

WDS Discussion Paper – June 2006

This paper summarises the proposal for publishing security constraint information from September 2007 when the System Operator introduces a new application that automatically generates an n-1 thermal security constraints

Its purpose is to provide a draft proposal for industry consultation at the June 2006 System Operator workshops. It also acts as a formal follow up to the early May 2006 informal System operator participant visits.

1: Background

N-1 Security Constraints are applied to the SPD market clearing engine to ensure the power system is dispatched in accordance with the EGRs and the security policy of the System Operator's Policy Statement.

The System Operator proposes to automate the way security constraints are calculated using an application called SFT. This automation will be delivered by the System Operator's market systems replacement programme (MSP). This application will allow the System Operator to determine and implement thermal security constraints dynamically, providing better management of constraints in real time operation, enabling a more secure, efficient and cost effective use of grid capabilities.

SFT will not increase the number of security constraints in real time or in final pricing because constraints only bind if they are needed to manage a real security issue. The number of constraints applying in final pricing is not a function of the type of tool used to calculate constraints.

The present method for calculating constraints has the following drawbacks:

1. The load, generation and more importantly network configuration can differ from the assumptions used to form the constraints applying in dispatch.
2. Some contingencies can be identified in real time dispatch that were not identified in planning (and for which an appropriate constraint has not been applied to the model in planning time)
3. Thermal constraints are developed in a manual process, with associated work load burden and attendant risks. There is limited ability to provide notice of the actual or likely application of these constraints.

The new SFT based method addresses each of these drawbacks but also changes the way constraint information will need to be published to industry.

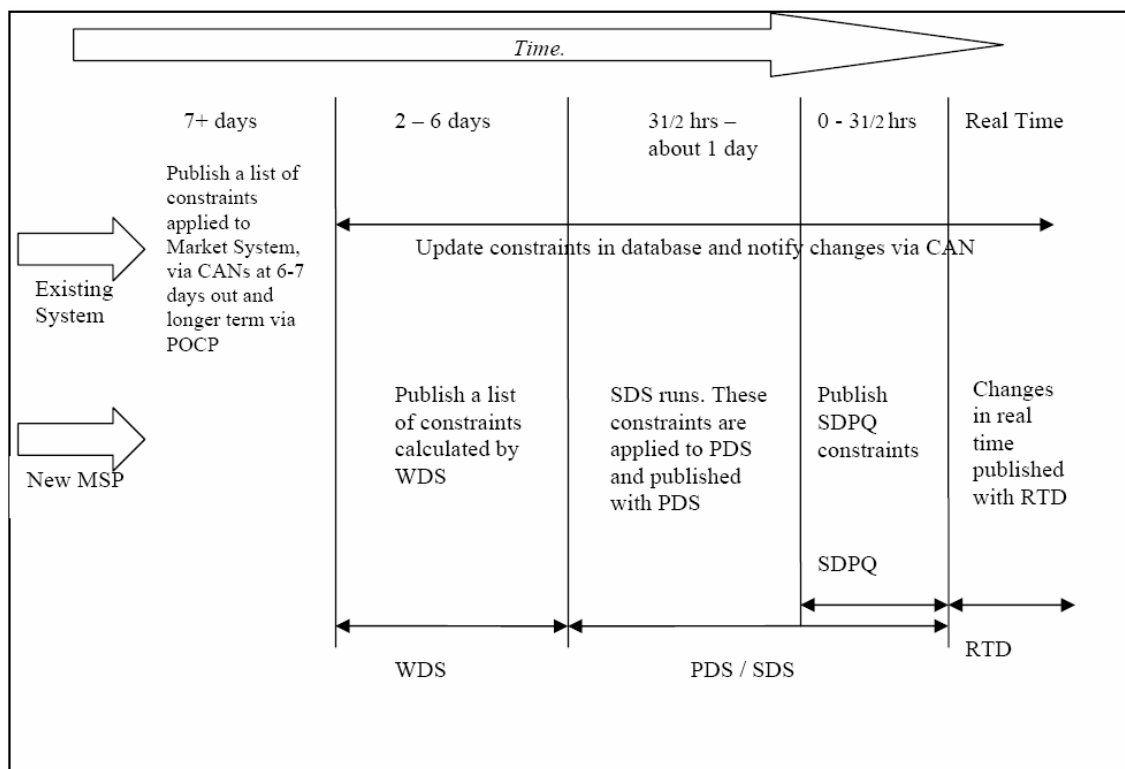
SFT will generate constraints for a particular grid configuration and dispatch pattern and so will only calculate constraints that are likely to bind or bind within a nominated percentage of a defined parameter limit.

The current method the System Operator uses to notify the industry of constraint changes will no longer be appropriate. Current process relies on a large number of permanent and outage constraints being applied to SPD with no indication of whether they will bind until the PDS and SDPQ schedules are produced. All changes to constraints identified within 1 week of real time are currently notified via CANs; these normally account for grid outages changes and real time adjustments.

