

SFT Implementation

Parallel Operations Interim Report for Participants

System Operator

15/09/2010



*Keeping the lights on
24 hours a day, 7 days a week*

SYSTEM OPERATOR

Keeping the energy flowing

TRANSPower



1 Latest Timetable

Activity	Dates
Parallel Operations	16 Aug – 8 Oct 10
Scenario Testing (includes preparation and reporting)	11 Oct – 5 Nov 10
Scenarios	18 Oct – 22 Oct 10
SFT Market system released into production (with SFT off)	Dec 10
System Operator begins using SFT for planning outages	Feb 11
SFT Go live	28 Mar 11

2 Parallel Operations Observation Summary

- § The vast majority of constraints generated have similar to the near binding manually applied constraints. This is as expected,
- § Appendix A contains the SFT constraints that have bound in RTD during the parallel operations periods to date.
- § Appendix B contains the full list of SFT constraints generated during parallel operations to date. This list includes constraints generated by all SFT schedules and therefore includes constraints generated out to the WDS timeframe and for outages that were subsequently cancelled (i.e. constraints were never applied in real time).
- § The list in Appendix B contains more constraints than we expect to be generated by SFT in the future. We now have the ability in the latest software release to exclude branches permanently from monitoring for constraint creation. This work is continuing during the parallel operations period.
- § Appendix C lists the typical history of a particular SFT constraint from the WDS time frame through to real-time. Note the minimal change to the coefficients, the RHS, and the percentage binding as the timeframe decreases from 6 days to real time.
- § During the parallel operations, there have been 3 groups of constraints generated by SFT that had not been identified in advance as being required. These constraints have now been developed and applied to our production system; two permanent constraints and one outage constraint.
- § There have been a number of outage and permanent constraints identified by SFT that fell outside the parallel operations period. Approximately 8 SFT constraints have been generated where existing constraints did not exist but are valid; 5 have been created as permanent or outage constraints
- § There were no unnecessary SFT constraints generated in scheduling time due to planned outages (i.e. no constraint required deactivation during the planning period.
- § SFT generated three constraints in real time that were subsequently deactivated; they were not required. The constraints were generated when KIN was spurred to protect ARI KIN 1 for a contingency of ARI KIN 2 when the KIN TRK system splits were offered during a grid emergency on 6 Sep 10. Further investigation revealed we were close to needing the overload scheme armed and the contingency definitions required change.
- § There have been no other constraints deactivated in real time.

- § There have been no RHS adjustments required in real time; whenever a constraint was binding, the associated violation was active or near violating.
- § During the parallel running period, the System Operator determined the need for additional constraints to manage a complicated outage of OHW_WKM 1. The outage required a system split on the KIN TRK 1 & 2 circuits, enabling and disabling a complex array of contingency definitions, and applying and removing several outage constraints. The planners built two constraints manually. This process involved three planners and took 6 hours to create two constraints. The SFT team supplied the planners with the two equations that SFT had identified. In comparison, these 2 constraints were automatically created and scheduled in the SFT Environment. Less than 2 minutes was taken to validate the constraints against the planned topology. The constraint build and RHS values of the SFT constraints compared with the manually created constraints below demonstrates the kind of accuracy we have seen so far during SFT Parallel Operations.

SFT Constraint **Name:** HAT_WKM1.1_OTA_WKM1.1_OTA_WKM1_WKM_LN
Build: $-1.318 * HAT_WKM1.1 + -0.557 * OTA_WKM1.1 \leq 674.0$

Equivalent Manual Constraint **Name:** OHW_WKM1&KIN_TRK_SPLIT_O_W_2A_temp
Build: $-1.33 * HAT_WKM1.1 + -0.55 * OTA_WKM1.1 \leq 676.0$

SFT Constraint **Name:** OTA_WKM1.1_HAT_WKM1.1_SHAMWKM1_WKM_LN
Build: $-1.227 * OTA_WKM1.1 + -0.374 * HAT_WKM1.1 \leq 419.4$

