IOWA STATE UNIVERSITY
Department of Economics, Department of Electrical & Computer Engineering

Report on:

ERCOT PNNL Contract 401882: *Start Date* 3/19/2018

Development of an Integrated Transmission and Distribution Test System to Evaluate Transactive Energy Systems

ISU Project Team:

PI Leigh Tesfatsion & Co-PI Zhaoyu Wang

Grad Research Assistant: Swathi Battula

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ERCOT Contract: Presentation Outline

- **Original Task/Milestone Schedule: M1-M3**
- **Updated Task/Milestone Schedule: M1-M3**
- **M3.2 Work to Date:** Summary of AMES V5.0 Work to Date for Milestone M3.2
- **M3.2 Work in Progress:** Summary of AMES V5.0 Work in Progress for Milestone M3.2
- **M3.2: Report on AMES V5.0 Verification Test Cases**
  - Notes on AMES V5.0 Verification Test-Case Data Files
  - Summary of AMES V5.0 Verification Test Cases Conducted to Date
  - Brief Summary of Planned Future AMES V5.0 Verification Test Cases
  - Report on New AMES V5.0 Verification Test Case Results
    - VerTestCaseBaseCase: Input data and outcome verification for a base test case
    - VerTestCaseGenMinPowerLevel: Input data and outcome verification for various generator coding aspects
  - Reprise of Previously Reported AMES V5.0 Test Case Results
    - VerTestCaseMultiDayRun: Input data and outcome verification demonstrating correct refreshing of initial DAM/RTM conditions in multiple-day runs

Original Task & Milestone Schedule

Milestone	Date Due	Original Description
M1	May 31, 2018	5-zone model of the old ERCOT system, posted to a web repository.
M2	Sep 30, 2018	Nodal model of the new ERCOT system, posted to a web repository.
M3	Sep 30, 2018	Submitted conference or journal paper on this work.

Updated Task & Milestone Schedule

Milestone	Date Due	Date Delivered	Fuller Descriptions of Actual Work
M1* DONE	May 31, 2018	June 5, 2018	Development of 8-Bus ERCOT model (with nodal locational marginal pricing); grid/load/gen data posted at PNNL repository
M2.1 DONE	Sept 30, 2018	August 1, 2018	Basic 8-Bus ERCOT Test System, implemented via AMES V3.1, posted at https://github.com/ITDProject/ERCOTTestSystem
M2.2 DONE	Sept 30, 2018	August 24, 2018	8-Bus ERCOT Test System (with wind power), implemented via AMES V3.2, posted at https://github.com/ITDProject/ERCOTTestSystem
M3.1 DONE	Sept 30, 2018	August 31, 2018	200-Bus ERCOT Test System (with wind power), implemented via AMES V3.2, posted at https://github.com/ITDProject/ERCOTTestSystem/tree/master/ERCOT_Test_Systems/The_200Bus_ERCOT_Test_System
M3.2**	Feb 28, 2019		200-Bus ERCOT Test System (with wind power), implemented via AMES V5.0, to be posted at PNNL/ISU repositories.
M3.3**	Feb 28, 2019		Paper to be submitted that focuses on the development of the ERCOT Test Systems

- * **M1 Modification (Ok'd by PNNL):** For M1 we have skipped the modeling of the old (zonal) ERCOT system and instead directly worked to develop an 8-bus model of the new (nodal) ERCOT system.
- ** **M3 Modification: Contract extension through Feb 28, 2019 received from PNNL on Dec 21, 2018, for completion of task M3**

Summary of AMES V5.0 Work to Date for M3.2

- **Extension of AMES V5.0 Capabilities for Milestone M3.2**
  - [DONE] Coding for Daily DAM SCUC optimization
  - [DONE] Coding for RTM SCED optimization every M minutes (M user specified).
  - [DONE] Coding for FNCS integration to enable network co-simulation.
  - [DONE] Detailed documentation for analytical DAM SCUC/SCED optimization in AMES V5.0
  - [DONE] Basic documentation for AMES V5.0, including a detailed list for all parameters/flags and initial state variables that need user configuration.

