Driving Innovation, Rewarding Performance: Seattle's Next Generation Energy Codes and Utility Incentives

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ABSTRACT

The 2012 Seattle Energy Code includes a new compliance pathway based on verified energy performance – the first outcome-based energy code path in the nation. This voluntary, alternative pathway, in a departure from prescriptive and modeled-performance code paths, regulates whole building energy consumption by verifying actual building energy use against a specific energy use index (EUI) threshold. The framework is being aligned with utility incentives to encourage innovation and reward performance.

In advance of the 2012 code implementation, the City of Seattle and Preservation Green Lab partnered to create the Seattle Outcome-Based Energy Code demonstration program, a voluntary pilot project. The three initial projects are all historic building renovations, whose owners engaged in the program to test the energy and financial outcomes of the alternative path.

One of the demonstration projects is the Anhalt Apartments, a 39-unit multifamily building which includes both renovation of an existing historic building and construction of an addition. To support energy conservation in this project Seattle City Light has developed an incentive calculation method based on the building's verified energy use. This approach differs from traditional incentive programs, which estimate theoretical savings and offer rebates for specific energy efficiency measures.

This paper describes ways in which the outcome-based approach supports innovative energy saving strategies, and describes the process undertaken to develop the code pathway collaboratively with multiple stakeholders. This paper also addresses challenges faced by the utility in identifying an appropriate baseline, accurately estimating energy savings, and structuring incentives to reward verified energy performance.

Background

Prescriptive energy codes are the norm for enforcing standards of building energy performance in jurisdictions throughout the world. Prescriptive energy codes lay out a menu of options for elements in building construction with minimum or maximum values for components that designers incorporate into projects. This approach is relatively simple for building inspectors to verify, and supports a widely accepted measure-specific method for quantifying energy savings in buildings beyond code.

However, prescriptive codes largely overlook a "whole building" approach to efficiency by ignoring plug and process loads, as well as other user behaviors that influence building performance, thereby missing opportunities to maximize energy savings (Spataro 2011). It is also quite difficult to create standards that can effectively deal with integrated design – for example, balancing effective daylighting with increasingly restrictive glazing allowances (Denniston 2011). Prescriptive codes can also be very costly and time-consuming for public agencies to review and update. Code updates can also translate to increased costs and diminishing energy savings returns for builders and developers. Improving building insulation, for example, becomes less cost effective and realizes only incremental energy savings with each required increase in R-value (Denniston 2011). The largest drawback of prescriptive codes, however, may be that the approach does nothing to verify energy performance over time.

With the advent of energy modeling, development of performance-based codes have aimed to address a number of these concerns. Performance-based or modeled-performance energy codes allow projects to demonstrate modeled energy usage and comply through "percent better than" a specified baseline. Performance-based codes built on the "percent better than" standard allow for a whole-building analysis of energy use, integration of new technology at earlier stages of design, increased design flexibility, and better analysis of systems that are low cost that deliver large energy savings. However, this approach fails to address a number of pitfalls. As with prescriptive codes, plug and process loads are not included, predicted energy use is often optimistic. Enforcement from local jurisdiction ends at the Certificate of Occupancy (Spataro 2011). The fundamental question of how buildings perform after occupancy remains unanswered with the performance-based code approach.

Outcome-based energy codes go a step beyond performance-based codes by verifying actual energy performance in buildings. Compliance is contingent upon demonstrating that a building's energy use, once the building is occupied, meets or exceeds a specific performance target. By monitoring building performance, outcome-based energy codes incorporate the design flexibility of the performance-based model while including *all* energy loads. Outcome-based energy codes also have the potential to create a positive feedback loop, in which verified energy use data gathered from projects can be incorporated into targets used in future code revisions. This path is not without potential drawbacks, including reluctance of building owners, designers, and contractors to assume responsibility for building energy usage beyond project completion, especially if financial penalties are to be assessed based on measured energy usage. An outcome-based approach can also result in higher commissioning and maintenance costs, given the increased focus on performance. (Spataro 2011). Finally, outcome based codes require longer term engagement in building performance by not just the project's development team, but by city building officials. Regulators must stay involved with project monitoring, commissioning and reporting for the entire building monitoring period, typically 12 months after the building reaches a certain level of occupancy (Spataro 2011). This longer involvement can translate to more expense for cities, in terms of more training for building officials and more staff time spent on enforcement and verification. Given these drawbacks, outcome-based codes are not ideally suited for every new building. Small, simple buildings that fit well into a prescriptive code approach may not be able to justify the additional cost and time investment required by an outcome-based approach. However, for building designers, owners, developers and building officials interested in more aggressive approaches to energy savings, the outcome-based approach is an appealing new direction in code enforcement.