Equivalent Manual Constraint **Name:** OHW_WKM1&KIN_TRK_SPLIT_O_W_1_temp
Build: $-1.23 * OTA_WKM1.1 - 0.39 * HAT_WKM1.1 \leq 416.0$

3 Appendix A

SFT Constraints that bound in RTD

Date	Trading Period	Constraint
20/08/10	34	ARI_HAM1.1__ARI_HAM2.1__\$ARIHAM2__HAM__LN
20/08/10	33	ARI_HAM1.1__ARI_HAM2.1__\$ARIHAM2__HAM__LN
31/08/10	33	KAW_OHK.1__WKM_PPI_WRK.1__:S__WKM_WRK__KAW__LN
6/09/10	36	ROX__T10__110KV__GOR_ROX.1__GOR_ROX__XF
6/09/10	35	ROX__T10__110KV__GOR_ROX.1__GOR_ROX__XF
6/09/10	34	ROX__T10__110KV__GOR_ROX.1__GOR_ROX__XF
6/09/10	33	ROX__T10__110KV__GOR_ROX.1__GOR_ROX__XF
8/09/10	37	ROX__T10__110KV__GOR_ROX.1__GOR_ROX__XF
8/09/10	35	ROX__T10__110KV__GOR_ROX.1__GOR_ROX__XF

