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
- Work Done for Milestone M3.2
- Work in Progress for Milestone M3.2
- Concerns with code/documentation (with specific references) for GLD Household ETP Model

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**

Work Done for Milestone 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.

Work Done for Milestone 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 is 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 into the SCUC formulation appropriately

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.

Concerns: GLD Household ETP Model

References Cited In Following "Concerns":

[1] L. Tesfatsion and S. Battula (2019), "Notes on the GridLAB-D Household Equivalent Thermal Parameter Model," ISU Working Paper, January 4.
http://www2.econ.iastate.edu/tesfatsi/GLDETPHouseholdModel.Notes.LTesfatsionSBattula.pdf

[2] Pratt, R (2010) House-E Heating/Cooling Loads: Specifications and User Inputs, Pacific Northwest National Laboratory Report, Version 19.0 (12/23/2010).

[3] GridLAB-D, 2017. Residential Module User's Guide,
http://gridlab-d.shoutwiki.com/wiki/Residential_module_user's_guide

[4] GLD (2018) Explanation of the GLD `fan_design_airflow',
http://gridlab-d.shoutwiki.com/wiki/Fan_design_airflow

[5] GLD code for House,
https://github.com/gridlab-d/gridlab-d/blob/master/residential/house_e.cpp

Concerns: GLD Household ETP Model … Continued

CONCERN 1: Missing f_{ac} in GLD source code [5, lines 1808-1809]; refer to [2, p. 5] and [1, Footnote 5, p. 8] for details.

CONCERN 2: Incorrect expression for 'design_heating_cfm' (design heat airflow) in GLD documentation [4]; refer to [2, p. 19], [5, line 1479], and [1, Footnote 14, p. 17] for details.

CONCERN 3: Incorrect characterization of SHGC_{nom} as a **user-set** parameter in GLD source code [5, line 190]; refer to [1, Footnote 13, p. 16] for details. Rather, SHGC_{nom} is derived as a function of other user-set parameters.

CONCERN 4: Incorrect expressions for H_m and A_w in GLD documentation [3]; refer to [2], [5], and [1, Footnote 10, p. 15] for details.

CONCERN 5: Incorrect characterization of C_a as a **user-set** parameter in the GLD source code [5, line 190] and in various GLD docs; refer to [1, Footnote 10, p. 15] for details. Rather, C_a is derived as a function of other user-set parameters.

CONCERN 6: Problems with the discussion of A and R in at least three different GLD documents that suggests A and R are parameters whose values can each be **independently** set by the user; refer to [1, Footnote 11, p. 15] for details.

CONCERN 7: Incorrect characterization of R_{g} as a **user-set** parameter in GLD source code [5, line 408] and various GLD documents; refer to [1, Footnote 11, p. 15] for details. Rather, R_g is derived as a function of other user-set parameters.