Initial Movement towards an Outcome-Based Code Compliance Path

Beginning in 2008, the City of Seattle, New Buildings Institute (NBI), and a host of regional stakeholders in the Pacific Northwest began to explore the feasibility of an "outcome-based" energy code focused on compliance through verified performance. The City of Seattle led the outcome-based development process as part of its broader Climate Action Plan, which outlined a roadmap for reducing carbon emissions associated with the built environment. The roadmap included one of the nation's first mandatory benchmarking ordinances, requiring certain buildings to report energy performance to the City, and development of an outcome-based energy code, with focus on verified building performance versus predictive outcomes. The concept of the outcome-based code was borrowed from the Danish energy code – a 14-page document significantly simpler than the 200 page 2009 Seattle Energy Code (*Building Regulations 2010)*. The Seattle outcome-based code project had three objectives:

1. Create a protocol for target-setting for all major building-use types;
2. Establish a process for City design review, permitting, and inspection;
3. Develop an enforcement mechanism with equal leverage to a Certificate of Occupancy.

In addition to the stakeholder group's work to meet these objectives, The City of Seattle Department of Planning and Development (DPD) developed an outcome-based energy code pilot project by partnering with the Preservation Green Lab of the National Trust for Historic Preservation (NTHP). The purpose of the pilot was to test an outcome based compliance pathway on actual projects permitted under the 2009 Seattle Energy Code. Lessons learned from this pilot would then be leveraged to develop an outcome based code compliance pathway for the 2012 Seattle Energy Code.

NTHP was selected as the pilot partner due to the organization's interest in developing policies that encourage sustainable reuse of existing buildings, and allow design teams to innovate and capitalize on original design intelligence of older buildings. The Preservation Green Lab created a demonstration program to develop a draft code framework, and recruited three historic renovation projects to test application of the code in partnership with City of Seattle Department of Planning and Development (DPD). Because Seattle Energy Code (SEC) gives substantial discretion to the building official to modify code requirements for historic structures (SEC 2009 101.3.2.2), the use of historic projects allowed for more flexibility in developing and testing an outcome-based framework.

Innovation through Demonstration

Working collaboratively, the Preservation Green Lab and Seattle DPD developed criteria for participation in the demonstration program, including requirements for ambitious energy targets beyond code-equivalent buildings. Demonstration projects were required to trigger the City's substantial alterations requirement for bringing existing buildings up to the performance standards of new construction. Additionally, project owners were required to commit to at least 12 months of post-occupancy measurement and verification, which commences once 75% of the project is occupied. A 12 month period was selected with the intent to limit the post occupancy engagement of City building officials and project owners to a reasonable amount of time without causing undue burden to either party. Although this period is not long enough to gauge long-term building performance, it provides useful insight into how the building operates after occupancy. Long term performance monitoring will be done through the City's benchmarking and reporting requirement. Data acquired through the reporting requirement will allow building officials to understand how a building's performance changes over time. This data can also be used to evaluate whether a 12-month data monitoring period is an acceptable proxy for understanding a building's verified performance. Three demonstration projects were selected for the outcome based pilot project:

- Supply Laundry Building: A 35,000 square foot former industrial laundry building. Partially conditioned and being converted to speculative mixed-use by Vulcan Real Estate.
- 1510 Melrose: A 10,000 square foot former automobile repair shop. Unconditioned and being converted to mixed-use residential, office and restaurant. Owned and developed by a former engineer with an interest in energy efficiency.
- Anhalt Apartments: A 24-unit apartment building that had previously been converted to medical office. Being returned to original residential use, with a new 15-unit addition on the same parcel. Developed by Trinity Real Estate and Norman Partners.