4 Appendix B

ARI_BOB1.1_ATI_WKM.1_ATI_WKM_ARI_LN	ARI_HAM2.1_HAT_WKM1.1_HAMWKM1!_HAM_LN	KAW_MAT1.1_KAW_MAT2.1_:S_KAW_MAT2_MAT_LN
ARI_BOB1.1_HAT_WKM1.1_\$HAMWKM1_ARI_LN	ARI_HAM2.1_HAT_WKM1.1_HAMWKM1\$_HAM_LN	KAW_MAT1.1_KAW_MAT2.1_KAW_MAT2_MAT_LN
ARI_BOB1.1_HAT_WKM1.1_:S_\$HAMWKM1_ARI_LN	ARI_KIN1.1_ARI_KIN2.1_\$ARIKIN2_ARI_LN	KAW_MAT2.1_KAW_MAT1.1_:S_KAW_MAT1_MAT_LN
ARI_BOB1.1_HAT_WKM1.1_:S_HAMWKM1!_ARI_LN	ARI_KIN1.1_ARI_KIN2.1_:S_\$ARIKIN2_ARI_LN	KAW_MAT2.1_KAW_MAT1.1_KAW_MAT1_MAT_LN
ARI_BOB1.1_HAT_WKM1.1_:S_HAMWKM1\$_ARI_LN	ARI_KIN1.1_ARI_KIN2.1_:S_ARIKIN2!_ARI_LN	KAW_OHK.1_WKM_PPI_WRK.1_:S_WKM_WRK_KAW_LN
ARI_BOB1.1_HAT_WKM1.1_HAMWKM1!_ARI_LN	ARI_KIN1.1_ARI_KIN2.1_:S_ARIKIN2\$_ARI_LN	KIN_TRK1.1_HAT_WKM1.1_\$HAMWKM1_KIN_LN
ARI_BOB1.1_HAT_WKM1.1_HAMWKM1\$_ARI_LN	ARI_KIN1.1_ARI_KIN2.1_ARIKIN2!_ARI_LN	KIN_TRK1.1_HAT_WKM1.1_HAMWKM1!_KIN_LN
ARI_BOB1.1_HAT_WKM2.1_\$OHWWKM1_ARI_LN	ARI_KIN1.1_ARI_KIN2.1_ARIKIN2\$_ARI_LN	KIN_TRK1.1_HAT_WKM1.1_HAMWKM1\$_KIN_LN
ARI_BOB1.1_HAT_WKM2.1_:S_\$OHWWKM1_ARI_LN	ARI_KIN1.1_HAT_WKM1.1_:S_HAMWKM1!_ARI_LN	KIN_TRK1.1_HAT_WKM2.1_OHWWKM1!_KIN_LN
ARI_BOB1.1_HAT_WKM2.1_:S_OHWWKM1!_ARI_LN	ARI_KIN1.1_HAT_WKM1.1_:S_HAMWKM1\$_ARI_LN	KIN_TRK1.1_HAT_WKM2.1_OHWWKM1\$_KIN_LN
ARI_BOB1.1_HAT_WKM2.1_:S_OHWWKM1\$_ARI_LN	ARI_KIN1.1_HAT_WKM1.1_HAMWKM1!_ARI_LN	KIN_TRK1.1_KIN_TRK2.2_KIN_TRK2_KIN_LN
ARI_BOB1.1_HAT_WKM2.1_OHWWKM1!_ARI_LN	ARI_KIN1.1_HAT_WKM1.1_HAMWKM1\$_ARI_LN	KIN_TRK1.2_HAT_WKM1.1_\$HAMWKM1_TRK_LN
ARI_BOB1.1_HAT_WKM2.1_OHWWKM1\$_ARI_LN	ARI_KIN2.1_ARI_KIN1.1_\$ARIKIN1_ARI_LN	KIN_TRK1.2_HAT_WKM1.1_HAMWKM1!_TRK_LN
