SMART BUILDINGS CENTER A project of NEEC

Market Snapshot:
The Improving Value Proposition for Virtual Energy Assessment Technologies

The Smart Buildings Center (SBC), a project of the Northwest Energy Efficiency Council (NEEC), has completed a virtual energy assessment demonstration project which studied how effective a new breed of technologies is at enabling energy efficiency improvements in commercial, public, and multifamily buildings. The project scope included research covering nearly 70 technologies, resulting in the selection of six technologies for 30-day deployments across 10 greater Seattle-area buildings and the study of two existing deployments.

Virtual energy assessment technologies are software platforms that serve a wide range of functions, including helping building owners collect and use energy data to better understand their buildings' performance and identify opportunities for improvement. These technologies represent a rapidly growing sector that is getting a lot of attention as the next big chapter of energy efficiency.

The Demonstration Project

Four core product capabilities of virtual energy assessment technologies in the SBC project emerged:

1. Create easily-understandable, visually-engaging building performance reports from existing building data
2. Identify energy-saving improvement opportunities that deserve deeper exploration
3. Proactively facilitate ongoing management of building energy use
4. Validate investments in energy efficiency over time

Within the subset of virtual energy assessment tools tested by the SBC, no single technology provided a full spectrum of capabilities within these four core areas for every building owner involved in the project. The demonstration project did highlight features common among the virtual energy assessment tools, grouped into categories below.

VEAT Technology Quick Guide: Table of Capabilities

Baseline	Establishes a starting period for measuring, tracking, analyzing, and validating energy
Benchmark	Compares peer buildings to estimate relative magnitude of opportunities for improvement
Dashboard	Summarizes and graphically presents building energy performance
Data acquisition	Imports energy use data from multiple sources automatically
Disaggregation	Separates whole building energy use into end uses, e.g. heating, cooling, and lighting

Monitoring	Tracks ongoing and up-to-date whole-building or system-level energy performance
Opportunity identification	Recommends actions for improving building energy performance
Portfolio management	Provides energy performance metrics for multiple buildings to prioritize investigations and actions
Project tracking and management	Tracks and helps manage project timelines, metrics, and evaluation of results
Reporting and engagement	Generates reports and facilitates sharing of energy performance information with a variety of stakeholders
Return on investment	Calculates projected and realized savings associated with energy efficiency improvements
Savings verification	Calculates savings from the baseline while also taking into account variables like weather and occupancy changes

Methodology

The SBC[1] focused its initial demonstration project on virtual energy assessment technologies because these technologies have the potential to quickly enable the industry to identify, plan, and implement energy savings decisions based on real energy use data. The project team identified relevant technologies by tapping the knowledge and experience of the SBC's partners, and by consulting the extensive research conducted by the Northwest Energy Efficiency Alliance (NEEA).[2]

Of the initial 70 technologies discovered, the SBC selected six for deployment and found two existing deployments to analyze. Preference was given to technology developed in the Pacific Northwest, since the SBC effort is in large part focused on elevating the stature of the energy efficiency leadership in that region. Companies in California and elsewhere in the U.S. were also eligible and were selected when consistent with project criteria. The selected eight companies had:

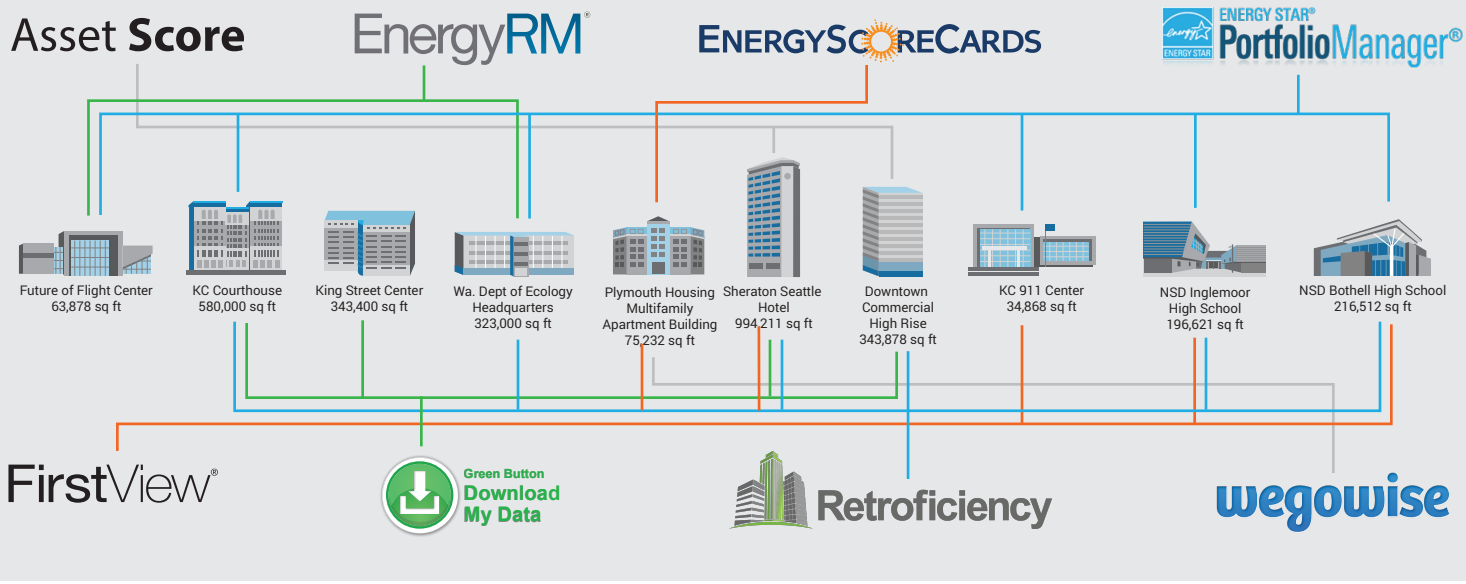
- A representative mix of product features and benefits of the 70 technologies discovered
- The capacity to work with existing building energy data (monthly and interval)
- The ability to produce results within a short period of time

The SBC selected 10 greater Seattle-area buildings for deployment that:

- Were diverse—included multifamily, government, and commercial buildings, some of which were part of broader building portfolios
- Already had a recently-completed a traditional energy audit so the results of the demonstration projects could be compared against previous efforts

[1] The demonstration project and results are made possible by funding under the U.S. Economic Development Administration i6 Green Challenge grant program.

[2] NEEA is a nonprofit alliance of utilities and energy efficiency organizations working to accelerate energy efficiency in the Northwest by advancing the adoption of energy-efficient products, services, and practices. Learn more at http://neea.org. SBC gratefully acknowledges NEEA's contributions and expertise.

