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

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ERCOT Contract: Presentation Outline

❑ Original Task/Milestone Schedule: M1-M3

❑ Updated Task/Milestone Schedule: M1-M3

❑ Work on Milestone M3.2

  ▪ Modified AMES V5.0 to incorporate FNCSActive flag

  ▪ Modified AMES V5.0 so that users have two input options for fixed (non-price responsive) loads and non-dispatchable generation:

    — directly input *net fixed loads =* fixed loads minus non-dispatchable generation

    — separately input fixed loads & non-dispatchable generation

  ▪ Answered Qiuhua's query regarding `Execute' method in `WPMarket'

  ▪ Updated to-do checklist for AMES V 5.0 constraint implementations

❑ Work on Milestone M3.3: Latest ERCOT Journal Paper Draft

❑ 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**

Work on Milestone M3.2: AMES V5.0 Modifications

❑ Modified AMES V5.0 to incorporate an FNCSActive flag

➢ Users need to set FNCSActive flag to 'True' if they want AMES to run with FNCS

➢ Users need to set FNCSActive flag to 'false' if they want AMES to run without FNCS

❑ Modified AMES V5.0 to enable users to input NDG (Non dispatchable generation) data

➢ User needs to input NDG data using the following name tags

#NDGDataStart

#NDGDataEnd

Work on Milestone M3.2 … Continued

❑ Qiuhua Query: How is 'execute' method in 'WPMarket' called?

➢ AMESMarket.java extends 'SimModelImpl'. 'SimModelImpl' is an abstract base class which implements 'SimModel'. SimModelImpl allows modeling of a simulation to be controlled by a user through GUI, e.g. user can start, pause and stop simulation through a GUI.

➢ 'WPMarket' class extends 'BasicAction' class which is an abstract base class.

The execute method of this class object will be executed continuously until the simulator is stopped when the class object is added to a 'Schedule'.

Note: Check line #858 of AMESMarket.java to see how WPMarket class object is added to 'Schedule'.

➢ Summary: With the use of above Java classes, 'execute' method of 'WPMarket' is run continuously until a stop code is activated.

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

      ' 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