Summary of AMES V5.0 Work to Date for M3.2 … Continued

- **[DONE]**

— **Modified `PSST' Code**

- To ensure correct refreshing of initial DAM/RTM conditions for multiple-day runs.
- To report DAM LMPs and GenCo Commitments back to the user.
- To read 'startup' and 'shutdown' cost components from AMES
- To produce output messages related to solver, e.g. status of the solver, termination condition of the solver
- To include the parameter 'Maximum Time Limit' – to allow the solver to terminate after the prescribed time has elapsed

— **Verification Tests Done**

- Verified 'DAM SCUC' outcomes for their correctness for simple test cases
- Verified 'RTM SCED' outcomes for their correctness for simple test cases with RTM running every five minutes (i.e., M=5)
- Verified that AMES V5.0 runs for multiple days
- Verified that all the cost components from AMES are read correctly into the SCUC formulation

Summary of Work in Progress for Milestone M3.2

- **[IN PROGRESS] Additional Verification Checks for AMES V5.0 Code**
  - Additional DAM/RTM verification test cases are being formulated and conducted.
    - *Example:* Formulation of test cases with varied generator production cost coefficients and minimum generating capacity that permit validation of production cost component modeling for the SCUC optimization
  - Need to ensure outcomes are reported properly back to the user. Additional data that need to be written to '.out' file are: RTM LMPs, RTM GenCo commitment data, DAM/RTM power flow data, LMP true costs, and generator profit/propensity data.
  - Detailed verification of PSST code for validating SCUC optimization formulation, including both objective function and constraints.

- **[IN PROGRESS] Further Cleaning Up of AMES V5.0 Code**
  - Current code includes unused functions that need to be removed.

Report on AMES V5.0 Verification Test Cases

Notes on AMES V5.0 Test-Case Data Files

- Input data files for verification test cases are located in the following GitHub website directory: AMES-V5.0\DATA\VerificationTestCases\
- Intermediary output files:
  - Data files written by AMES V5.0
    - ✓ ReferenceModel.dat : This is an input file for PSST that contains input data required to solve SCUC.
    - ✓ RTReferenceModel.dat : This is an input file for PSST that contains input data required to solve SCUC.
    - ✓ rt-unitcommitments.dat: : This is an input file for PSST that contains the unit commitment status of each generator for each M-minute period.
  - SCUC output data files generated by PSST for Day-Ahead Market (DAM)
    - ✓ Xfertoames.dat : Contains DAM unit commitment status and dispatch schedule for each generator along with generator ID.
    - ✓ DAMLMP.dat : Contains DAM LMP at each bus for each hour of a 24-hour period
  - SCED output data files generated by PSST for the Real-Time Market (RTM)
    - ✓ RTSCED.dat : Contains RTM LMP at each bus for each M-minute period, power dispatch scheduled for each generator for the next M-minute period, and start-up and shut-down cost details for each minute of each M-minute period.

Summary of AMES V5.0 Verification Test Cases Conducted to Date

1. VerTestCaseBaseCase

   – This test case produces SCUC/SCED outcomes under the following conditions:

   i. Transmission congestion is absent
   ii. Minimum power generation limits are taken to be zero
   iii. Start up, shut down and no-load costs are taken to be zero
   iv. Minimum up-time and down-time values are taken to be 0 (hr)
   v. No ramping limits
   vi. Day-ahead and real-time load forecasts are set equal

   – This test case provides a base case for later comparison purposes.

2. VerTestCaseGenMinPowerLevel

   – This test case verifies a generator's minimum power level is maintained when it is committed, given the above-stated conditions (i) and (iii)-(vi).

3. VerTestCaseMultiDayRun

   – This test case verifies DAM/RTM initial conditions are refreshed appropriately when AMES V5.0 is run for multiple successive days.

Brief Summary of Planned Future AMES V5.0 Verification Test Cases

- VerTestCaseCostComponents

  The purpose of this test case is to verify cost component aspects of the SCUC formulation under the above-stated conditions (i)-(ii) and (iv)-(vi) – i.e., to verify that the SCUC formulation correctly includes no-load, start-up, and shut-down cost components.

- VerTestCaseUpTimeDownTime

  The purpose of this test case is to verify that the minimum up-time and down-time constraints are correctly modeled in the SCUC formulation.

