2017 Winter Conference

Las Vegas, Nevada

Haider Khan, MSME
ICF
Haider.khan@icf.com

Application of Building Energy Modeling for Utility Analytics

part of Seminar 4

Urban-Scale Energy Modeling

Learning Objectives

- **Provide an overview of UBEM techniques and data sources.**
- **Describe how UBEM can be used to make well-informed utility planning decisions.**

ASHRAE is a Registered Provider with The American Institute of Architects Continuing Education Systems. Credit earned on completion of this program will be reported to ASHRAE Records for AIA members. Certificates of Completion for non-AIA members are available on request.

This program is registered with the AIA/ASHRAE for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product. Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Awareness of the relationship between microclimate and building energy use

- Optimization by climate zone for energy efficiency of neighborhood building morphology.
- Recognize significance of analytical problems that can be addressed at urban scale that cannot be well addressed at the individual building level.
- Recognize key structural and operating requirements for an urban-scale energy modeling platform.
- Explain how urban scale models can be created
- Understand usefulness of building energy benchmark data in an urban context

Outline/Agenda

- UBEM Techniques
- UBEM Data Sources
- Case Studies

UBEM Techniques

- Utilize Representative Building Models and Building Sharedown
  - Calibrate to the total consumption for each sector for each region
- Model each building in a region individually
  - Calibrate to utility bill information

UBEM Data Sources

- NAICS data mapping to representative buildings
- Utility bill data
- Total regional consumption data

Case Study 1 – Integrated Resource Planning

- Problem: Hourly demand is needed as input to the model as typical constraints are on demand capacity
- Motivation: system costs can significantly increase if the right resources are not considered for capacity planning
- Challenge: determination of hourly demand estimates through engineering approaches are not reliable
- Approach: depending on the available budget and timeline, the appropriate UBEM technique is applied to most accurately determine hourly demand
- Result: a detailed and defensible approach for IRP planning that takes difficult to quantify interactive effects into account

Case Study 2– Electrification Potential

- Problem: cost of service for electricity is highly variable as compared to other fuels. A 8760 loadshape is needed as the electric systems are dynamic
- Motivation: comparing electricity to other fuels is difficult unless other advantages such as application of TOU rates
- Challenge: TOU rates and other demand management strategies require hourly demand estimates
- Approach: depending on the available budget and timeline, the appropriate UBEM technique is applied
- Result: a detailed and defensible estimate that takes difficult to quantify variable pricing and cost of service into account and is flexible with changes in the system

Case Study 3 – DSM Program Implementation Support

- Problem: energy and demand savings estimates are required for claiming DSM program cost effectiveness
- Motivation: estimating accurate demand and energy savings from DSM programs is critical for system planning purposes
- Challenge: using engineering estimates or non-BEM approaches could include cascading impacts between measures
- Approach: BEMs are created and simulated for each applicant for programs that may have interactive/cascading effects
- Result: a detailed and defensible approach that takes difficult to quantify interactive effects into account

Case Study 4 – Non Wire Alternatives

- Problem: Hourly demand is needed as typical constraints are on demand capacity
- Motivation: comparing all available DERs consistently requires consideration of the temporal aspects
- Challenge: calculation of hourly demand estimates for all DERs is required
- Approach: depending on the available budget and timeline, the appropriate UBEM technique is applied
- Result: a detailed and defensible approach that takes difficult to quantify interactive effects of various DERs into account

Case Study 5 – EE Policy Development

- Problem: the assessment of policy impact requires a large number of complex scenario analysis
- Motivation: a non-biased, comprehensive analysis is typically required for stakeholder buy-in
- Challenge: accurate representation of the baseline and parametric scenario analysis
- Approach: apply UBEM technique with parametric scenario analysis
- Result: a detailed and defensible estimate of the impact of policy

Conclusions

- While building energy modeling (BEM) is most widely used for building design, there are several other important applications of BEM
- These include:
  - utility integrated resource planning and demand side management modeling, design, and implementation support
  - building energy code development /energy efficiency policy development

QUESTIONS?

Haider Khan

Haider.Khan@ICF.com