The building owners participated in the demonstration program for a variety of reasons:

- A desire to preserve the historic character of these buildings, while driving innovative approaches to achieving code equivalent performance (or better);
- Availability of technical design assistance and performance target setting from the NHTP;
- Concerns over compliance issues for certain components in historic buildings, even when using RS-29, the 2009 SEC modeled performance compliance pathway. For example, site built storm window have no NFRC rating or U-Value without on-site testing.
- Interest in pursuing optimal energy performance in an historic building, including application of renewable energy. The 2009 SEC's modeled performance pathway (RS-29) is based on consumption, and does not allow for credit to be taken for on-site renewables. (2009 SEC section RS-29.2.4)

The Preservation Green Lab developed legally binding agreements with the City and each demonstration project to establish performance targets, work collaboratively with both DPD staff and project design teams to identify optimal design solutions, and establish compliance checklists and enforcement mechanisms.

Target-Setting: Target-setting for outcome-based codes has been especially contentious among national stakeholders (Dunn 2010). It was also one of the largest challenges of this demonstration project. Although the City's mandatory benchmarking ordinance is now in effect, most buildings permitted under the 2009 energy code are still under construction, or recently completed, so operating data is not yet available for a significant number of buildings. The pool of buildings permitted under the 2006 energy code is quite small due to the contraction of the construction market during the recent economic downturn, and buildings built under codes predicating the 2006 code do not offer comparable buildings to those built under the 2009 prescriptive code. Without previous building performance data as a baseline, and because regionally specific data per building-use type was not reliable, the targets were set using DPD-approved energy modeling software and standard reference or default values as required in the 2009 Seattle Energy Code. Projects were required to target performance at least 5 percent better than a modeled code-equivalent new building.

Compliance: Seattle DPD required demonstration projects to submit design documents and respond to corrections or questions by stating how the proposed design intended to reach target performance on a whole-building scale, rather than measure-by-measure. An energy model was also required for each project. Energy modeling inputs and assumptions were reviewed and critiqued by DPD staff.

Enforcement: The ability to penalize buildings that fail to meet their energy target after issuing a Certificate of Occupancy is critical. The team realized the compliance mechanism for this pilot project needed enough teeth to provide a similar level of enforcement as traditional energy codes. Options for enforcement mechanisms were discussed directly with demonstration project teams and also in workshops with development professionals, engineers and architects. Options included revoking Certificate of Occupancy; granting temporary Certificate of Occupancy until compliance was demonstrated; posting performance bonds; structuring utility rates based on performance; and fees based on performance against the target. Ultimately, the team selected a combination of performance bond and fee based on total building area. The building owner must post a bond upon initial occupancy, which would only be released on energy target verification at the completion of the 12-month monitoring period Seattle DPD was responsible for collecting and holding these fees and bonds. In the event that a project did not meet its target, the project would be required to identify mitigation measures through an ASHRAE Level II Energy Audit or equivalent process approved by the City. The project would then implement those measures deemed most effective and cost efficient to achieve the standard.

Commissioning and Reporting: All three demonstration projects were required to fully comply with the robust commissioning requirements of the 2009 Seattle Energy Code. These requirements include a written commissioning plan, systems balancing, functional testing of HVAC and lighting systems and controls; and an air infiltration test. Reporting requirements are specified in each project's Memorandum of Understanding (MOU) between the NTHP and the City of Seattle DPD. Data will be provided to the City via Energy Star Portfolio Manager and Target Finder, and adjusted for the percentage of the building which is occupied as well as seasonal temperature variation. The MOU is recorded on each project's title in the county assessor's office, and runs with the property in the event of a sale or transfer of title.

Initial Pilot Outcomes

Although these buildings have not yet produced a full year of data, the initial results are very positive. The 1510 Melrose building, with uninsulated brick walls, custom retrofits to original windows, and high-efficiency mechanical equipment, is currently operating with 31 percent less energy consumption than the modeled code-equivalent reference building. Supply Laundry, recently leased, is targeting performance 48 percent better than the modeled reference.

The Anhalt Apartments project, although still under construction has become the model for codification of the outcome-based pathway in the 2012 Seattle Energy Code. As the third and final project to participate in the demonstration process, it benefitted from improvements in the review process by City of Seattle DPD as staff became more comfortable with this new approach. The project also had the most realistic EUI baseline of the three, based on lessons learned from EUI estimation in the previous two projects. The project owner engaged in an integrated design approach, bringing all members of the design and construction teams together to conduct analysis of all possible energy strategies and predicted energy savings and costs. Some of the project's energy conservation features include: heat recovery ventilators, aggressive glazing and insulation in the new building addition; insulating cellular shades in units in the renovated portion of the building; and energy efficient water heaters and lighting throughout the building. The outcome-based approach allowed this project to utilize building modeling to accommodate trade-offs between envelope systems, HVAC, and hot water heating systems. Furthermore, the project was able to use more accurate modeling assumptions for the historic elements of the building envelope (window retrofits and existing brick walls) than allowed under the RS-29 (modeled performance) code compliance pathway of the 2009 Seattle Energy Code.

