not have all of the data required for the detailed block diagrams. They need to approach OEMs to get the information.
    - Some methods cannot show up on the diagrams; they are huge or not even possible to represent as a diagram.

- AEMO requested a template or example of Goldwind's suggested prototype so that can be checked with small-signal stability tool provider if it is possible to adopt.

- AEMO meeting with ElectraNix was raised, with AEMO confirming that it has reached out to ElectraNix.

- Action: Amin of Goldwind will provide the transfer function code to AEMO, for trial and AEMO feedback.

- AEMO questioned if the transfer function that Goldwind will provide, if it is sufficient to capture sub-synchronous oscillation, for example between 2-25Hz.
    - Goldwind indicated that this is possible so long as a suitable frequency range is selected when running the perturbation tool.

- AEMO commented that the grid is currently seeing 19Hz oscillations.
    - Goldwind suggested that oscillation in the order of 10Hz is likely related to wind farm controller (PPC) and oscillations due to higher frequencies likely originating from the converters.
    - Goldwind suggested that in theory the 19Hz oscillations could be captured using the transfer function method.

- Balance of control system aspects were noted as essential for small block system diagrams.

- - AEMO need to know various operating points to see where any disturbance is, but must also know who is causing and who is contributing to the disturbance.
  - Goldwind unsure if block diagrams will give the complete picture AEMO desires.
- AEMO questioned if it is possible to develop these transfer functions just for the individual components.
  - A range of transfer functions can be developed for each device, which could be a solution.
  - This would require more testing for each operating point and cause more workload but could solve IP issues.

- The meeting ended with Goldwind agreeing to provide additional information regarding the transfer function and look up table approach to AEMO in time when Amin has further developed and tested these. No timeframe was flagged for this provision.