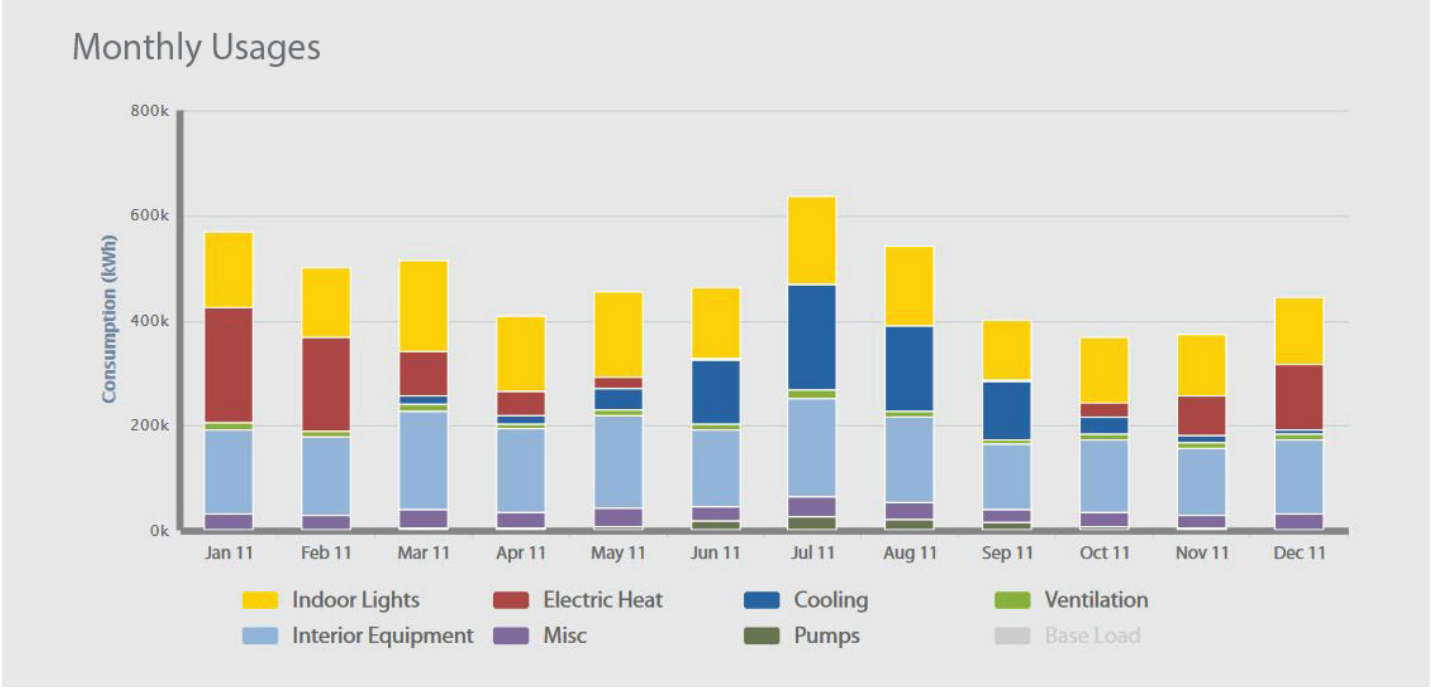


Findings

The virtual energy assessment tools tested by the SBC can bring considerable value to building owners and managers who are taking preliminary steps toward more energy efficient operations. Traditionally, site audits represented the first step, but during an exploratory phase, these audits can be too costly and time-intensive for a building owner. Virtual tools can help building professionals quickly understand baseline energy conditions and discover opportunities for improvement. These tools can then help focus the efforts of traditional site audits that will deliver more in-depth analyses to support investment decisions.

Through the demonstration project, several key themes emerged about the value of virtual energy assessment tools. Below are the core capabilities of the technologies tested by the SBC.

1. Create easily-understandable, visually-engaging building performance reports from existing building data

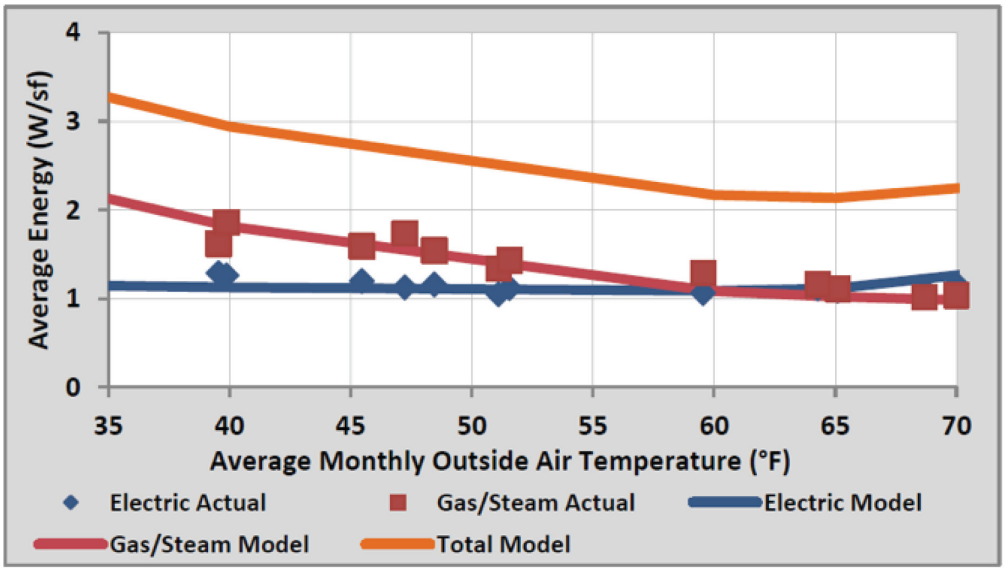


Retroficiency Virtual Energy Assessment (VEA)

Free or low-cost virtual assessment tools can give building operations staff access to monthly energy data from their own utility bills/records and produce a quick building-specific or portfolio-wide snapshot of energy performance. Even owners and operators of small buildings, who often do not address energy efficiency due to a lack of inexpensive, user-friendly analysis tools and sufficient data, can now begin to take their first steps toward focusing on which energy-savings projects might make the most sense without a significant upfront investment.