- VerTestCaseRampUpRampDown

  The purpose of this test case is to verify that ramping constraints are correctly modeled in the SCUC/SCED formulation.

Verification Test Case 1 - VerTestCaseBaseCase

Verification Test Case 1 - VerTestCaseBaseCase

- VerTestCaseBaseCase: This test case provides a base case for later comparison purposes.

Some of the ***input data*** given in VerTestCaseBaseCase.dat are presented below.

#GenDataStart

// Name	ID	atBus	FCost	a	b	capL	capU	InitMoney
GenCo1	1	1	0.0000	10.0000	0.0050	0	1000	1000000.0000
GenCo2	2	2	0.0000	11.0000	0.0050	0	1000	1000000.0000
GenCo3	3	3	0.0000	12.0000	0.0050	0	1000	1000000.0000
GenCo4	4	4	0.0000	13.0000	0.0050	0	1000	1000000.0000
GenCo5	5	5	0.0000	14.0000	0.0050	0	1000	1000000.0000
GenCo6	6	6	0.0000	20.0000	0.0091	0	1000	1000000.0000
GenCo7	7	7	0.0000	25.0000	0.0092	0	1000	1000000.0000
GenCo8	8	8	0.0000	30.0000	0.0093	0	1000	1000000.0000

#GenDataEnd

#ScucInputDataStart

// Name	PowerT0	UnitOnT0	MinUpTime	MinDownTime	NominalRampUp	NominalRampDown	StartupRampLim	ShutdownRampLim	Schedule	Schedule2
GenCo1	0.0000	0	0	0	0	0	0	0	1	1
GenCo2	1000.0000	1	0	0	0	0	0	0	1	1
GenCo3	0.0000	0	0	0	0	0	0	0	1	1
GenCo4	1000.0000	1	0	0	0	0	0	0	1	1
GenCo5	0.0000	0	0	0	0	0	0	0	1	1
GenCo6	1000.0000	1	0	0	0	0	0	0	1	1
GenCo7	0.0000	0	0	0	0	0	0	0	1	1
GenCo8	1000.0000	1	0	0	0	0	0	0	1	1

#ScucInputDataEnd

Verification Test Case 1 – VerTestCaseBaseCase … Cont'd

- VerTestCaseBaseCase: This test case provides a base case for later comparison purposes.

Some of the ***input data*** given in VerTestCaseBaseCase.dat are presented below.

#LSEDataFixedDemandStart												
//	Name	ID	atBus	H0	H1	H2	H3	H4	H5	H6	H7	
	LSE1	1	1	400	400	400	400	400	400	400	400	
	LSE2	2	2	400	400	400	400	400	400	400	400	
	LSE3	3	3	400	400	400	400	400	400	400	400	
	LSE4	4	4	400	400	400	400	400	400	400	400	
	LSE5	5	5	400	400	400	400	400	400	400	400	
	LSE6	6	6	400	400	400	400	400	400	400	400	
	LSE7	7	7	400	400	400	400	400	400	400	400	
	LSE8	8	8	400	400	400	400	400	400	400	400	
//	Name	ID	atBus	H8	H9	H10	H11	H12	H13	H14	H15	
	LSE1	1	1	400	400	400	400	400	400	400	400	
	LSE2	2	2	400	400	400	400	400	400	400	400	
	LSE3	3	3	400	400	400	400	400	400	400	400	
	LSE4	4	4	400	400	400	400	400	400	400	400	
	LSE5	5	5	400	400	400	400	400	400	400	400	
	LSE6	6	6	400	400	400	400	400	400	400	400	
	LSE7	7	7	400	400	400	400	400	400	400	400	
	LSE8	8	8	400	400	400	400	400	400	400	400	
//	Name	ID	atBus	H16	H17	H18	H19	H20	H21	H22	H23	
	LSE1	1	1	400	400	400	400	400	400	400	400	
	LSE2	2	2	400	400	400	400	400	400	400	400	
	LSE3	3	3	400	400	400	400	400	400	400	400	
	LSE4	4	4	400	400	400	400	400	400	400	400	
	LSE5	5	5	400	400	400	400	400	400	400	400	
	LSE6	6	6	400	400	400	400	400	400	400	400	
	LSE7	7	7	400	400	400	400	400	400	400	400	
	LSE8	8	8	400	400	400	400	400	400	400	400	
#LSEDataFixedDemandEnd												

Verification Test Case 1 – VerTestCaseBaseCase … Cont'd

- VerTestCaseBaseCase: This test case provides a base case for later comparison purposes.

