

Scaling Commercial Building O+M – Initial Results from Mandatory Building Tune-Ups in Seattle

Terry Sullivan, City of Seattle, Office of Sustainability and Environment
Rebecca Baker, City of Seattle, Office of Sustainability and Environment
Blake Ringeisen, City of Seattle, Office of Sustainability and Environment

ABSTRACT

The City of Seattle's Building Tune-Ups policy is one of the few policies in the nation that requires existing commercial buildings to take specific actions in their building to save energy. In a city with carbon neutral electricity, focusing the tune-up on HVAC operations and maintenance maximizes the carbon impact of the energy savings and can save an estimated 10% to 15% on energy bills without significant capital investments if implemented correctly. Over the past three years, we've taken the initial policy framework and made it a reality – staffing up, building out IT systems, executing a strategic communications plan, training the local workforce, coordinating action with the voluntary Building Tune-Up Accelerator Program, preparing for impact analysis – and adapting along the way through early evaluation. The results were a first-year compliance rate for the largest buildings of over 95% and over 300 tune-ups conducted across the city in total. This paper highlights the main elements of successful early program implementation, identifies lessons learned, reports on key performance indicators, and discusses how this policy fits in the larger framework of Seattle's Climate Action Plan. It then offers recommendations to inform similar policies and programs in other jurisdictions given the current landscape of existing building energy efficiency and decarbonization policies.

Background

Seattle's residential and commercial buildings account for just over a third of the city's core greenhouse gas emissions.¹ In 2011, Seattle adopted a bold climate goal for our city to become carbon neutral by 2050 and over a two-year collaborative process developed a Climate Action Plan that set a target of reducing building sector emissions by 39% by 2030 and 82% by 2050 over a 2008 baseline (City of Seattle 2013). Around the same time, Seattle's Office of Sustainability and Environment (OSE) began implementing one of the nation's first mandatory benchmarking policies to require building owners, operators, and managers to track their buildings' energy performance and allow for easier identification of opportunities for improvement. From this policy context, Seattle decided in 2015 to become one of the first cities in the nation to regulate building energy use within existing commercial buildings and began developing the Seattle Building Tune-Ups policy (City of Seattle 2019), adopted into Seattle Municipal Code in 2016.

¹ Seattle's municipal electric utility maintains a carbon neutral electric grid, which leads to a smaller percentage of emissions from buildings compared to transportation than most other major cities. See seattle.gov/environment for the latest inventory.

Beyond Benchmarking

Seattle's Climate Action Plan included both near- and long-term actions to lower greenhouse gas emissions. In the building sector, a near term action included requiring building energy audits for the largest and least efficient commercial and multifamily buildings to help identify cost effective improvements. By 2014, while regularly benchmarked buildings had shown a modest reduction in existing building energy use and Seattle's GHG inventory revealed reductions in our residential building sector, commercial sector emissions reductions tracked well behind the Climate Action Plan targets.

Recognizing Seattle would need additional policies to meet our commercial sector emissions targets, an extensive research and stakeholder engagement process was launched. Audit policies in New York City and San Francisco were reviewed as potential approaches for the Seattle market along with Pacific Northwest National Lab's (PNNL) Re-tuning™ program. In parallel, researchers were analyzing early policy results and determining that benchmarking policies were foundational yet limited in their ability to generate savings while audit policies were not demonstrating substantial savings (Hsu 2014).

Seattle ultimately designed a policy that would deliver near term energy and emissions reductions at a low cost for building owners with typical payback timeframes of 1-3 years. This option was prioritized over more costly ASHRAE Level II audits that would not require implementation of energy reduction measures. Seattle adapted its policy approach from PNNL's Re-tuning research and retro-commissioning programs to create a first of its kind building tune-up regulation (PNNL 2019). Tune-ups aim to optimize energy and water performance by identifying low- or no-cost actions related to building operations and maintenance, that can generate 10-15% in energy savings, on average. The Building Tune-Ups Ordinance was adopted in March 2016 under Seattle Municipal Code SMC 22.930 and compliance specifications were detailed in OSE Director's Rule 2016-01, published January 2017 (OSE 2017).

What is a Seattle Building Tune-Up?

Building Tune-Ups involve assessment and implementation of operational and maintenance (O+M) improvements to achieve energy and water efficiency. Examples of operational fixes include changes to thermostat set points or adjusting lighting or irrigation schedules. Tune-ups also review HVAC, lighting, and water systems to identify needed maintenance, cleaning, or repairs - for example replacing faulty sensors or fixing problems with an economizer. According to PNNL's research on the Re-tuning program, the approach can yield 10-15% in average energy savings when implemented correctly (Fernandez et al. 2017).