Accessing limited building performance data without the need for a more involved site audit or a potentially costly metering installation is a significant benefit of virtual audit tools. But perhaps the most powerful features of these technologies are the visual reports and benchmarking capabilities that make building performance problems and opportunities immediately clear, and can facilitate discussions with staff, supervisors, and financial analysts about pursuing energy efficiency investments.

2. Identifying energy-saving improvement opportunities that deserve deeper exploration



NBI FirstView

Energy professionals and building operators have long sought a tool that can quickly and efficiently identify energy saving opportunities across an entire portfolio of buildings and/or within individual buildings. The virtual assessment technologies the SBC tested provided an easy way for building managers to identify the best opportunities for efficiency investments. Stephen Kozlen, optimization program manager for McKinstry Energy Management Services, supervised several of the demonstration test buildings. He saw how the tools tested gave the user a high-level opportunity analysis—essentially a list of the most feasible energy efficiency interventions for each building. He observed, and the SBC agreed, that these tools are often faster than people at getting to a set of high-level opportunities which can then be used by building managers to narrow their focus to the most promising interventions. The results can also help building managers engage building decision makers about where to focus their limited resources and get to implementation faster.

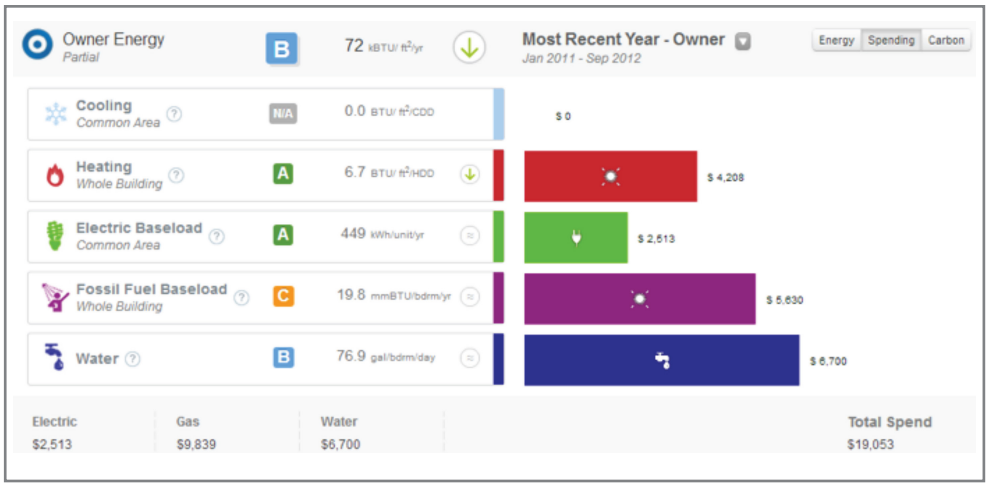
"We've watched the technology market improve over the last couple of years, and we can see how these tools can save significant time in the upfront analysis," Kozlen said. "Virtual tools represent a great solution to a longtime struggle to quickly get deeper insight using interval data. As a result, we've been shifting to a business model that can inexpensively leverage these tools as opposed to building them ourselves. This benefits both McKinstry and our clients."

3. Proactively facilitate ongoing management of building energy use

Staying on top of building performance over time is a key next step for many building managers, and a few of the products tested by the SBC are now making that process easier and more affordable than ever. To move beyond reactive facility management, centered on equipment failures and spikes in energy expenses, products are now available that allow building owners, managers, and operators to monitor trends in performance.

This allows them to take action before issues arise, syncing decisions with budget cycles and organizational priorities. This transition from reactive to proactive building performance management is a relatively new practice that will likely become standard in the years to come, and virtual energy assessment technologies will play a role in that shifting paradigm.

