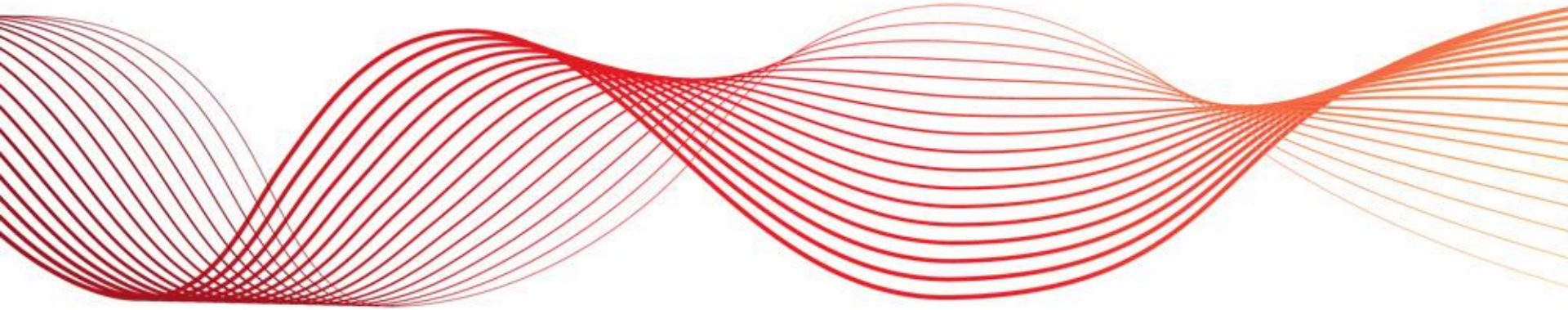
WIND AND SOLAR ENERGY CONVERSION MODEL GUIDELINES - ISSUES AND PROPOSED CHANGES

23 February 2016



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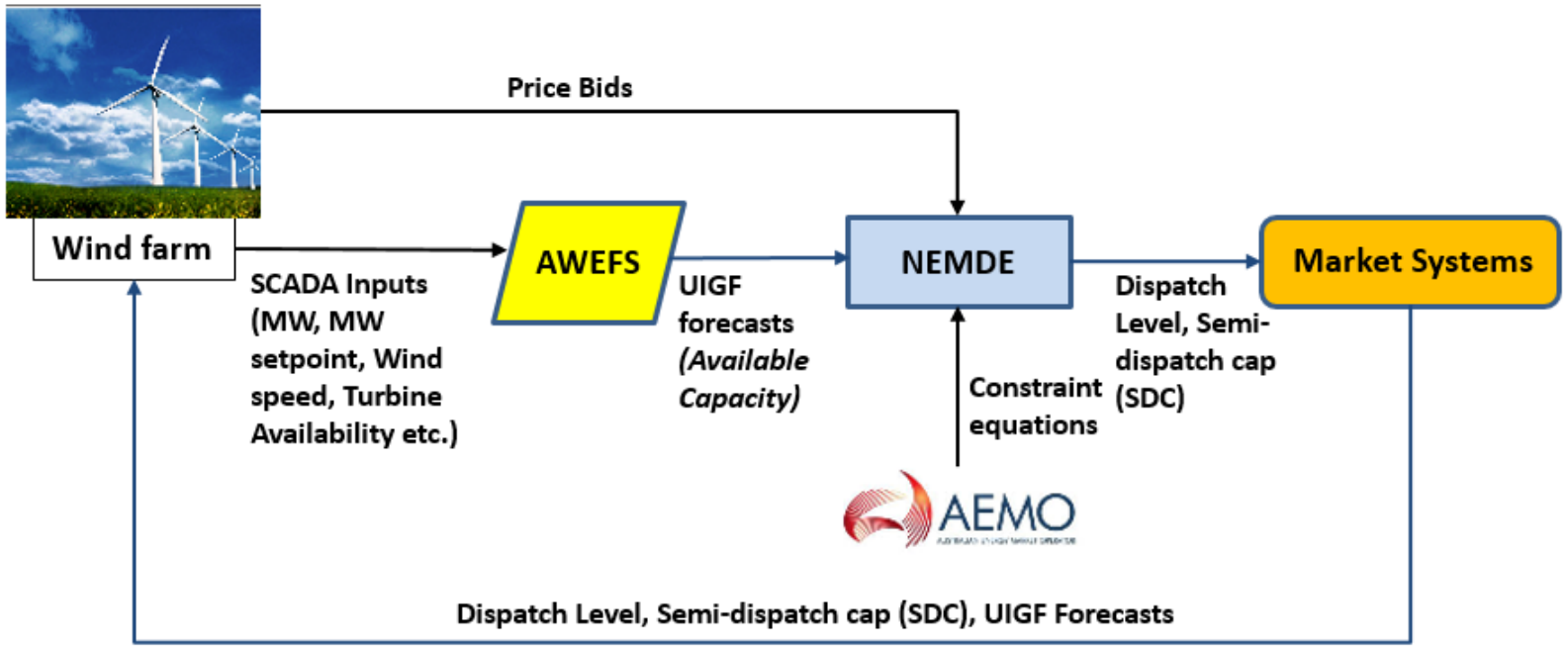
SESSION OVERVIEW

