Automated and Virtual: The Role of Energy Models in Home Energy Assessments

As one of the largest household expenses, utility bills can place a burden on homeowners. Heating and cooling, lighting, and plug loads can add up to costly expenses for many. Fortunately, energy efficiency projects can reduce home energy use and spending, bringing down utility bills by an average of three to five percent each month. Homeowners often do not know which efficiency projects to undertake, but in-home energy audits help to identify potential improvements. These audits themselves can be costly and time consuming to homeowners. This may dissuade homeowners from moving forward on projects that would result in energy and cost savings. Consequently, states and program administrators, along with energy professionals and the real estate industry, have begun exploring new ways to understand a home's energy use. This includes creating an easy, accessible way to analyze a home's performance while considering time and costs for the homeowner, contractors, and program administrators.

Recently, automated energy models (AEMs), have gained popularity as an alternative to in-home audits. These tools expedite efficiency projects by estimating a home's energy use and performance from publicly-available tax assessment data. AEMs provide a simpler route for consumers to become better informed about their home's energy efficiency and operational costs, and more energy-conscious homeowners may be more likely to undertake energy efficiency projects. An increase in projects would create more local jobs, promote workforce development, and aid in decarbonizing the building sector as a whole.

Automated Energy Model Approaches: AEM & AEM+

As AEMs have become more widely used, program administrators and energy professionals have adapted the tools to better fit industry needs. Today, AEMs typically come in two forms, the standard AEM and the more comprehensive AEM+. While similar, the two approaches have a few key differences, as outlined below.

AEMs generate an automated home energy baseline without any manual entry. These tools solely utilize pre-existing data from real estate listings or tax assessor documents, energy certifications, and solar PV information. The data sources provide 6-8 home characteristics, including age, size, primary heating fuel, foundation type, number of bedrooms, and whether or not air conditioning is present. An AEM uses these characteristics to model how the home uses energy. AEMs require minimal time commitment and are easy to use.

AEM+ approaches improve on the accuracy of AEMs by including additional parameters. Homeowners or an authorized agent may manually add information regarding heating, cooling, and water heating appliances, attic and basement type, insulation levels, lighting, and utility bills. These details help create a better picture of how the home uses energy. Despite requiring greater homeowner buy-in, AEM+ tools provide a more complete model of the home while still offering a more efficient process than an in-home audit.

Energy Estimator – Powered by HELIX & ClearlyEnergy

Developed by NEEP and ClearlyEnergy, Energy Estimator generates baseline home energy costs broken down by consumption category. This AEM+ tool utilizes ClearlyEnergy's proprietary AEM software and leverages solar PV data and verified energy models (i.e. U.S. DOE Home Energy Score and RESNET HERS Index) stored in HELIX. Homeowners can improve the accuracy of the baseline estimate by adding utility bill information and detailed home energy and insulation features. Once all data is entered, Energy Estimator formulates a home energy report that includes links to product sites, energy professionals, and appliance incentives. The tool supports voluntary or mandatory labeling policies and energy disclosure ordinances.

Home Energy Labeling Information eXchange

HELIX is a secure platform that has the capability of generating a custom label through a repository of home energy labels, certifications, and solar PV data. HELIX is designed to auto-populate Multiple Listing Service (MLS) listings with home energy data.

Energy Estimator uses HELIX to store the generated home energy label as well as recognize work already done on the home.

AEM+ In Action: Montpelier, Vermont

Vermont's capital has emphasized the importance of improving its building stock energy performance to achieve net-zero carbon goals. By implementing the **Montpelier Home Energy Information Ordinance,** the city will regulate and enforce energy efficiency disclosure requirements. Montpelier sellers and selling agents will include a Vermont Home Energy Profile (VHEP) when listing a home for sale. The city will leverage Energy Estimator and HELIX to generate these home energy labels and manage implementation of the ordinance. Montpelier chose a virtual solution for its ordinance to address concerns from stakeholders around the cost and timing of in-home audit solutions.

Virtual Approaches: Response to COVID-19

The COVID-19 pandemic has changed the dynamics of the energy efficiency industry and affected many aspects of in-home audits. Energy efficiency programs and on-site assessments quickly hit a standstill. Now, as on-site work begins to resume amidst the health crisis, the energy industry has been developing practices to ensure both health and safety and project success. The industry quickly seized upon widely offered technologies and introduced a virtual component to in-home audits that entails phone/video assistance or online assessments. More utilities and energy professionals are exploring the virtual approach as it provides:

- **Affordability**: By avoiding an auditor's in-home and travel time, the cost to analyze home energy use and costs decreases significantly, addressing an important concern of the cost-effectiveness of efficiency programs offered by states and utilities.
- **Expediency**: By offering an online platform accessible to homeowners and energy professionals, the process involves less time spent on scheduling an appointment, walking through a home, and waiting for results.
- **Flexibility**: The approach allows energy professionals and homeowners to work together to enter facts about the home's energy systems and utility bill information. This increases customer convenience, accuracy, and ownership of the results. With increased flexibility, energy professionals can perform a larger number of virtual audits and create a more sustainable pipeline of work.

Approach Overview	AEM	AEM+	Virtual
Homeowner "buy-in"	N/A	✓	✓
Ability to highlight home energy features	N/A	✓	✓
Level of Automation	Fully Automated	Automated w/ Additional Homeowner Inputs	N/A; Homeowner Driven
Example	Snugg Pro (Boulder, CO)	Energy Estimator	Mass Save

Looking Towards the Future

Energy efficiency plays a critical role in reducing a home's utility bills and carbon footprint while ensuring home comfort, health, and safety. By providing a cost-effective and more efficient way to understand home energy use, automated energy models (AEMs) can increase participation in energy efficiency programs and drive emissions reduction. COVID-19 further shed light on the importance of automated and virtual approaches as in-person energy audits became more challenging.

The shift towards increased automation should have positive impacts throughout the energy industry. In their simplest form, AEMs make it possible to scale the transparency of home energy performance and produce reasonable energy cost estimates with publicly available data. By manually adding data, AEM+ approaches provide homeowners with more complete home energy performance and costs information. These tools can serve as a way to add value and identify cost-saving efficiency measures. A streamlined home assessment process also benefits contractors and assessors by reducing the cost and time of in-home audits. In addition, AEMs can help to identify homes that would benefit from the more thorough step of an in-home audit.

While the deployment of AEM and virtual approaches will have many benefits, program administrators must also recognize new barriers these tools create. Notably, these approaches depend on reliable internet connection. To ensure equitable implementation of computerized approaches, program administrators, utilities, and contractors must address the needs of rural, low-income, and other customers who often have unequal access to high speed internet. In addition, elderly customers and customers with disabilities may not be able to complete a virtual audit themselves, so continuing to offer alternative options remains important. If thoughtfully designed, AEM and virtual approaches will offer greater access to efficient and healthy homes with a smaller energy burden to all consumers.

Gaining more control over a home's energy consumption and costs requires effective tools. By streamlining in-home audits and more easily achieving baseline energy comparisons, AEM and virtual approaches help usher in a new future for home energy improvements. In doing so, states and communities will better ensure healthy buildings, strengthened energy efficiency, and renewed progress on carbon reduction goals, even as we grapple with the long-lasting effects of COVID-19.