"BrightPower's EnergyScoreCards gave us a quick, visual, point-in-time snapshot of which systems in one of our buildings might hold the greatest opportunity for efficiency improvements—especially for heating and electricity use—and will allow us to further target our investigation," said Kim Lokan, director of facilities at Plymouth Housing Group in Seattle. "We were especially impressed by the weather-normalized comparisons from year to year, which will help us accurately measure and benchmark performance over time and," she added, "ultimately allow us to more proactively manage our portfolio of buildings."



Bright Power EnergyScoreCards

4. Validate investments in energy efficiency over time

Helping building owners and portfolio managers make good investment decisions today builds the case for future strategic spending and brings a level of comfort to both financial decision makers and financial institutions. Validating efficiency investments has traditionally been a tedious process. Thanks to the progress and maturation of these tools, the validation process can be streamlined and automated while providing visually-compelling reports that portray precisely how much energy and money have been saved. It is easier than ever for building stakeholders to understand and communicate how investments in energy efficiency are performing.

"When I observed that current energy use at the Future of Flight Aviation Center was lower than our historic baseline, it confirmed that recent investments in energy efficient equipment upgrades had paid off," said Garrison Marr, energy and resource conservation specialist at Snohomish County. "We've never had that insight before. Our building management team will be very excited to hear they outperformed expectations. The EnergyRM DeltaMeter report will be a great tool to use to share our success and generate enthusiasm among our leadership and engineering teams for implementing more improvements."

Indices	Full Year 2012 - Owner		Most Recent Year - Owner		Difference		Units
Energy Index	75	C	72	B	-3%	-3.00	kBTU/ ft²/yr
Cooling Index	0.0	N/A	0.0	N/A	-	0.00	BTU/ ft²/CDD
Heating Index	7.3	A	6.7	A	-8%	-6.00	BTU/ ft²/HDD
Non-Seasonal Electric Index	458	A	449	A	-2%	-9.00	kWh/unit/yr
Non-Seasonal Fossil Fuel Index	19.8	C	19.8	C	=	0.00	mmBTU/bdrm/yr
Water Index	76.9	B	76.9	B	=	0.00	gal/bdrm/day

Bright Power EnergyScoreCards

Technology Summary

Each product in the SBC study offered a unique mix of capabilities depending on the needs of the building and stakeholders, making certain tools more desirable for different building sectors.

The product summary below gives an overview of the technologies tested by the SBC and their associated capabilities.

Technology		Cost
Asset Score	Baseline, Benchmark, Disaggregation, Opportunity identification, Reporting and Engagement	Free
EnergyRM	Baseline, Benchmark, Dashboard, Disaggregation, Monitoring, Opportunity identification, Portfolio management, Project tracking and management, Reporting and Engagement, Savings verification	$$$
EnergyScoreCards	Baseline, Benchmark, Dashboard, Data acquisition, Disaggregation, Monitoring, Portfolio management, Project tracking and management, Reporting and Engagement, Savings verification	$$
ENERGY STAR® PortfolioManager®	Baseline, Benchmark, Data acquisition, Monitoring, Portfolio management, Reporting and Engagement	Free
FirstView®	Baseline, Benchmark, Disaggregation, Opportunity identification, Reporting and Engagement, Portfolio management	$$
Green Button Download My Data	Data acquisition	Free
Retroficiency	Baseline, Benchmark, Disaggregation, Opportunity identification, Portfolio management, Reporting and Engagement, Savings verification, Monitoring	$$$
wegowise	Baseline, Benchmark, Dashboard, Data acquisition, Monitoring, Portfolio management, Reporting and Engagement, Savings verification	$

"Disaggregation" represents energy consumption individually by major end-use categories such as heating, cooling, lighting, and more.

Interested readers are invited to continue learning about virtual energy assessment technologies through additional SBC documents focused on the commercial, public, and multifamily sectors, as well as building portfolios.

A one-page, graphical overview is also available as a quick reference to understanding virtual energy assessment tools. Please visit www.smartbuildingscenter.org.

Conclusion

Overall, the project results show that, regardless of the size or number of buildings being managed, virtual energy assessment technologies exist today that can help managers rapidly and cost-effectively find ways to reduce energy consumption. These technologies gather, organize, analyze, and present energy usage and building data in a way that generates valuable performance feedback for building operators and ultimately helps them manage energy consumption more effectively. These tools give building operators a jump-start on planning, prioritizing, and implementing energy efficiency improvements, summarized by the key functions below.