Some of the ***DAM output data*** reported in the output files xfertoames.dat and ReferenceModel.dat are presented below.

Table 1: Generation ON/OFF Status

		GenCo1	GenCo2	GenCo3	GenCo4	GenCo5	GenCo6	GenCo7	GenCo8
	InitialCondition	0	1	0	1	0	0	0	0
D1	H1	1	1	1	1	0	0	0	0
D1	H2	1	1	1	1	0	0	0	0
D1	H3	1	1	1	1	0	0	0	0
D1	H4	1	1	1	1	0	0	0	0
D1	H5	1	1	1	1	0	0	0	0
D1	…	1	1	1	1	0	0	0	0
D1	H23	1	1	1	1	0	0	0	0
D1	H24	1	1	1	1	0	0	0	0

Table 2: Power Generation (p.u.)

		GenCo1	GenCo2	GenCo3	GenCo4	GenCo5	GenCo6	GenCo7	GenCo8
	InitialCondition	0	10	0	10	0	10	0	10
D1	H1	10	10	10	2	0	0	0	0
D1	H2	10	10	10	2	0	0	0	0
D1	H3	10	10	10	2	0	0	0	0
D1	H4	10	10	10	2	0	0	0	0
D1	H5	10	10	10	2	0	0	0	0
D1	…	10	10	10	2	0	0	0	0
D1	H23	10	10	10	2	0	0	0	0
D1	H24	10	10	10	2	0	0	0	0

Verification Test Case 1 – VerTestCaseBaseCase … Cont'd

- VerTestCaseBaseCase: This test case provides a base case for later comparison purposes.

  Some of the ***RTM output data*** reported in the output files rt-unitcommitments.dat, RTReferenceModel.dat, and RTSCED.dat are presented below.

Table 3: Generation ON/OFF Status

		GenCo1	GenCo2	GenCo3	GenCo4	GenCo5	GenCo6	GenCo7	GenCo8
D2	H1	1	1	1	1	0	0	0	0
D2	H2	1	1	1	1	0	0	0	0
D2	H3	1	1	1	1	0	0	0	0
D2	H4	1	1	1	1	0	0	0	0
D2	H5	1	1	1	1	0	0	0	0
D2	…	1	1	1	1	0	0	0	0
D2	H23	1	1	1	1	0	0	0	0
D2	H24	1	1	1	1	0	0	0	0

Table 4: Power Generation (p.u.)

		GenCo1	GenCo2	GenCo3	GenCo4	GenCo5	GenCo6	GenCo7	GenCo8
D2	H1	10	10	10	2	0	0	0	0
D2	H2	10	10	10	2	0	0	0	0
D2	H3	10	10	10	2	0	0	0	0
D2	H4	10	10	10	2	0	0	0	0
D2	H5	10	10	10	2	0	0	0	0
D2	…	10	10	10	2	0	0	0	0
D2	H23	10	10	10	2	0	0	0	0
D2	H24	10	10	10	2	0	0	0	0

Verification Test Case 1 – VerTestCaseBaseCase … Cont'd

Verification Test Case 1 – VerTestCaseBaseCase

Observations

- ✓ From Table 1 and 2's entries **D1: H1-H24**, it can be seen that the generators are indeed committed and scheduled for dispatch based on their merit order – i.e. SCUC outcomes are verified (for conditions (i) – (iv) stated earlier).
- ✓ From Table 3 and Table 4's entries **D1: H1-H24**, it can be seen that the SCED outcomes are consistent with those of SCUC given that the real-time load forecast is same as that of the day-ahead load forecast.

Conclusions

- ✓ Verified SCUC/SCED outcomes for a simple base case under conditions (i)-(vi).