This integrated approach led to a design that would not have been achieved by following the prescriptive code. The project also places a strong emphasis on resident engagement strategies to ensure that the target EUI will be met.

Measuring Energy Savings Post-Occupancy

Since EUI is so heavily influenced by resident behavior, developing effective strategies to engage residents in energy conservation critical to ensure that the Anhalt Apartments' performance target is met. The MOU for the project specifies two options to fulfill requirements for building monitoring and engagement: either a lease provision that allows project owners to access resident electrical consumption data, or a detailed plan for sub-metering and monitoring of individual unit loads. Despite the higher cost associated with the second option, the development team opted for this approach on the assumption that a robust, interactive building monitoring system within which residents can monitor their energy use and compare their use to other residents will encourage residents to focus more consciously on energy conservation. The monitoring system will include two components with feedback features for residents:

- NEST smart thermostats in each unit. In addition to NEST's self-learning and self-programming capabilities, this system will offer residents feedback on energy use over time via a smart phone application.
- Electrical sub-metering equipment with real-time data output and web-based, user-friendly software that will allow each resident to view energy consumption and compare it to generalized consumption data of other units in the building. The monitoring equipment package for this system includes pulse output multiple meter units (MMUs), pulse transmitters and a remote data logger (RDL) which can be remotely accessed via internet. These capabilities will allow the building owner to see both individual unit data as well as real time aggregate building energy use data, and compare their use to average unit use.

In addition to offering sophisticated feedback for residents, this system will allow Preservation Green Lab and the Seattle City Light to more clearly understand where and how significant building energy savings are being realized.

Utility Incentives to Support Innovation

Seattle City Light's Conservation Resources Division (CRD) supports innovations in energy efficiency in buildings by offering financial incentives for projects that demonstrate energy savings beyond code. Although CRD is involved in code development and enforcement policy, actual code review and enforcement is carried out by Seattle Department of Planning and Design (DPD). CRD does not have an official role in code compliance, instead focusing exclusively on identifying and incentivizing savings opportunities beyond code. Multifamily buildings such as the Anhalt Apartments are typically served by CRD's Built Smart program, a multifamily new construction incentive program which utilizes prescriptive energy saving measures to reward energy conservation measures that exceed components required by the Seattle Energy Code. Measures in the Built Smart program include efficient windows, lighting power density below code maximums, and efficient appliances and whole house fans. To support the new outcome based code compliance pathway in the 2012 Seattle Energy Code, Seattle City Light recognizes the need to develop a new performance-based approach to incentivizing projects which utilize the outcome-based energy code compliance pathway. The Anhalt Apartments was the selected to pilot an incentive approach because it was the only project of the three which included only one tenant use (residential), simplifying the selection of a building baseline and evaluation of the proposed EUI for the building. The fact that there is no Tenant Improvement work to be done on the project also simplifies the timing for energy incentive payments. The project includes only electric heating and electric hot water, which avoids the dilemma of calculating savings in a split-fuel situation.

Identifying an Appropriate Baseline, Developing Methods for Estimating Energy Savings

The first step in estimating an incentive for the project was to identify an appropriate EUI baseline for a building constructed according to the 2009 Seattle Energy Code prescriptive requirements. The mechanical consultant on the project utilized energy modeling to create a baseline simulation equivalent to a prescriptive SEC compliant building. The modeled building proposed had an EUI of 44.3 kBtu/sf (after a deduction for a required renewable energy component), which was accepted by City of Seattle DPD as an acceptable baseline. The SCL Conservation team reviewed the model assumptions and compared the baseline EUI to a number of multifamily occupancy studies to determine whether it was a reasonable assumption on which to base an incentive. Some SCL Conservation staff members felt that this baseline was too high; however, given that DPD accepted this EUI as a baseline, SCL opted to accept the proposed baseline in order to maintain consistency of data.

The predicted EUI for the project was modeled with proposed design parameters using eQuest software version 3.64. The expected EUI of the proposed design was 40.1 kBtu/sf. SCL accepted this as a reasonable EUI estimate.