ARI_BOB1.1_OTA_WKM1.1_OTA_WKM1_ARI_LN	ATI_OHK.1_WKM_PPI_WRK.1_:S_WKM_WRK_OHK_LN	KIN_TRK1.2_HAT_WKM1.1_HAMWKM1\$_TRK_LN
ARI_BOB1.1_OTA_WKM2.1_OTA_WKM2_ARI_LN	ATI_OHK.1_WKM_PPI_WRK.1_WKM_WRK_ATI_LN	KIN_TRK1.2_HAT_WKM2.1_OHWWKM1!_TRK_LN
ARI_HAM1.1_ARI_BOB1.1_\$ARIBOB1_HAM_LN	ATI_OHK.1_WKM_PPI_WRK.1_WKM_WRK_OHK_LN	KIN_TRK1.2_HAT_WKM2.1_OHWWKM1\$_TRK_LN
ARI_HAM1.1_ARI_HAM2.1_\$ARIHAM2_HAM_LN	CPK_WWD_WIL3.3_MTI_WKM1.1_MTIWKM1!_WWD_LN	KIN_TRK1.2_KIN_TRK2.2_KIN_TRK2_TRK_LN
ARI_HAM1.1_ARI_HAM2.1_:S_\$ARIHAM2_HAM_LN	CPK_WWD_WIL3.3_MTI_WKM2.1_MTIWKM2!_WWD_LN	OHK_WRK.1_WKM_PPI_WRK.1_WKM_WRK_WRK_LN
ARI_HAM1.1_HAT_WKM1.1_\$HAMWKM1_HAM_LN	EDG_KAW1.1_ATI_OHK.1_ATI_OHK_KAW_LN	OKE_OWH.1_KAW_OHK.1_KAW_OHK_OKE_LN
ARI_HAM1.1_HAT_WKM1.1_:S_\$HAMWKM1_HAM_LN	EDG_KAW1.1_EDG_KAW3.1_EDG_KAW3_KAW_LN	OKE_TRK.1_KAW_OHK.1_KAW_OHK_TRK_LN
ARI_HAM1.1_HAT_WKM1.1_HAMWKM1!_HAM_LN	EDG_KAW2.1_ATI_OHK.1_ATI_OHK_KAW_LN	ROX_T10_110KV_BAL_GOR.1_BAL_GOR_XF
ARI_HAM1.1_HAT_WKM1.1_HAMWKM1\$_HAM_LN	EDG_OWH.1_EDG_KAW3.1_EDG_KAW3_EDG_LN	ROX_T10_110KV_GOR_ROX.1_GOR_ROX_XF
ARI_HAM2.1_ARI_BOB1.1_\$ARIBOB1_HAM_LN	HAM_KPO2.2_HIN_KPO.1_HIN_KPO_KPO_LN	ROX_T10_110KV_HWB_ROX1.1_HWB_ROX1_XF
ARI_HAM2.1_ARI_HAM1.1_\$ARIHAM1_HAM_LN	HEN_HPI1.1_ALB_HEN3.1_:S_ALB_HEN3_HEN_LN	ROX_T10_110KV_HWB_ROX2.1_HWB_ROX2_XF
ARI_HAM2.1_ARI_HAM1.1_:S_\$ARIHAM1_HAM_LN	INV_NMA.1_NMA_TWI1.1_:S_NMA_TWI1_INV_LN	STK_T3_110KV_MPI_UTK.1_MPI_UTK_XF
ARI_HAM2.1_HAT_WKM1.1_\$HAMWKM1_HAM_LN	INV_NMA.1_NMA_TWI2.1_:S_NMA_TWI2_INV_LN	WKM_PPI_WRK.1_OHK_WRK.1_:S_OHK_WRK_WKM_LN
ARI_HAM2.1_HAT_WKM1.1_:S_\$HAMWKM1_HAM_LN	KAW_T13_220KV_EDG_OWH.1_EDG_OWH_XF	