Verification Test Case 2 -
VerTestCaseGenMinPowerLevel

Verification Test Case 2 - VerTestCaseGenMinPowerLevel

- VerTestCaseGenMinPowerLevel: This test case verifies various generator coding aspects. Some ***input data*** given in VerTestCaseGenMinPowerLevel.dat are presented below.

#GenDataStart

// Name	ID	atBus	FCost	a	b	capL	capU	InitMoney
GenCo1	1	1	0.0000	10.0000	0.0050	0	1000	1000000.0000
GenCo2	2	2	0.0000	11.0000	0.0050	0	1000	1000000.0000
GenCo3	3	3	0.0000	12.0000	0.0050	0	1000	1000000.0000
GenCo4	4	4	0.0000	13.0000	0.0050	400	1000	1000000.0000
GenCo5	5	5	0.0000	14.0000	0.0050	0	1000	1000000.0000
GenCo6	6	6	0.0000	20.0000	0.0091	0	1000	1000000.0000
GenCo7	7	7	0.0000	25.0000	0.0092	0	1000	1000000.0000
GenCo8	8	8	0.0000	30.0000	0.0093	0	1000	1000000.0000

#GenDataEnd

#ScucInputDataStart

// Name	PowerT0	UnitOnT0	MinUpTime	MinDownTime	NominalRampUp	NominalRampDown	StartupRampLim	ShutdownRampLim	Schedule	Schedule2
GenCo1	0.0000	0	0	0	0	0	0	0	1	1
GenCo2	1000.0000	1	0	0	0	0	0	0	1	1
GenCo3	0.0000	0	0	0	0	0	0	0	1	1
GenCo4	1000.0000	1	0	0	0	0	0	0	1	1
GenCo5	0.0000	0	0	0	0	0	0	0	1	1
GenCo6	1000.0000	1	0	0	0	0	0	0	1	1
GenCo7	0.0000	0	0	0	0	0	0	0	1	1
GenCo8	1000.0000	1	0	0	0	0	0	0	1	

1#ScucInputDataEnd

Verification Test Case 2 – VerTestCaseGenMinPowerLevel … Cont'd

- VerTestCaseGenMinPowerLevel: This test case verifies various generator coding aspects. Some ***input data*** given in VerTestCaseGenMinPowerLevel.dat are presented below.

#LSEDataFixedDemandStart												
//	Name	ID	atBus	H0	H1	H2	H3	H4	H5	H6	H7	
	LSE1	1	1	400	400	400	400	400	400	400	400	
	LSE2	2	2	400	400	400	400	400	400	400	400	
	LSE3	3	3	400	400	400	400	400	400	400	400	
	LSE4	4	4	400	400	400	400	400	400	400	400	
	LSE5	5	5	400	400	400	400	400	400	400	400	
	LSE6	6	6	400	400	400	400	400	400	400	400	
	LSE7	7	7	400	400	400	400	400	400	400	400	
	LSE8	8	8	400	400	400	400	400	400	400	400	
//	Name	ID	atBus	H8	H9	H10	H11	H12	H13	H14	H15	
	LSE1	1	1	400	400	400	400	400	400	400	400	
	LSE2	2	2	400	400	400	400	400	400	400	400	
	LSE3	3	3	400	400	400	400	400	400	400	400	
	LSE4	4	4	400	400	400	400	400	400	400	400	
	LSE5	5	5	400	400	400	400	400	400	400	400	
	LSE6	6	6	400	400	400	400	400	400	400	400	
	LSE7	7	7	400	400	400	400	400	400	400	400	
	LSE8	8	8	400	400	400	400	400	400	400	400	
//	Name	ID	atBus	H16	H17	H18	H19	H20	H21	H22	H23	
	LSE1	1	1	400	400	400	400	400	400	400	400	
	LSE2	2	2	400	400	400	400	400	400	400	400	
	LSE3	3	3	400	400	400	400	400	400	400	400	
	LSE4	4	4	400	400	400	400	400	400	400	400	
	LSE5	5	5	400	400	400	400	400	400	400	400	
	LSE6	6	6	400	400	400	400	400	400	400	400	
	LSE7	7	7	400	400	400	400	400	400	400	400	
	LSE8	8	8	400	400	400	400	400	400	400	400	
#LSEDataFixedDemandEnd												

Verification Test Case 2 – VerTestCaseGenMinPowerLevel … Continued

- VerTestCaseGenMinPowerLevel: This test case verifies various generator aspects. Some of the ***DAM output data*** reported in the output files xfertoames.dat and ReferenceModel.dat are presented below.