As highlighted in the Annual Energy End Use Chart, figure 1 below, differences in proposed energy usage were modeled in cooking, ventilation fans, heating, and domestic hot water, with energy savings coming from the latter two. The model assumed code baseline for lighting, plug loads, and appliances.

	Annual Energy End Use (Mbtu/yr)											
	Interior Lighting	Garage Lighting	Ext Lighting	Plug Loads	Cooking	Heating	Cooling	Vent Fans	Garage Fans	DHW	Elevators	Total
Baseline	152.70	36.20	5.4	278.6	100.9	418.6	1.1	44.1	7.8	284	7.3	1336.8
Proposed	152.70	36.20	5.4	278.6	100.6	336.2	1.1	52.6	7.8	219	7.3	1197.8

Figure 1. Anhalt Apartments Proposed Design vs SEC Baseline. Source: Anhalt Apartment Energy Modeling Summary by Flack + Kurtz, March 19, 2013.

As building design progressed, it became clear that lighting and appliance loads would be less than projected in the building energy model due to more aggressive lighting design and specification of efficient lighting and appliances. SCL conservation staff utilized “deemed” and "estimated" savings to incorporate these expected savings into the incentive estimate as well. Additional savings were also identified in whole house fan commissioning of the units in the new building. The 2009 Seattle Energy Code does not currently specify a maximum ventilation rate per unit. To limit heat loss by over-ventilation, the Built Smart program offers a fan commissioning rebate for unit whole house fans commissioned to meet the minimum code-specified ventilation rate. A kWh savings per apartment unit value was applied to units in the addition. Units in the existing building renovation were excluded, since those units utilize HRV systems which were included in the model.

Structure of Incentive Rebate

The challenge of structuring an energy efficiency rebate to reward actual building performance is balancing the Utility's desire for to see verified energy savings over time with the project owner's need for capital up front to cover the costs of technology needed to realize those energy savings. This challenge was especially relevant for the Anhalt Apartments, which faces, in addition to costs associated with other building energy conservation measures, significant capital costs to implement a robust energy sub-metering and monitoring system.

Although Seattle City Light CRD is optimistic that the monitoring system and resident engagement platforms planned for the Anhalt will result in energy savings, there is very little data available that may predict how much savings can be expected from this system. Seattle City Light is hesitant to offer an up-front rebate to directly offset a portion of the cost of the system. The same problem exists with the modeled energy savings in the building. Because modeled energy savings are rarely verified after occupancy, there is little known about how modeled energy savings in buildings translate to verified savings. Furthermore, separating savings associated with resident engagement from savings assumed in prescriptive rebate estimates is problematic. For this reason, Seattle City Light prefers to pay for verified energy savings after the completion of the post-occupancy monitoring period.

To address the needs of both CRD and the project owner, the rebate incentive will be split into two payments, which are depicted in Figure 2 below.

Payment 1: Due at the conclusion of construction

Deemed Savings Meaures	kWh saved	Proposed Incentive
Interior Common Area Lighting	11,053	$ 3,946
Parking Garage Lighting	3,341	$ 1,193
In-unit Lighting	23,565	$ 8,413
Energy Star Refrigerators	1,716	$ 1,170
Whole house fan efficacy	2,250	$ 844
Whole House Fan commissioning	4,935	$ 1,762
	46,860	**$ 17,327**

Payment 2: Based on verified energy savings minus payment 1; due at the conclusion of 12 month monitoring period

Measure estimates from Energy Model	kWh saved	Proposed Incentive
Water heating savings	19,045	$ 6,799
HVAC system	24,143	$ 8,619
	43,188	**$ 15,418**

Payment 2 would also include rebates for additional savings through resident engagement which are not included in energy model.

TOTAL ESTIMATED PROJECT INCENTIVE AMOUNT *Not including savings realized through resident engagement / building monitoring*	$ 32,745
TOTAL PROJECT PROPOSED kWh SAVINGS	**90,048**

Figure 2. Anhalt Apartments Energy Efficiency Rebate Estimate, March 2, 2014.

The first payment will cover lighting, appliance and ventilation savings not included in the building energy model. These kWh savings and associated incentives are based on existing measures in the Built Smart program. This payment will be made at the completion of construction following an inspection and verification of installed fixtures. The second and final portion of the payment will be based on total verified energy savings in the project and confirmed through reporting during a12 month monitoring period, which coincides with the monitoring period specified by DPD, who will be enforcing compliance and assessing any financial penalties if the building does not hit the established performance target. The final incentive payment will have the amount from the first payment subtracted, ensuring that the developers are paid only for energy savings verified through building monitoring. The incentive rate will be $0.375 / kWh, which is the average incentive rate across all Built Smart measures, adjusted for inflation during the monitoring period.

