# A COMPUTATIONALLY-EFFICIENT BUILDINGS ENERGY MANAGEMENT APPROACH FROM ANCILLARY SERVICES

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## INTRODUCTION

The demand response capability can be considered an ancillary service to support the distribution systems operation during outages and limited available energy moments. With an efficient demand response algorithm, this power reduction request can be done without compromise the users' comfort and constraints.

## SOLUTION DESCRIPTION

The present study proposes a new Building Energy Management System (BEMS) algorithm which considers a new regional strategy to reduced the required computation time of usual BEMS algorithm. Figure 1 shows the topology.

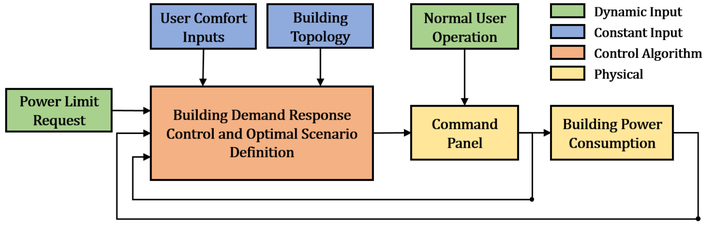


Figure 1. Simplified Control Topology.

Table 1. Computational Time Requirement Comparison.

| Case | Time Duration [s] | |
|---|---|---|
| | Traditional Approach | Solution Approach |
| Control Interaction | 4.0930 | 1.5683 |
| Entire Simulation | 665.3728 | 63.2034 |

## INITIAL RESULTS

The initial algorithm was deployed in the MATLAB platform and integrated with an building electrical model on Simulink. Table 1 and Fig. 2 and 3 show the collected results.

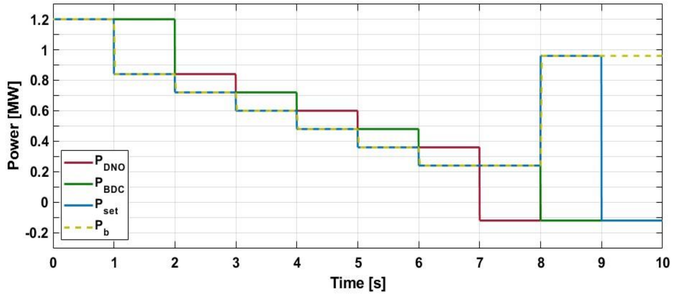


Figure 2. Power Request Tracking.

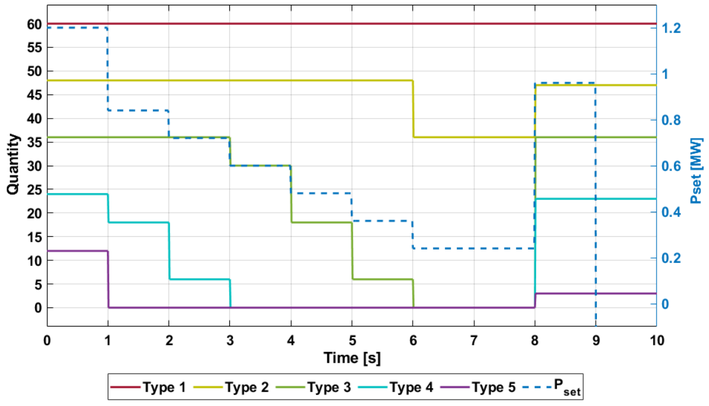


Figure 3. Granular Response.

## COMPLETE TESTBED

The final validation testbed is compounded by a Controller Hardware-in-the-loop (C-HIL) topology. A Raspberry PI is responsible to host the BEMS control algorithm using VOLTTRON platform which is connected to OPAL-RT, Real-Time Digital Simulator. The simulator hosts the building model, which is controlled by the VOLTTRON commands. The Fig. 4 and 5 shows the VOLTTRON and OPAL-RT connection and testbed topology.

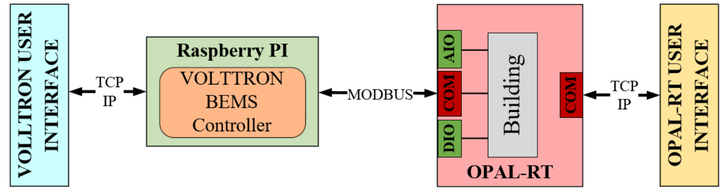


Figure 4. Control Testbed Topology.

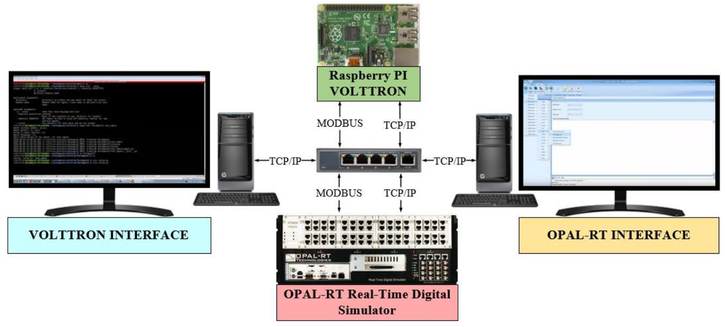


Figure 5. C-HIL Complete Testbed.