



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
- ❑ New Work on Milestone M3.2
 - Handling forecast data in AMES V5.0
- ❑ New Work on Milestone M3.3
 - Additional work on ERCOT journal paper
- ❑ Remaining M3.2/M3.3 Tasks

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**	July 31, 2019		200-Bus ERCOT Test System (with wind power), implemented via AMES V5.0, to be posted at PNNL/ISU repositories.
M3.3**	July 31, 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 July 31, 2019 received from PNNL on March 4, 2019, for completion of task M3

New Work on M3.2: Handling forecast data in AMES V 5.0

- ❑ Types of forecasts that are required - day-ahead and real-time forecasts for DAM and RTM
- ❑ LSEs and NDGs submit day-ahead forecast to ISO.
 - Each LSE has a method, 'submitDAMLoadForecast' (check line 126 of LSEAgent.java) to handle load forecast. Similarly, each NDGenAgent has 'submitDAMNDGForecast' (line 91 of NDGenAgent.java) method to handle load forecast.
 - Currently, these methods are coded assuming that forecast is obtained from other agents such as 'loadforecast.py' through FNCS. However, these methods can be modified based on how we want to model forecasting.
- ❑ LSEs do not participate in real-time markets. ISO does the real-time forecast for load. Since NDG is treated as negative load, the real-time forecast for NDG is also done by ISO.
- ❑ ISO has 'getRealTimeLoadForecast' and 'getRealTimeLoadForecast' methods (check ISO.java) to handle real time forecasts.

Work-To-Do on M3.2: AMES V5.0 Validation Steps

- ❑ Verification of modeling of all constraints for bugs in code using simple test cases
 - Perform verification tests for
 - Power Balance Constraints
 - Power Flow Constraints
 - Generator capacity, ramping and hot-start constraints
 - System-wide and zonal reserve constraints
- ❑ Unit testing for AMES V5.0

ECA Model Notes (EMN) Implementation	Equation No in EMN	Implemented in AMES V5.0?	Validated?	Remarks
Objective Function	(16)	Yes	Partial	
Power Flow Constraints	(33)-(34)	Yes	No	
Power Balance Constraints	(35)	Yes	No	
Slack Variable Constraints	(36)-(37)	Yes	-	
Generator Capacity Constraints	(38)-(40)	Yes	Partial	
Generator Ramping Constraints	(41)-(43)	Yes	No	
Generator minimum-up time constraints	(44)-(46)	Yes	Yes	
Generator minimum-down time constraints	(47)-(49)	Yes	Yes	
Generator hot-start constraints	(50)-(52)	Yes	No	
Generator start-up cost constraints	(53)	Yes	Yes	
Generator shut-down cost constraints	(54)	Yes	Yes	
System-wide down/up reserve requirement constraints	(65)-(66)	Yes	No	
Zonal down/up reserve requirement constraints	(67)-(68)	Yes	No	
Voltage angle specifications	(69)-(70)	Yes	Yes	
Total Production Cost Approximation Constraints	(71)-(80)	Yes	Partial	

Note: Above model equations are implemented in python files located at AMES-V5.0\psst\psst\model.
constraints.py provides the modeling of the SCUC/SCED objective function and constraints

Work on Milestone M3.3: ERCOT Journal Paper Draft

1. Introduction
2. ERCOT Wholesale Power Market Operations
3. ERCOT Test Platform: Market Component
4. ERCOT Test Platform: Grid Component
5. Example: An 8-Bus ERCOT Test Grid
6. Illustrative Application: Construction of an 8-Bus ERCOT Test System
7. Platform Support for T & D Studies

7.A Integration with the PNNL TESP – **TO BE DONE BY PNNL**

‘ With “illustrative test case”, we could spill into an example of how we are integrating AMES with the other parts of TESP. ’ (Tom McDermott)

7.B Integration with the ISU ITD TES Platform

8. Conclusion

References

Appendix A: Nomenclature for the ERCOT Test Platform

Appendix B: Software Installation

B.1 AMES V5.0: Java Requirements

B.2 AMES V5.0: Python Requirements

B.3 FNCS Requirements for T & D Studies

Appendix C: Key AMES (V5.0) Classes

Remaining M3.2/M3.3 Tasks

- ☐ ERCOT Journal Paper: In Progress
- ☐ Code Validation: In Progress
- ☐ Cleaning up of AMES V5.0: In Progress
- ☐ Coding of Market Settlement Aspects in AMES V5.0