- Overview of Wind and Solar forecasting in Dispatch
- Update on AWEFS/ASEFS1 fixes for Dispatch forecast oscillation & erode to zero problems
- Outline of Local Limits issue
- Proposed solution to Local Limits issue
  - Consultation on required change to Wind/Solar Energy Conversion Model (ECM) Guidelines
- Additional proposed Wind/Solar ECM Guidelines changes

OVERVIEW OF WIND/SOLAR FORECASTING IN DISPATCH AND SEMI-DISPATCH



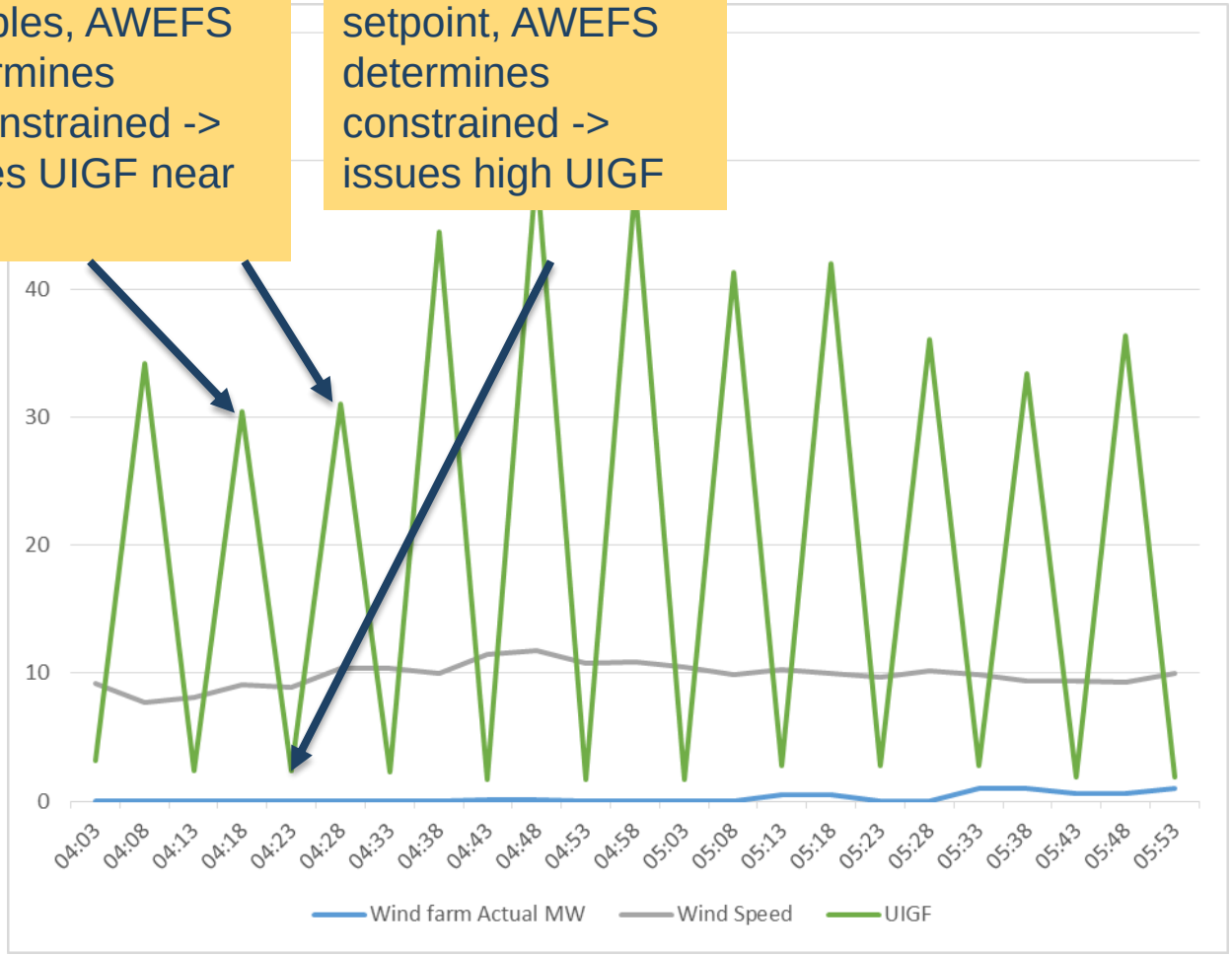
AWEFS/ASEFS1 PRODUCTION OF DISPATCH FORECAST (UIGF)