The System Operator proposes to introduce new weekly schedules to replace the current functionality for constraint publication. Instead of publishing a list of constraints being applied to the SPD model, the System Operator would be forecasting the likelihood of the constraints being applied via a forward looking schedule. The constraints would be published when they exceed a defined parameter (“% of binding”) which would allow participants to make risk assessments of the likelihood of the constraint actually binding in real time and pricing.

2: Base Line Proposal

The System Operator’s base line proposal is shown graphically below.



The System Operator’s proposal would include the publishing of constraints with the PDS/SDS, SDPQ, RTD schedules and the proposed new WDS schedule. The proposed constraint publication format is shown in tabular form below. A discussion follows the table.

Schedule	Timing	Constraint 1		2	Outage 1	2	3
		Name	%				
WDS	Day 7	1.34*TKU_WKM1.1+ 0.32*TKU_WKM2.1 <120					
	Day 6...	1.36*TKU_WKM1.1+ 0.31*TKU_WKM2.1 <119					
	...Day 2	1.34*TKU_WKM1.1+ 0.32*TKU_WKM2.1 <120			BPE_TKU1.1		
SDS/PDS	1pm day before	1.38*TKU_WKM1.1+ 0.29*TKU_WKM2.1 <117			BPE_TKU1.1		
	3pm day before...	1.36*TKU_WKM1.1+ 0.31*TKU_WKM2.1 <119			BPE_TKU1.1		
	Half an hour before constraint is required	1.34*TKU_WKM1.1+ 0.32*TKU_WKM2.1 <120			BPE_TKU1.1		
SDPQ	3 hours in advance	Should be the same as the SDS/PDS results			BPE_TKU1.1		
	2 1/2 hours in advance				BPE_TKU1.1		
	Half an hour before constraint is required		Locked for RTD and Pricing			BPE_TKU1.1	
RTD	Constraints applied to RTD	1.34*TKU_WKM1.1+ 0.32*TKU_WKM2.1 <129 RHS Changes normally or Ad hoc updates			BPE_TKU1.1		

SDS/PDS and SDPQ Constraints

The System Operator will publish (in COMIT) a list of security constraints that are within 80% of binding in the SDS and SDPQ schedules. The SDS has same duration as the PDS but uses the System Operator load forecast. Currently information from the SDS schedule is not published in Comit. The constraints would be published in a form similar to the form of current security constraints.

Every time the schedules were run, the constraints would be recalculated and would be updated to account for any changes to schedule inputs e.g. bid, offer or grid outage changes.

Real Time Constraints

The RTD schedule would use the constraints calculated from the last applicable SDPQ schedule. If constraints are modified after the last applicable SDPQ schedule the changed constraints would be published with the relevant RTD schedule. There would be no more CANs issued with this constraint information.

New Weekly Dispatch Schedules (WDS)

The proposed WDS would run every day at 1am. The first period is T1 of the next day and it would cover a full 6 days. The WDS would use “rolled over” generation offers from the same day of the previous week. The offers to be used are at gate closure time for each trading period. For example the Wednesday 17th April T7 forecast offers would be the offers for 10th April T7 at gate closure, 1am on 10th April. The schedule would be used internally by the System Operator for security analysis. The security constraints that are within 80% of binding in the WDS schedule would be published. On each occasion the schedules are run, the constraints would be recalculated and automatically account for changes to offers. There needs to be caution in respect of any additional information to be published with the WDS because the schedules would be based on rolled over generation offers. The caution is required to ensure conformance with Commerce Act competition requirements which presently allow publications of offers only after 14 days.

Outage Publication

Currently the System Operator manages grid outages in SPD by constraining branches to zero. SPD recognises branches constrained to zero and removes them from its internal model. In the future branches would no longer be constrained to zero but will be removed from the external model that is an input to SPD. Because constraints are currently published in TPIX, outage information is also currently published, as branches constrained to zero. In the future, the System Operator proposes to publish grid outages directly with the WDS, the PDS, and SDPQ schedules. The outage information published will be in the form of real grid component information e.g. BPE_TKU1.1 or BPE CB 62.

Summary of the Proposed Solution

The combination of the proposed publications would replace the current functionality for constraint publication. Instead of publishing a list of constraints being applied to the SPD model, the System Operator would forecast the likelihood of the constraints being applied through the medium of various forward looking schedules.

Publication of the constraints generated from the WDS schedule used by the System Operator for security analysis is considered the best indication of constraints and is consistent with the Policy Statement objective to forecast constraints likely to occur.

Over the next 6 months the System Operator will further analyse the way it manages grid security over the 1-7 day time horizon. There will be discussion at the System Operator SFT workshops on 27th and 30th of June 06 including a possible alternative WDS schedule as discussed in section 3 below.

3: Alternative WDS – “Batched WDS”

A possible alternative WDS schedule based on batched cases in combination with additional information being published was discussed at the System Operator’s preliminary participant visits in May 06.