5 Appendix C

HISTORY FOR ARI_HAM1.1__ARI_HAM2.1__\$ARIHAM2__HAM__LN, Trading Period 43 on 17/09/2010

Run Type	Run Time	Formula	Limit (MW)	Solution (MW)	% Binding	Ambient Temp	SFT Status
RTP	17/09/2010 21:30:30	.442 * ARI_HAM2.1 + 1.405 * ARI_HAM1.1 <=	82.710	82.266	99.46	20	AC Solved with Violations
RTP	17/09/2010 21:25:30	.442 * ARI_HAM2.1 + 1.405 * ARI_HAM1.1 <=	82.710	81.652	98.72	20	AC Solved with Violations
RTD	17/09/2010 21:24:00	.442 * ARI_HAM2.1 + 1.405 * ARI_HAM1.1 <=	82.710	76.527	92.52	20	AC Solved with Violations
RTP	17/09/2010 21:20:30	.442 * ARI_HAM2.1 + 1.405 * ARI_HAM1.1 <=	82.710	79.436	96.04	20	AC Solved with Violations
RTD	17/09/2010 21:19:00	.442 * ARI_HAM2.1 + 1.405 * ARI_HAM1.1 <=	82.710	75.688	91.51	20	AC Solved with Violations
RTP	17/09/2010 21:15:30	.442 * ARI_HAM2.1 + 1.405 * ARI_HAM1.1 <=	82.710	80.119	96.87	20	AC Solved with Violations
RTD	17/09/2010 21:14:00	.442 * ARI_HAM2.1 + 1.405 * ARI_HAM1.1 <=	82.710	75.067	90.76	20	AC Solved with Violations
RTP	17/09/2010 21:10:30	.442 * ARI_HAM2.1 + 1.405 * ARI_HAM1.1 <=	82.710	79.716	96.38	20	AC Solved with Violations
SDPQ	17/09/2010 21:10:00	.442 * ARI_HAM2.1 + 1.404 * ARI_HAM1.1 <=	82.660	77.467	93.72	20	AC Solved with Violations
RTD	17/09/2010 21:09:00	.442 * ARI_HAM2.1 + 1.405 * ARI_HAM1.1 <=	82.710	74.639	90.24	20	AC Solved with Violations
RTP	17/09/2010 21:05:30	.442 * ARI_HAM2.1 + 1.405 * ARI_HAM1.1 <=	82.710	80.311	97.1	20	AC Solved with Violations
RTD	17/09/2010 21:04:00	.442 * ARI_HAM2.1 + 1.405 * ARI_HAM1.1 <=	82.710	75.227	90.95	20	AC Solved with Violations
PDS	17/09/2010 21:03:01	.442 * ARI_HAM2.1 + 1.405 * ARI_HAM1.1 <=	82.710	79.149	95.69	20	AC Solved with Violations
RTD	17/09/2010 20:59:00	.442 * ARI_HAM2.1 + 1.405 * ARI_HAM1.1 <=	82.710	76.340	92.3	20	AC Solved with Violations
SDPQ	17/09/2010 20:40:00	.442 * ARI_HAM2.1 + 1.405 * ARI_HAM1.1 <=	82.710	77.613	93.84	20	AC Solved with Violations
SDPQ	17/09/2010 20:10:00	.441 * ARI_HAM2.1 + 1.407 * ARI_HAM1.1 <=	82.800	78.150	94.38	20	AC Solved with Violations
SDS	17/09/2010 20:03:02	.441 * ARI_HAM2.1 + 1.408 * ARI_HAM1.1 <=	82.820	78.342	94.59	20	AC Solved with Violations
SDPQ	17/09/2010 19:40:00	.441 * ARI_HAM2.1 + 1.408 * ARI_HAM1.1 <=	82.820	78.327	94.57	20	AC Solved with Violations
SDPQ	17/09/2010 19:10:00	.442 * ARI_HAM2.1 + 1.417 * ARI_HAM1.1 <=	83.140	80.425	96.73	20	AC Solved with Violations
PDS	17/09/2010 19:03:02	.441 * ARI_HAM2.1 + 1.422 * ARI_HAM1.1 <=	83.400	81.201	97.36	20	AC Solved with Violations
SDPQ	17/09/2010 18:40:00	.441 * ARI_HAM2.1 + 1.422 * ARI_HAM1.1 <=	83.400	81.760	98.03	20	AC Solved with Violations
SDPQ	17/09/2010 18:10:00	.441 * ARI_HAM2.1 + 1.41 * ARI_HAM1.1 <=	82.910	78.773	95.01	20	AC Solved with Violations
SDS	17/09/2010 18:03:01	.441 * ARI_HAM2.1 + 1.408 * ARI_HAM1.1 <=	82.850	78.447	94.69	20	AC Solved with Violations
SDPQ	17/09/2010 17:40:00	.44 * ARI_HAM2.1 + 1.423 * ARI_HAM1.1 <=	83.200	81.532	98	20	AC Solved with Violations
PDS	17/09/2010 17:03:02	.44 * ARI_HAM2.1 + 1.425 * ARI_HAM1.1 <=	83.240	80.468	96.67	20	AC Solved with Violations
SDS	17/09/2010 16:03:02	.44 * ARI_HAM2.1 + 1.425 * ARI_HAM1.1 <=	83.240	82.029	98.55	20	AC Solved with Violations
PDS	17/09/2010 15:03:02	.442 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.990	80.703	97.24	20	AC Solved with Violations
SDS	17/09/2010 14:03:02	.442 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.990	79.679	96.01	20	AC Solved with Violations
PDS	17/09/2010 13:03:02	.441 * ARI_HAM2.1 + 1.42 * ARI_HAM1.1 <=	83.120	83.120	100	20	AC Solved with Violations
SDS	17/09/2010 12:03:02	.441 * ARI_HAM2.1 + 1.42 * ARI_HAM1.1 <=	83.120	81.105	97.58	20	AC Solved with Violations