Tune-Up Specialists Lead the Process

Building Tune-Up assessments, verified corrections, and reporting must be done by a qualified Tune-Up Specialist, a designation OSE developed through the policy development process to leverage one of seven existing building energy training or certification programs, as shown in Table 1.

Table 1. Building Tune-Up Certification Options

Certification	Certified/Licensed By
Professional Engineer (PE) in mechanical or architectural engineering	Washington State Department of Licensing per WAC 196-27A-020(2)(d)
Building Operator Certification (BOC) Level II	Northwest Energy Efficiency Council (NEEC)
Certified Energy Manager	Association of Energy Engineers (AEE)
Certified Commissioning Professional (CCP)	Building Commissioning Certification Board (BCCB)
Commissioning Authority (CxA)	AABC Commissioning Group (ACG)
Existing Building Commissioning Professional (EBCP)	Association of Energy Engineers (AEE)
Sustainable Building Science Technology Bachelor of Applied Science (BAS)	South Seattle College (SSC)

In addition to one of the certifications, a Tune-Up Specialist must have seven years of relevant energy education or experience and fill out an OSE Tune-Up Specialist Application which OSE uses to verify certifications.² Once a building owner has identified a Tune-Up Specialist to do the work, the tune-up process includes six main steps:

Tune-Up Specialist Registers. Tune-Up Specialists must create an account in the Seattle Services Portal and register as a Tune-Up Specialist by providing certification information such as license numbers and certification expiration dates. OSE reviews all Tune-Up Specialist applications to confirm the individual meets the required qualifications. Only approved Tune-Up Specialists are permitted to submit Building Tune-Ups.

Conduct a Building Assessment. The Tune-Up Specialist collects data on building systems and operations, including high-level building audit data, summary data on type and condition of HVAC systems, and a review of benchmarking and water data. The assessment is comprised of 39 prescriptive assessment elements across five focus areas: HVAC systems and controls, lighting systems and controls, domestic hot water, water usage, and the building envelope.

Identify Corrective Actions. Through the building assessment, the Tune-Up Specialist will identify required operational and maintenance improvements to the building and report these back to the building owner. If a deficiency is found, the Tune-Up Specialist must identify a fix for the deficiency, called a corrective action. Some corrections are required and must be implemented while implementation of voluntary corrections is optional. Both the assessment and corrections are heavily weighted towards building heating and DHW systems, which in Seattle often use natural gas, our most carbon-intensive energy source.

Implement Corrective Actions. After the assessment, the Tune-Up Specialist shares their findings with the building ownership and will discuss options for implementing the corrections.

² The Northwest Energy Efficiency Council (NEEC) maintains a directory of qualified Tune-Ups Specialists at www.neec.net. The City of Seattle cannot make any recommendations or referrals.

Implementation of the corrective actions may be completed by the Tune-Up Specialist or someone else qualified to do so, such as in-house facility staff or another vendor.

Verify Changes. The Tune-Up Specialist verifies that all corrected equipment and systems are functioning as intended, and that all identified required corrective actions have been adequately addressed.

Report to the City. The Tune-Up Specialist must complete the Seattle Building Tune-Ups Summary Report, review with the building owner, and submit to the City for review.

This process typically takes three to twelve months, depending on a variety of factors, including (1) how difficult it is for the Tune-Up Specialist to access tenant spaces, (2) how complex the building is, (3) how many corrective actions need to be implemented by the ownership, (4) how engaged ownership is, and (5) how much back and forth is required in the Tune-Up report review.

Who Has to “Tune” and When?

Building Tune-Ups are required every five years for buildings with 50,000 square feet (SF) or more of non-residential space, excluding parking. This translates to just over 900 of the largest commercial buildings in Seattle. To support building owners and allow for a more manageable implementation schedule, compliance deadlines were phased in by building size in four cohorts beginning in early 2019, as shown in Table 2.³

Table 2. Building Tune-Up Cohorts

Cohort	Building Size Range	Tune-Up Deadline	Buildings
1	200,000 SF+	3/1/2019	180
2	100,000 – 199,999 SF	10/1/2019	275
3	70,000 – 99,999 SF	10/1/2020	176
4	50,000 – 69,999 SF	10/1/2021	266