The alternative WDS (called WDS² for convenience) could also run every day at 1am. The first period would again be T1 of the next day and it would run for a full 1 to 6 days (can be configured). The WDS² would use a batch of pre-defined generation and load offers. Up to 6 scenarios are possible with current technology.

The batching facility would allow a combination of generation and load scenarios to be run. It is proposed that 3 load x 2 generation scenarios be run to make up 6 combined scenarios.

The three proposed load scenarios would be the base System Operator medium load forecast (MTLF) and the MTLF plus and minus 2% at each load bus. This would give an indication of the sensitivity of load to constraints. Alternatively 6 generation scenarios with 1 load scenario could run.

The questions we need to address are which scenarios to use and what data to publish for each scenario. Although the work to manage the scenarios is likely to be significant, this alternative is worth pursuing because of possible benefits to industry arising from the additional information that would be published with this alternative schedule. Again, Commerce Act considerations would need to be considered and taken into account in determining the publication protocols. However, we doubt there would be problems for a batched WDS. The best process would require industry participants to be involved in the selection of cases.

System Operator has investigated manufacturing base generation scenarios for discussion at the workshop. It looked at creating some extreme scenarios with fixed offers but found the task complicated, though not impossible. For each week long scenario, we need perhaps two offers per station per trading period – this is less than currently offered but still equates to 2 offers x 65 stations x 48 intervals per day x 6 days, a total of 37,400 offers for each scenario. Rationalisation techniques could be used to reduce the numbers e.g. running only every ‘nth’ interval.

The work required to create and manage these scenarios will be significant especially as it is likely the System Operator would need to periodically update the scenarios to keep them relevant to operational conditions (e.g. it seems unlikely there would be value in running a scenario with a high HVDC north scenario when there is a South Island drought).

A possible process for managing the scenarios is described below:

- a) Industry to develop and manage a library of 20 scenarios, published on System Operator web site.
- b) Every 6 months the 20 scenarios to be reviewed at the half yearly SO workshops
- c) At this workshop the process to be reviewed
- d) At the 20th of the month the SO to review the applicable generation scenarios to be used for the following month and publish the proposed scenarios on its website.
- e) Participants to have 5 days to offer alternative proposals
- f) On the 25th of the month the SO to decide which scenarios to use and action

As a base the System Operator would publish a list of security constrains for every scenario that is within 80% of binding in the WDS² schedule. The additional information that could be published with the WDS₂ can be discussed at System Operator SFT workshops. The additional information that could be published with the WDS² is described in Appendix B.

The two distinct types of WDS schedules: WDS (proposed rolled over WDS schedule) and WDS² (batched WDS schedule) are described below in Appendix A.

Appendix A: New WDS Schedules

Input Type	WDS proposed	WDS ² [batched scenarios]
Publication to COMIT	Constraints and outages only	Definitely constraints and outages and possibly other things
Inputs		
Frequency regulating reserve requirements	Not applied to WDS.	Not applied to WDS.
HVDC Scheduling Application	Applied to WDS	Applied to WDS
HVDC ramp rate constraints	Not applied to WDS.	Not applied to WDS.
HVDC running level requirements (DCSA constraints)	Not applied to WDS.	Not applied to WDS.
Other adjustments (bona fides/discretionary action)	Not applied to WDS.	Not applied to WDS.
Network Model (including outage information)	Network Model (including approved outage information from Outage Scheduler)	Network Model (including approved outage information from Outage Scheduler)
Conforming Load	MTLF	MTLF (with facility to run low and high load variation in the batch)
Non Conforming Load	Rolled over Non Conforming load Bids - (suggests Metered load?)	Use the Non Conforming load forecast from the MTLF - i.e load from last week
Generation (non-IG) information, including ramp rates	Generation Offer Rolled over (no ramp rates or set to 9999?)	Generation scenarios (no ramp rates or set to 9999?)
IG information, including ramp rates	Intermittent Generation Rolled over	Generation scenarios (no ramp rates or set to 9999?)
Initial Generation Value (for each generator market node)	Not required so override the Ramp rate for all offers to 9999	Not required so override the Ramp rate for all offers to 9999
Reserve offers	Not required	Not required
Reserve requirements	RAF = 0	RAF = 0
Security Constraints (thermal/voltage/stability)	SFT created constraints + Manual Constraints	SFT created constraints + Manual Constraints
Voltage Profile	Voltage profile at controlled busses	Voltage profile at controlled busses
Mixed constraints	Standard	Standard
Constraint Violation Penalties	Standard	Standard



Appendix B: Batch WDS Publication Options

<i>Items that Could be Published Automatically with WDS²</i>
Constraint Information for each scenario (will be published with the proposed WDS also)
Forecast Grid Owner outages (will be published with the proposed WDS also)
Transpower week ahead load forecast at a bus level
Generation and load sensitivity factors for each binding or near binding constraint showing the “marginal” impact of injections on constraints
Expected voltage profiles