Table 5: Generation ON/OFF Status

		GenCo1	GenCo2	GenCo3	GenCo4	GenCo5	GenCo6	GenCo7	GenCo8
	InitialCondition	0	1	0	1	0	0	0	0
D1	H1	1	1	1	1	0	0	0	0
D1	H2	1	1	1	1	0	0	0	0
D1	H3	1	1	1	1	0	0	0	0
D1	H4	1	1	1	1	0	0	0	0
D1	H5	1	1	1	1	0	0	0	0
D1	…	1	1	1	1	0	0	0	0
D1	H23	1	1	1	1	0	0	0	0
D1	H24	1	1	1	1	0	0	0	0

Table 6: Power Generation (p.u.)

		GenCo1	GenCo2	GenCo3	GenCo4	GenCo5	GenCo6	GenCo7	GenCo8
	InitialCondition	0	10	0	10	0	10	0	10
D1	H1	10	10	8	4	0	0	0	0
D1	H2	10	10	8	4	0	0	0	0
D1	H3	10	10	8	4	0	0	0	0
D1	H4	10	10	8	4	0	0	0	0
D1	H5	10	10	8	4	0	0	0	0
D1	…	10	10	8	4	0	0	0	0
D1	H23	10	10	8	4	0	0	0	0
D1	H24	10	10	8	4	0	0	0	0

Verification Test Case 2 – VerTestCaseGenMinPowerLevel … Continued

- VerTestCaseGenMinPowerLevel: This test case verifies various generator coding aspects.

Some of the ***RTM output data*** reported in the output files rt-unitcommitments.dat, RTReferenceModel.dat, and RTSCED.dat are presented below.

Table 7: Generation ON/OFF Status

		GenCo1	GenCo2	GenCo3	GenCo4	GenCo5	GenCo6	GenCo7	GenCo8
D2	H1	1	1	1	1	0	0	0	0
D2	H2	1	1	1	1	0	0	0	0
D2	H3	1	1	1	1	0	0	0	0
D2	H4	1	1	1	1	0	0	0	0
D2	H5	1	1	1	1	0	0	0	0
D2	…	1	1	1	1	0	0	0	0
D2	H23	1	1	1	1	0	0	0	0
D2	H24	1	1	1	1	0	0	0	0

Table 8: Power Generation (p.u.)

		GenCo1	GenCo2	GenCo3	GenCo4	GenCo5	GenCo6	GenCo7	GenCo8
D2	H1	10	10	8	4	0	0	0	0
D2	H2	10	10	8	4	0	0	0	0
D2	H3	10	10	8	4	0	0	0	0
D2	H4	10	10	8	4	0	0	0	0
D2	H5	10	10	8	4	0	0	0	0
D2	…	10	10	8	4	0	0	0	0
D2	H23	10	10	8	4	0	0	0	0
D2	H24	10	10	8	4	0	0	0	0

- **Verification Test Case 2 –** VerTestCaseGenMinPowerLevel
  - **Observations**
    - ✓ From Table 2 and 6's entries **D1: H1-H24**, it can be seen that the GenCo4 is scheduled for its minimum output generator and GenCo3's generation is reduced to accommodate this change.
    - ✓ From Table 6 and Table 8's entries, it can be seen that there is no change in RTM and DAM outcomes as assumption (vi) is maintained.
  - **Conclusions**
    - ✓ Verified various generator coding aspects for a simple test case under conditions (i)-(vi).

Reprise of Previous Test-Case Work:

Verification Test Case 3 – VerTestCaseMultiDayRun

Previous work: Verification Test Case 3

- **VerTestCaseMultiDayRun** : This test case verifies refreshing of initial DAM/RTM conditions.

Some of the ***input data*** given in VerTestCaseMultiDayRun.dat are presented below.