Free or Low Cost Technology can:	▪ Create easy-to-read, visual reports on whole building performance from existing energy usage and building data ▪ Identify energy improvement opportunities that deserve deeper exploration
Moderate to Higher Cost Technology can further:	▪ Proactively facilitate ongoing management of building energy use ▪ Validate investments in energy efficiency over time

Future Needs

As much progress as virtual energy assessment technologies have made in recent years, there is still a need to improve the utility of these tools if they are to become truly viable solutions for identifying deeper energy savings opportunities in commercial and multi-family buildings. The SBC has developed several calls to action which emerged from the demonstration project. Addressing the barriers below will not only help move these tools further into the mainstream market, but will also increase the value of technologies by enabling delivery of more robust results at a lower cost than traditional means.

1. Provide affordable access to interval data for all buildings

Virtual energy assessment technologies are more likely to proliferate if robust interval data is made more accessible and affordable for individual buildings and small portfolios. Interval data is typically only available to high-demand buildings and large portfolio customers at many utilities. Onsite monitoring equipment is often expensive and requires a high level of knowledge to implement correctly. Certain smart building technologies are already starting to drive the cost of acquiring interval data from thousands of dollars per meter to hundreds of dollars per meter. This will continue to open up new pathways for building performance assessment and begin to galvanize new areas of the energy efficiency industry.

2. Strengthen analysis of monthly data until richer data is more affordable

Monthly data for large building portfolios is often available in a consistent format, from which existing technologies can produce reports. Monthly data from individual buildings and small portfolios, however, usually comes in different formats from proprietary systems and most current technologies are unable to process it quickly, easily, and affordably. A few technology providers are already working to address this challenge and may allow smaller building groupings to benefit from these tools long before richer interval data becomes affordable and universally available.

3. Translate identified energy-saving opportunities into potential return on investment

Technology is getting better at identifying energy-saving opportunities, but this does not always naturally translate into financial visibility. Developers of technology platforms would do well to include return on investment (ROI) figures within their products. Soon the industry will have enough historical information on project expenses and energy savings to effectively predict and calculate the ROI on future projects with similar characteristics. Once this calculation process is made simple and efficient, and ROI calculations become more repeatable and therefore predictable, financial institutions and governments will be increasingly interested in supporting wide-scale project rollouts with loans, subsidies, and grants.

4. Cultivate partnerships among energy efficiency providers and develop all-in-one energy efficiency technology solutions

Technology providers and building operators would benefit from partnerships that enhance the value of virtual technologies to their ultimate customers. While some technologies may excel at data acquisition and portfolio management, for example, they may not offer opportunity identification; therefore, both providers could serve end users more effectively by forging partnerships with each other. These partnerships are expected to offer both additive and synergistic benefits for users.

If virtual energy assessment technologies are to realize their maximum potential as viable audit tools and provide a means to identify energy efficiency opportunities quickly, easily, and affordably, then efficient and consistent access to short-interval energy-use data on a large scale will become increasingly necessary. The massive amount of information embedded in short-interval data can clearly provide more robust and sophisticated analysis than monthly data; however, collecting this information is currently expensive and limited to only a subset of the technologies tested by the SBC. Widespread access to short-interval data, without the need for deployment of multiple sensors, will allow for in-depth analysis more quickly and at a lower cost, and could overcome barriers currently prohibiting a majority of otherwise willing participants from buying in. Access to this level of data will enhance the understanding of existing building operations and lead to more targeted energy savings opportunities that translate into greater ROIs and faster payback for building owners and financing entities.

With further development, better data, and broader deployment, virtual energy assessment technologies will give not only building owners and managers, but also utilities, governmental grantors, investors, and energy services companies, the analytical information they need to invest confidently in broad energy efficiency initiatives as well as provide the tracking and management capabilities to validate those investments over time.

About the Smart Buildings Center

The Smart Buildings Center (SBC) is a project of the Northwest Energy Efficiency Council (NEEC), which is a nonprofit industry association of the energy efficiency industry. The SBC supports growth and innovation in the Pacific Northwest's energy efficiency industry, serving as a hub for industry activities and raising the visibility of energy efficiency companies and projects.

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