From Demonstration to Adoption

The Outcome Based Energy Code pilot project was a critical step in developing a new outcome-based code compliance pathway for the 2012 Seattle Energy Code. Prior to the demonstration projects, City of Seattle energy code officials were uncomfortable with the concept of an outcome-based code since there was no clear enforcement mechanism equivalent to a Certificate of Occupancy, and the perceived risk of letting buildings “off the hook,” thereby setting a precedent for non-compliance, was significant. However, the demonstration program created an opportunity to develop aggressive targets and financial security requirements to encourage code compliance. This combination resulted in an effective new method of enforcement - only experienced developers and design teams were willing to take the risk associated with meeting a specific building performance target. All three developers in the demonstration projects built in performance buffers to ensure compliance, and all agreed to bonds or fees to guarantee performance.

For the 2012 Seattle Energy Code revision cycle, the outcome-based energy code pilot project served as the basis for the Target Performance Path (TPP), the new outcome-based compliance pathway for the 2012 Seattle Energy Code. This new pathway is offered as an alternative to existing prescriptive, component tradeoff, and modeled performance pathways, which were also tightened to achieve substantial gains in building energy efficiency (SEC 2012). Officials led a series of public meetings to vet each code innovation with the development community. Even with ambitious energy targets, developers embraced the concept of exchanging prescriptive code for verified post-occupancy performance, and TPP was adopted as part of the 2012 Seattle Energy Code on December 26, 2013.

The TPP includes two basic requirements: First, use energy modeling must demonstrate that the building's predicted energy use will be below the EUI target for that building type. Second, a post-occupancy monitoring period must demonstrate that the building has met or beat the EUI target through reporting building energy use. The monitoring period was set for a period of 12 consecutive months once the building has reached 75% occupancy. If the building meets the target, there are no further obligations. If a building fails to meet targets, it is assigned a financial penalty between $1 and $4 per square foot depending on the degree to which energy use exceeds the target. Half of the penalty may be returned to the building owner to apply towards building energy efficiency improvements (SEC 2012 C402.1.5).

The performance targets in the TPP were derived using a consensus of expert energy modelers from the area. Seattle does require energy benchmarking and disclosure for commercial buildings over 20,000 feet, but the dataset does not contain the depth and diversity of similar building needed to set an EUI target (OSE, 2014). Similarly, there were very few buildings in the benchmarking dataset permitted under the 2009 code. Therefore, the panel relied on their own recent experience with energy modeling to arrive at target EUIs for each use. Table 1 shows EUI targets for each of seven building types that would closely approximate the energy use of a code-compliant Seattle building. These are much lower than EUIs from existing benchmarked buildings, even relatively recent construction. For example, office buildings built after 2000 had an actual EUI of 59.8 kBTU/sq ft, compared to the target of 40 kBTU/sq ft (OSE, 2014).

Table 1. 2012 Seattle energy code target performance path energy use targets (2012 SEC C402.1.5)

Use	Target, in kBTU/ square foot / year
B- occupancy office	40
B-occupancy medical office	50
R-2 occupancy multi-family	35
S-1 & S-2 occupancy warehouse	25
E-occupancy school	45
M-occupancy retail	60
I-2 occupancy hospital	150
Parking garages, enclosed*	10
Parking garages, open*	6

* Parking garages, including unconditioned and conditioned spaces, within the above occupancies shall be calculated separately.

Several technical requirements from the energy code are still mandatory components of the TPP, including air barrier testing, commissioning, metering, and inclusion of solar-ready roofs. These measures are intended to give the building occupants and operators the best possible chance of hitting or even surpassing their targets.

Tenant behavior and specific building use will clearly impact the ability of buildings to meet their energy targets and is an area of great uncertainty. Understanding the exceptions and unique uses is a key piece of the TPP. It includes provisions for changes in retail operating hours and another for changes of occupancy. For data centers, a method to isolate and subtract data centers from whole-building energy use was also developed. This calculation can also be used to isolate other external process loads, such as laundries or commercial kitchens. The pilot should uncover additionally specific occupancy considerations for future modeling.