#GenDataStart

// Name	ID	atBus	FCost	a	b	capL	capU	InitMoney
GenCo1	1	1	0.0000	10.0000	0.0050	100	1000	1000000.0000
GenCo2	2	2	0.0000	11.0000	0.0060	90	1000	1000000.0000
GenCo3	3	3	0.0000	12.0000	0.0070	80	1000	1000000.0000
GenCo4	4	4	50000	13.0000	0.0080	100	1000	1000000.0000
GenCo5	5	5	50000	14.0000	0.0090	100	1000	1000000.0000
GenCo6	6	6	50000	20.0000	0.0091	100	1000	1000000.0000
GenCo7	7	7	50000	20.0000	0.0092	100	1000	1000000.0000
GenCo8	8	8	50000	20.0000	0.0093	100	1000	1000000.0000

#GenDataEnd

#ScucInputDataStart

// Name	PowerT0	UnitOnT0	MinUpTime	MinDownTime	NominalRampUp	NominalRampDown	StartupRampLim	ShutdownRampLim	Schedule	Schedule2
GenCo1	1000.0000	1	0	0	0	0	0	0	1	1
GenCo2	1000.0000	1	0	0	0	0	0	0	1	1
GenCo3	1000.0000	1	0	0	0	0	0	0	1	1
GenCo4	1000.0000	1	0	0	0	0	0	0	1	1
GenCo5	1000.0000	1	0	0	0	0	0	0	1	1
GenCo6	1000.0000	1	0	0	0	0	0	0	1	1
GenCo7	1000.0000	1	0	0	0	0	0	0	1	1
GenCo8	1000.0000	1	0	0	0	0	0	0	1	1

#ScucInputDataEnd

Previous work: Verification Test Case 3 … Continued

- **VerTestCaseMultiDayRun** : This test case verifies refreshing of initial DAM/RTM conditions.

Some of the ***input data*** given in VerTestCaseMultiDayRun.dat are presented below.

#LSEDataFixedDemandStart												
//	Name	ID	atBus	H0	H1	H2	H3	H4	H5	H6	H7	
	LSE1	1	1	1200	2200	3200	4200	200	200	200	200	
	LSE2	2	2	200	200	200	200	200	200	200	200	
	LSE3	3	3	200	200	200	200	200	200	200	200	
	LSE4	4	4	200	200	200	200	200	200	200	200	
	LSE5	5	5	200	200	200	200	200	200	200	200	
	LSE6	6	6	200	200	200	200	200	200	200	200	
	LSE7	7	7	200	200	200	200	200	200	200	200	
	LSE8	8	8	200	200	200	200	200	200	200	200	
//	Name	ID	atBus	H8	H9	H10	H11	H12	H13	H14	H15	
	LSE1	1	1	200	200	200	200	200	200	200	200	
	LSE2	2	2	200	200	200	200	200	200	200	200	
	LSE3	3	3	200	200	200	200	200	200	200	200	
	LSE4	4	4	200	200	200	200	200	200	200	200	
	LSE5	5	5	200	200	200	200	200	200	200	200	
	LSE6	6	6	200	200	200	200	200	200	200	200	
	LSE7	7	7	200	200	200	200	200	200	200	200	
	LSE8	8	8	200	200	200	200	200	200	200	200	
//	Name	ID	atBus	H16	H17	H18	H19	H20	H21	H22	H23	
	LSE1	1	1	200	200	200	200	200	200	200	200	
	LSE2	2	2	200	200	200	200	200	200	200	200	
	LSE3	3	3	200	200	200	200	200	200	200	200	
	LSE4	4	4	200	200	200	200	200	200	200	200	
	LSE5	5	5	200	200	200	200	200	200	200	200	
	LSE6	6	6	200	200	200	200	200	200	200	200	
	LSE7	7	7	200	200	200	200	200	200	200	200	
	LSE8	8	8	200	200	200	200	200	200	200	200	
#LSEDataFixedDemandEnd												

Previous work: Verification Test Case 3 … Continued

- **VerTestCaseMultiDayRun :** This test case verifies refreshing of initial DAM/RTM conditions.

Some of the ***DAM output data*** reported in the output files xfertoames.dat and ReferenceModel.dat are presented below.