Although most buildings achieve compliance by conducting a tune-up, building owners have the choice of more than ten alternative compliance pathways or can apply for a waiver or extension in limited circumstances. The alternative compliance options were designed to try and recognize that many building owners are already making investments to save energy – and that could show up in an exemplary energy performance certification or evidence of a recently completed a tune-up equivalent project.⁴ For buildings permitted to be demolished, undergoing a major renovation, or in extreme financial distress, owners can apply for a waiver for a five year tune-up cycle, but will need to comply in subsequent cycles. And under limited circumstances building owners can apply for a one-year extension, including a change of ownership within one year of the deadline, high vacancy rates, permitted mechanical improvements, or if more time is

³ The first deadline for private sector buildings was originally 10/1/2018 but was moved back due to delays in the online compliance portal launch.

⁴ See www.seattle.gov/buildingtuneups for a full list of compliance options.

needed to demonstrate a 15% EUI reduction through the EUI Reduction alternative compliance pathway.

Non-compliance leads to two potential fines, the first issued 180 days after the deadline and the second issued 360 days after the deadline, which vary in amount based on building size.⁵ This creates a six month “grace period” for building owners to complete and submit their tune-ups before any fines are assessed and another six months following a smaller fine to comply. The use of grace periods and a smaller initial fine are designed to encourage compliance, giving building owners and their representatives time to finish the tune-up rather than receiving a large initial fine.

Standing Up an Innovative Policy

Beginning in late 2016 as the policy process wrapped up, OSE’s Benchmarking team took on implementation of the policy and outlined an approach focused on building an effective outreach and communications strategy alongside efforts to develop compliance systems. Below we outline some of the key steps we took rolling out this new policy followed by some of the key lessons we learned that might be relevant to other jurisdictions.

Leading (and Learning) by Example

The Seattle City Council passed a companion resolution in early 2016 requiring tune-ups in City-owned facilities and guidelines for energy efficient asset preservation (Seattle City Council 2016). OSE was directed to coordinate and implement periodic tune-ups through its citywide Resource Conservation Management Initiative.⁶ To lead by example and generate lessons learned for the market, the largest municipal facilities were required to complete tune-ups one year in advance of the private market. Serving as a process and implementation ‘guinea pig’, the City of Seattle worked with local providers to establish standard protocols and conduct assessments on a subset of large buildings across four departments.

Accelerating Tune-Ups: Scaling Up Local Expertise

Development of an existing building energy efficiency mandate creates a double-edged sword – while policy can move an entire market to required action, bringing along everyone from innovators to laggards, an unintended consequence is limited or prohibited incentive funding. In many jurisdictions, utilities are unable or hesitant to provide incentives if they are merely helping owners meet an existing code baseline, such as the Building Tune-Up mandate.⁷

⁵ The first fine ranges from \$2,000 - \$5,000 and second fines from \$8,000 - \$20,000, depending on the buildings size. See seattle.gov/buildingtuneups for detailed violation information.

⁶ To improve resource efficiency across the City of Seattle's building portfolio, the Office of Sustainability and Environment coordinates a citywide Resource Conservation Management Initiative. In 2013, the City adopted a Resource Conservation Management Plan to centralize resource use monitoring and to coordinate with capital departments to build on their existing efforts to improve the efficiency of City facility operations.

⁷ See Seattle Municipal Code Title 22 “Building and Construction Codes” Chapter 22.930 for Tune-Ups code language.

To address this issue, utilities are exploring ways to exceed new regulations or to help owners comply in advance of mandated compliance deadlines.

Seizing on this approach, OSE partnered with Seattle’s municipal electric utility, Seattle City Light, to seek funding from the U.S. Department of Energy (DOE) to support “mid-size” buildings (approximately 50,000 - 100,000 SF) to meet the tune-up requirements early. The resulting Building Tune-Up Accelerator (TUA) Program not only aided owners of smaller buildings but also jump-started training of local energy service providers.⁸ The program required a mandatory training to qualify as a Tune-Up Specialist and participate in the pilot. Partners at the University of Washington Integrated Design Lab, Smart Buildings Center, and Pacific Northwest National Lab (PNNL) offered a series of multi-day service provider trainings, scaling up local expertise and providing a training approach for the Tune-Up mandate to follow. Early adoption also presented an opportunity to uncover implementation issues. Areas of confusion or scenarios that required policy interpretation helped set precedent for the mandated market. The Accelerator program successfully worked with owners of 102 buildings to attain early compliance while allowing these smaller buildings an incentive of up to \$0.12 per square foot (City of Seattle 2020).