- AWEFS is required to produce UIGF – “Unconstrained Intermittent Generation Forecast”
- Two choices for forecast:
  - Wind-based, using wind-speed measurement SCADA
  - Output-based, using output MW SCADA
- Output-based is more accurate when not constrained
- AWEFS determines if farm constrained by:
  - comparing the output MW to the farm’s setpoint
  - comparing the Potential Power (based on wind speed and turbines available) to the setpoint
- ASEFS1 includes equivalent logic using irradiance and inverters available

OSCILLATIONS PROBLEM ILLUSTRATION

Setpoint = 30 MW, output still near zero when AWEFS samples, AWEFS determines unconstrained -> issues UIGF near zero

Setpoint ~ 2 MW, output near zero, close enough to setpoint, AWEFS determines constrained -> issues high UIGF



OSCILLATIONS AND ERODE TO ZERO PROBLEM

- Problem:
  - AWEFS is not reliably detecting constrained operation in semi-dispatch periods
  - Dispatch target can oscillate and/or erode to zero
- Interim partial solution:
  - Increase thresholds in AWEFS “constrained” test
  - Significant oscillation remains due to test in AWEFS of Potential Power against setpoint
  - Forecast accuracy outside semi-dispatch is slightly decreased
- In Production since first week of February 2016

PERMANENT AWEFS SOLUTION

- Provide the Semi-Dispatch Cap to AWEFS to more reliably detect constrained operation
- Adding SDC to AWEFS logic is expected to fix this oscillation problem
  - This solution is in active development with the vendor of AWEFS
- Pre-production implementation is anticipated by early March 2016
- Production implementation by early April 2016
- AEMO will closely monitor performance
  - New functionality can be rapidly disabled in case of problems

LOCAL LIMIT ISSUE FOR ECM CONSULTATION

- Problem: Difficult for participants to manage local limits on wind/solar farms in dispatch
  - Wind/solar farm has a local limit on its output, which may be dynamic
  - Without intervention, AWEFS dispatch forecast (UIGF) can be well above intended output
  - Upper MW Limit in NEM portal does not apply in dispatch
  - Management by bidding or by NEM control room are current approaches
- Solution:
  - Add mandatory SCADA Local Limit signal to limit dispatch forecast (UIGF) in AWEFS/ASEFS1
  - Requires consultation on ECM Guidelines, around 3 month process, starting today.
    - ECM Guidelines specify the static and dynamic (real-time SCADA) information that semi-scheduled generators must and may provide for use in AWEFS/ASEFS1