Table 1: Generation ON/OFF Status

		GenCo1	GenCo2	GenCo3	GenCo4	GenCo5	GenCo6	GenCo7	GenCo8
	InitialCondition	1	1	1	1	1	1	1	1
D1	H1	1	1	1	0	0	0	0	0
D1	H2	1	1	1	1	0	0	0	0
D1	H3	1	1	1	1	1	0	0	0
D1	H4	1	1	1	1	1	1	0	0
D1	H5	1	1	0	0	0	0	0	0
D1	…	1	1	0	0	0	0	0	0
D1	H23	1	1	0	0	0	0	0	0
D1	H24	1	1	0	0	0	0	0	0
D2	InitialCondition	1	1	0	0	0	0	0	0

Table 2: Power Generation (p.u.)

		GenCo1	GenCo2	GenCo3	GenCo4	GenCo5	GenCo6	GenCo7	GenCo8
	InitialCondition	10	10	10	10	10	10	10	10
D1	H1	10	10	6	0	0	0	0	0
D1	H2	10	10	10	6	0	0	0	0
D1	H3	10	10	10	10	6	0	0	0
D1	H4	10	10	10	10	10	6	0	0
D1	H5	10	6	0	0	0	0	0	0
D1	…	10	6	0	0	0	0	0	0
D1	H23	10	6	0	0	0	0	0	0
D1	H24	10	6	0	0	0	0	0	0
D2	InitialCondition	10	6	0	0	0	0	0	0

Previous work: Verification Test Case 3 … Continued

- **VerTestCaseMultiDayRun :** This test case verifies refreshing of initial DAM/RTM conditions.

Some of the ***RTM output data*** reported in the output files rt-unitcommitments.dat and RTReferenceModel.dat are presented below.

Table 3: Generation ON/OFF Status

		GenCo1	GenCo2	GenCo3	GenCo4	GenCo5	GenCo6	GenCo7	GenCo8
	InitialCondition	1	1	1	1	1	1	1	1
D2	H1	1	1	1	0	0	0	0	0
D2	H2	1	1	1	1	0	0	0	0
D2	H3	1	1	1	1	1	0	0	0
D2	H4	1	1	1	1	1	1	0	0
D2	H5	1	1	0	0	0	0	0	0
D2	…	1	1	0	0	0	0	0	0
D2	H23	1	1	0	0	0	0	0	0
D2	H24	1	1	0	0	0	0	0	0

Table 4: Power Generation (p.u.)

		GenCo1	GenCo2	GenCo3	GenCo4	GenCo5	GenCo6	GenCo7	GenCo8
	InitialCondition	10	10	10	10	10	10	10	10
D2	H1	10	4.2	0.8	1	0	0	0	0
D2	H2	10	4.2	0.8	1	0	0	0	0
D2	H3	10	3.8	0.8	1	1	0	0	0
D2	H4	10	2.2	0.8	1	1	1	0	0
D2	H5	10	6	0	0	0	0	0	0
D2	…	10	6	0	0	0	0	0	0
D2	H23	10	6	0	0	0	0	0	0
D2	H24	10	6	0	0	0	0	0	0

Previous work: Verification Test Case 3 … Continued

- **VerTestCaseMultiDayRun**
  - **Observations**
    - ✓ From Table 1's entries **D1-H24** and **D2-InitialCondition**, it can be seen that the refreshing of the initial ON/OFF status of each generator is done aptly.
    - ✓ From Table 2's entries **D1-H24** and **D2-InitialCondition**, it can be seen that the refreshing of the initial power level for each GenCo is done aptly.
    - ✓ From Table 1's entries **D1: H1-H24** and Table 3's **D2: H1-H24**, it can be seen that the GenCo ON/OFF commitment status levels determined on day **D1** are correctly carried over to the RTMs held on the following day (in this example **D2**).
    - ✓ From Table 1's entries **D1: H1-H24** and Table 4's entries **D2: H1-H24**, it can be seen that GenCo ON/OFF commitment status levels are maintained correctly, and that GenCo commitments determined on **D1** for the balancing of net load on the next day **D2** are determined in the most economical way (i.e. the more costly generators are dispatched at their minimum generation output levels).
  - **Conclusions**
    - ✓ Verified the refreshing of initial DAM/RTM conditions for multiple-day runs.