Conclusion: Scaling Up

The ultimate goal of an outcome-based energy code is to provide developers and designers with the flexibility to use innovative strategies to beat energy code targets. The City of Seattle's Outcome-Based Energy Code pilot program has demonstrated that design teams have been able to take advantage of this flexibility to far exceed target performance requirements using readily available strategies. Keys in paving the way for success using this pathway have been setting clear and specific performance targets for buildings to aim for, and allowing as much flexibility as possible to hit these targets. Partners in the development of the outcome-based program reiterated the necessity to provide design flexibility by focusing on measuring ultimate energy usage and moving away from prescriptive requirements that in the past have served as barriers and limited innovation.

Although the Anhalt Apartments are still under construction, all signs indicate that it will realize significant energy savings beyond what has been modeled. The project has also been the first to take advantage of Seattle City Light's new outcome-based approach to energy efficiency rebates through verified savings. This partnership has been beneficial for both parties. The project team is able to leverage rebate incentives to offset capital costs of energy saving measures, while the Anhalt project has provided Seattle City Light with an opportunity to test this new approach in advance of the Target Performance Path (TPP) of the 2012 Energy Code.

EUI target setting was an issue for all three projects in this pilot, and will continue to be another significant issue in performance-based code compliance pathways. However, the recent building boom and rapid compliance with the City's benchmarking and disclosure ordinance will increase the quantity and quality of recent building data. As this energy usage data becomes more accessible, EUI targets can be revised accordingly.

For the Anhalt project, the influence of residential behavior on building EUI and the necessity of resident-accessible building monitoring systems remains uncertain. Further understanding the variability occupancy can have on building performance is crucial to the outcome-based approach to incentivizing energy savings for multifamily buildings. As utility programs continue to evolve to support the TPP, this will be a continued area of focus, for both multifamily buildings and for buildings of other occupancy types. Outcomes from final reporting of the project will inform Seattle City Light's decision on whether to adopt a formal performance-based incentive program for projects taking the Target Performance Path as an effective tool for driving more innovative approaches to energy savings.

Despite these issues, the outcome-based demonstration project provided critical information to the process of developing the Target Performance Path to code compliance for the 2012 Seattle Energy Code. City officials, designers, project owners and energy incentive program managers now have a template from which to improve upon as more buildings select this code compliance path.

In the long term, the City of Seattle DPD anticipates that outcome-based codes will eventually become the main energy code compliance pathway, with prescriptive compliance being a secondary path available for simpler buildings. EUI targets will be adjusted incrementally as more reliable data is gathered to reach specific energy savings goals. As Seattle normalizes this pathway through future code updates, other cities may follow suit towards performance-based code compliance.

References

2009 Seattle Energy Code (SEC). Ordinance 123420. November 23, 2010. http://www.seattle.gov/dpd/cs/groups/pan/@pan/documents/web_informational/dpdp025700.pdf

2012 Seattle Energy Code (SEC). Ordinance forthcoming. December 27, 2013. http://www.seattle.gov/dpd/cs/groups/pan/@pan/documents/web_informational/dpdp025738.pdf

Building Regulations 2010. The Danish Ministry of Economic and Business Affairs. Copenhagen. December 2010 http://erhvervsstyrelsen.dk/file/155699/BR10_ENGLISH.pdf

Dunn, L., Antonoff, J., Denniston, S., and DiNola, R. 2010. *Toward a Future Model Energy Code for Existing and Historic Buildings*. The Preservation Green Lab. http://www.preservationnation.org/information-center/sustainable-communities/green-lab/additional-resources/nthp_outcome_based_energy_codes_white_paper.pdf

Office of Sustainability and the Environment (OSE). Seattle Building Energy Benchmarking Analysis Report. City of Seattle. January 2014. http://www.seattle.gov/Documents/Departments/OSE/EBR-2011-2012-report.pdf

Spataro, K., Bjork, M. and Masteller, M. *Comparative Analysis of Prescriptive, Performance-Based and Outcome Based Energy Code Systems.* Cascadia Green Building Council with Alaska Housing Finance Corporation. May 2011. http://www.ahfc.us/files/9013/5754/5384/cascadia_code_analysis_071911.pdf -

Denniston, S., Frankel, M and Hewitt, D. *Outcome Based Energy Codes on the Way to Net Zero.* New Buildings Institute. 2011 http://newbuildings.org/sites/default/files/Hewitt-Outcome_to_Zero.pdf