DEFINITION OF LOCAL LIMIT

- **Local limits** must reflect wind farm's *available capacity* and comply with UIGF requirement in NER 3.7B(c)(6) to exclude the effect of *network constraints*
- **Local limits include**:
  - Limits on *plant availability* (defined in NER), including generation outages
  - Limits on connection assets
  - Limits required to meet performance standards
- **Local limits exclude**:
  - AEMO semi-dispatch cap (limits managed by AEMO)
  - Market-related limits (managed through bidding)
  - Limits on *transmission network*
  - Limits on *distribution network*

BENEFITS AND COSTS OF SCADA LOCAL LIMIT

Benefits for Wind/Solar farms	Benefits for Market
Less manual intervention	More efficient dispatch outcomes
FCAS regulation causer pays factors more closely aligned with generator performance	Reduced over-dispatch error and frequency regulation

Costs for Wind/Solar farms	Costs for AEMO
Implementation of new SCADA “Local Limit”	ECM consultation and update process
	AWEFS/ASEFS1 system changes

ALTERNATIVE OPTIONS

Option	Problem(s)
Manage with rebidding of capacity into high price bands	• May be dispatched during supply scarcity • Rebidding is difficult to manage for dynamic limit, with increased risk of human error
Manage by bidding inflexible	• AEMO believes this is not NER compliant
Contact AEMO control room for generic constraint	• Unsuitable for dynamic limits • Significant manual intervention
Apply NEM portal Upper MW Limit in Dispatch	• Half-hour resolution may not suit dynamic local limits • Inconsistent with existing SCADA Turbines Available
Use existing MW Setpoint as Local Limit	• Local Limit needs to comply with NER to be used to cap UIGF

CONSULTATION ON SCADA LOCAL LIMIT

- Consultation process is via AEMO website
- Consultation will seek comment on:
  - How to specify, and the types of limits included/excluded
  - Costs of implementation
  - Mandatory vs Optional SCADA Local Limit signal
  - Quality handling, validation/substitution, defaults, update frequency

OPTIONAL: IMPROVING DISPATCH FORECAST ACCURACY

- **“SCADA Wind Speed”** is an existing ECM real-time item
  - Change to clarify that:
    - Wind speed measurements must be no greater than 15-second averages
    - Wind speeds may be averages of one or more representative locations in the wind farm (cluster)
- Add optional new ECM real-time **“SCADA Possible Power”**
  - **Possible Power:** Power that wind farm’s control system calculates could be theoretically generated based on available wind and turbines only, if not limited by any local or network limitation
  - AEMO will compare and report on AWEFS forecast performance against the performance of wind farm’s Possible Power forecast
  - Will enable future work to improve AWEFS dispatch forecast accuracy

OTHER MINOR ECM CHANGES

- Add Maximum Capacity static item for new wind/solar farms and for currently affected farms
- Clarify existing data item definitions
- Remove unused data items
- Grammatical and formatting improvements
- Details in ECM Consultation Issues Paper

CONSULTATION TIMELINE

- Pre-Consultation Forum: **23 February 2016**
- First stage:
  - Draft Issues Paper and Notice of Consultation: **18 March 2016**
  - Submissions close: **28 April 2016**
- Second stage:
  - Draft Report and Notice of Consultation published: **26 May 2016**
  - Submissions close: **10 June 2016**
- Final Report and ECM Guidelines: **25 July 2016**

FUTURE INTERMITTENT FORECASTING & ECM CHALLENGES

- AEMO is looking ahead to future challenges
  - Improvement of forecast accuracy
  - Battery & other storage
  - Combined wind / solar / storage plants through a single connection point
- AEMO intends to consult widely on these and other challenges and potential solutions
  - We welcome your input