

IBPSA Project 1 WP1.2 Meeting Summary

Expert Meeting in Rome, Italy
8/31/2019 - 9/1/2019

Breakout Sessions 1-1 and 1-2

- Tutorial of Prototype Software
 - Available at https://github.com/ibpsa/project1/blob/master/meetings/2019-08-31-expert-meeting-rome/wp_1_2/WP1.2_BOPTEST_Tutorial1.pdf
 - Covers software requirements and test case development, deployment, and use
 - Completed by two people before meeting (on Windows), one person during meeting (on Ubuntu)
 - Issues brought up:
 - Docker on Windows
 - Docker read/write permissions on Linux
 - Compilation of test case with no signal exchange blocks
 - General feedback was that processes were clear and acceptable
- Continued Development Needs
 - Fix issues and/or document solutions (led by LBNL)
 - How to parameterize and implement forecast errors (led by Tekniker)
 - How to parameterize and implement measurement noise (led by Sintef)
 - How to define workflow for training data for grey-black-box models different than testing data. Need to create “previous” year data, particularly weather data, to train with boundary conditions different than those of the test period. Consider using historic data instead of TMY, or determine how create new TMY.

Breakout Session 2-1

- Detailed building emulator and test case development progress update

Emulator	Developer	Developed	Documented	Reviewed by	BOP-TEST ready
BESTEST hydronic (1z) -	Filip	Ready	Being finalized	Dave: 2 nd review	In development
BESTEST air-based (1z) -	Dave	Ready	In development	Filip	Ready
8z residential hydronic heating + air cooling -	Valentin	Ready	1 st version	Krzysztof/Toa: ongoing	In development
8z residential air-based	Valentin/TBD	Based on 8z hydronic envelope		Dave	
Air-based commercial (1z)	Dave	In development	In development	Jesus	
Hydronic commercial (1z)	Krzysztof/Toa	Ready	1 st Version	Valentin: ongoing	In development
5z air-based commercial	Dave/Javier	Internal review	1 st version	Yanfei (Filip)	Ready
mz hybrid office (simple) -	Iago	Ready	In development	Valentin	In development
mz hybrid office (complex)	Filip	In development		PNNL?	
mz air-based prototype (complex)	Sen	Ready	1 st version	Iago	In development

- Presentation of 8-Zone Residential Building
 - Discussion of whether min-runtime control is too detailed for model. Decided to keep this type of realistic control in the model.
 - Model is ready to add signal exchange blocks
- Presentation of Multi-Zone Hybrid Office (Simple)
 - Model is ready to add signal exchange blocks
- For next meeting, aim to have 4 models ready to begin MPC testing:
 1. BESTEST Air (LBNL/KU Leuven)
 2. BESTEST Hydronic (KU Leuven /LBNL)
 3. 8-Zone Residential Hydronic (Engie/SDU)
 4. Multi-Zone Office Hybrid Simple (KU Leuven/Engie)

Breakout Session 2-2

- Joint with WP 1.1
- MPC Library Development
 - Development at <https://github.com/ibpsa/modelica-ibpsa-mpc>
 - Would like to use modelica-ibpsa models. Leads to three issues
 1. Direct copy of model
 2. Direct copy with parameter changes
 3. Copy with edited code/equations
 - First two issues can be taken care of by merge script and extends
 - Last issue could be addressed using:
 - Git cherry pick – would need to check depth setting and keep list of conflicts
 - Patch file – use diff and git patch to identify and apply file differences
 - For next meeting, prototype script and process for modelica-ibpsa merging to be developed and tested on small models (led by KU Leuven)
 - Unit testing
 - To include testing of optimal trajectories, objective values, iteration number, states and optimization variable numbers, decay of cost with iterations
 - Should set iteration count to prevent stalling
 - Example models for each component
 - For next meeting, development of framework on first small models (led by LBNL)
 - Develop guidelines for library use – like modelica-ibpsa wiki

Breakout Session 2-3

- Key Performance Indicators. Presentation available at https://github.com/ibpsa/project1/blob/master/meetings/2019-08-31-expert-meeting-rome/wp_1_2/BOPTEST_Use_Cases_and_KPIs.pdf
 - Implemented calculation for 5 of 8 originally specified
 - Addition of IAQ by CO₂

- Choose ppm-hour over limit as core KPI
 - Requires measurement of CO₂ in emulators, addition of CO₂ KPI measurement to signal exchange read block, CO₂ limit added to test case data
 - Brought up discussion of humidity – not include as core KPI for each emulator right now
- Addition of Peak Power
 - Important in U.S. on commercial electric utility bills, though not necessarily in Europe or elsewhere.
 - Do not include explicit KPI for peak power, but instead include in operational cost (through demand cost) where important.
- Flexibility
 - Still difficult to define
 - Can be measured through operation cost due to dynamic and highly dynamic price schedules
- Installation Costs
 - Report different categories as normalized (e.g. 1-5 scale) and create radar plots
 - Do once as group before final publication of metric (all MPC developers)
- Maximum Allowed Capital Cost / Yearly Savings
 - Calculate baseline KPIs for each emulator and store within test case. Therefore, can report savings as post-process with controller test.
- Scenarios
 - To begin testing, start with specific weeks in summer and winter, using whole month to eliminate initial conditions
 - Start with specific electricity pricing schemes
 - Start with deterministic cases (in terms of forecast error and measurement noise)
 - Possible to use representative days/weeks for whole-year tests, though still need more work before implementing as scenarios in BOPTEST (led by PNNL)
- Methods of Reporting and Dissemination
 - Beginning with internal testing, use spreadsheet
 - In the future, consider centralized location (e.g. website and database) to maintain and organize testing results (similar to <http://plato.asu.edu/sub/benchm.html>)

New-Comer Engagement Potential

- Beta-testing of developed software
- MPC development and testing using BOPTEST
- Development of new applications and test cases for MPC (e.g. natural ventilation strategies, evaporative cooling technologies)