Run Type	Run Time	Formula	Limit (MW)	Solution (MW)	% Binding	Ambient Temp	SFT Status
SDS	17/09/2010 11:40:16	.439 * ARI_HAM2.1 + 1.428 * ARI_HAM1.1 <=	83.380	82.616	99.08	20	AC Solved with Violations
PDS	17/09/2010 11:03:01	.441 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.920	82.920	100	20	AC Solved with Violations
SDS	17/09/2010 10:03:02	.441 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.920	79.680	96.09	20	AC Solved with Violations
PDS	17/09/2010 09:03:01	.442 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.980	82.980	100	20	AC Solved with Violations
SDS	17/09/2010 08:03:01	.442 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.980	79.682	96.03	20	AC Solved with Violations
PDS	17/09/2010 07:03:01	.44 * ARI_HAM2.1 + 1.428 * ARI_HAM1.1 <=	83.510	83.510	100	20	AC Solved with Violations
SDS	17/09/2010 06:03:01	.44 * ARI_HAM2.1 + 1.428 * ARI_HAM1.1 <=	83.510	82.895	99.26	20	AC Solved with Violations
PDS	17/09/2010 05:03:01	.44 * ARI_HAM2.1 + 1.428 * ARI_HAM1.1 <=	83.480	83.480	100	20	AC Solved with Violations
SDS	17/09/2010 04:03:01	.44 * ARI_HAM2.1 + 1.428 * ARI_HAM1.1 <=	83.480	82.876	99.28	20	AC Solved with Violations
PDS	17/09/2010 03:03:02	.44 * ARI_HAM2.1 + 1.429 * ARI_HAM1.1 <=	83.520	83.520	100	20	AC Solved with Violations
SDS	17/09/2010 02:03:02	.44 * ARI_HAM2.1 + 1.429 * ARI_HAM1.1 <=	83.520	83.034	99.42	20	AC Solved with Violations
PDS	17/09/2010 01:03:01	.441 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.960	82.960	100	20	AC Solved with Violations
SDS	17/09/2010 00:03:02	.441 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.960	79.679	96.05	20	AC Solved with Violations
PDS	16/09/2010 23:03:02	.44 * ARI_HAM2.1 + 1.428 * ARI_HAM1.1 <=	83.430	83.430	100	20	AC Solved with Violations
SDS	16/09/2010 22:03:02	.44 * ARI_HAM2.1 + 1.428 * ARI_HAM1.1 <=	83.430	82.661	99.08	20	AC Solved with Violations
PDS	16/09/2010 21:03:01	.442 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.950	82.950	100	20	AC Solved with Violations
SDS	16/09/2010 20:03:01	.442 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.950	79.674	96.05	20	AC Solved with Violations
PDS	16/09/2010 19:03:01	.442 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.950	82.950	100	20	AC Solved with Violations
SDS	16/09/2010 18:03:02	.442 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.950	79.675	96.05	20	AC Solved with Violations
PDS	16/09/2010 17:03:01	.442 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.950	82.950	100	20	AC Solved with Violations
SDS	16/09/2010 16:03:02	.442 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.950	79.671	96.05	20	AC Solved with Violations
SDS	16/09/2010 12:03:03	.441 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.940	79.679	96.07	20	AC Solved with Violations
SDS	16/09/2010 10:03:02	.441 * ARI_HAM2.1 + 1.413 * ARI_HAM1.1 <=	82.930	79.672	96.07	20	AC Solved with Violations
WDS	15/09/2010 16:34:03	.441 * ARI_HAM2.1 + 1.405 * ARI_HAM1.1 <=	82.630	77.181	93.41	20	AC Solved with Violations
WDS	14/09/2010 01:30:24	.441 * ARI_HAM2.1 + 1.411 * ARI_HAM1.1 <=	82.870	78.775	95.06	20	AC Solved with Violations
WDS	13/09/2010 01:30:13	.441 * ARI_HAM2.1 + 1.412 * ARI_HAM1.1 <=	83.030	78.983	95.13	20	AC Solved with Violations
WDS	12/09/2010 01:30:15	.438 * ARI_HAM2.1 + 1.409 * ARI_HAM1.1 <=	83.060	78.487	94.49	20	AC Solved with Violations
WDS	11/09/2010 01:30:14	.44 * ARI_HAM2.1 + 1.415 * ARI_HAM1.1 <=	82.960	79.735	96.11	20	AC Solved with Violations