Operationalizing the Checklist and Reporting Infrastructure

After passage of the legislation, OSE began drafting an initial reporting tool in Microsoft Excel to provide clarity to the public on what we expected in the eventual online report. The initial workbook, though not intended for final reporting, had multiple benefits: it allowed Tune-Up Specialists and owners to gain an early understanding of what they needed to prepare for final submittal, it allowed buildings participating in the Building Tune-Up Accelerator to have a reporting tool, it gave the City of Seattle a base to build an IT solution around, and it gave Tune-Up Specialists a readily available tool using a common software to collect data in to prepare for online submission.

Seattle decided to invest in an online tool over an Excel-based tool for a number of reasons. First, to provide a portal for building owners, owner representatives, and Tune-Up Specialists to submit and update tune-ups, submit alternative compliance, or register for multiple buildings in one place. Second, to create efficiencies and automations to level-set the increased work from an existing team taking on a new program with minimal staff. And finally, to allow for integration with existing benchmarking tools to more easily build out partially automated compliance and energy tracking across two programs.

Communicating Proactively to Build Awareness

Establishing a new program, whether regulatory or voluntary, requires adoption by a variety of building owner representatives that range in expertise and role. Communicating effectively and efficiently with a variety of stakeholders starts with building awareness and a common understanding of the requirements. As a part of the policy proposal, support for

⁸ See Ballinger, Nicole. “Carrots Before Sticks: Accelerating Mid-Size Commercial Building Compliance with Mandatory Building Tune-Ups in Seattle” ACEEE 2020.

communication and outreach activities in the first 18 months of program ramp up was requested and granted which resulted in the hiring of external consultant support.

To facilitate and maintain stakeholder engagement, a series of core approaches were deployed to increase awareness and understanding of the new regulation. First, program staff worked with consultants to outline strategies in a communication plan that identified target audiences, key messages and known obstacles. The process of developing a communication strategy also helped define and clarify program goals and objectives used to shape engagement actions. Second, a program brand was developed to create a platform of informational materials that clarify program details and help all players navigate complex and innovative policy. Development of a brand that invokes the program goals is an essential way to communicate what the program offers, what makes it unique, and in a sense, conveys its personality. Third, a website was launched accompanied by supplemental program and alternative compliance fact sheets. From there, an overview presentation slide deck was compiled that could be adapted per audience. Additional communication tools were added once the program was more established and outreach operations were running smoothly. These included a Tune-Up Specialist e-newsletter, case studies, blog posts and press releases announcing key compliance dates.

Partnering with trade groups to co-host program overview presentations and training helped Seattle reach building owners, managers and energy efficiency service providers. Articles in local trade organization newsletters ensured program announcements reached a larger audience and drove individuals to the program website to learn more. Formal notifications rounded out engagement activities providing official announcements of relevant compliance due dates and consequences for non-compliance per building size.

Throughout the ramp up period of program implementation, Seattle capitalized on the existing and well-established benchmarking program. Owners required to comply with Tune-Ups represent approximately a quarter of those that need to annually report and disclose building energy performance metrics. Adapting the existing e-newsletter to encompass the new requirement helped close the communication gap and provide a channel to grow awareness.

To embody a spirit of adaptive management, all communication, outreach and program implementation included methods for measuring and evaluating the results and effectiveness of the messaging, activities, and compliance processes. Frequently asked questions became a vital method for communicating code interpretations that inevitably arose as providers attempted to implement required and voluntary corrective actions. Measurement of effectiveness helped staff take advantage of intuitive opportunities and iteratively develop review processes.

Early Lessons Learned

In the process of turning this groundbreaking policy into a reality over the past three years, we've compiled a few observations about what's worked and what we've learned along the way.

Deadlines Matter and Grace Periods Worked – High First Year Compliance

Compliance for the first cohort of buildings (over 200,000 SF) surpassed 95% by the time the second round of violations were issued approximately one year after the March 1st, 2019 deadline. The pattern of submissions followed a cadence similar to many compliance programs –

a rush of submissions on and around the deadline and subsequent violation dates. Although at the original deadline for the first cohort only 43% of buildings were compliant, the deadline drove an additional 23% of buildings to submit. The grace period worked well and by the time the first violations were issued, compliance was up to 76% with an additional 12% recently submitted and under review.

This long process leads to drawn out and overlapping compliance periods that are challenging to manage – but giving owners ample time to comply with a new policy and escalating fine structures as a ‘stick’ to the tune-ups ‘carrot’ drove remarkably high compliance for the first year of a policy. By minimizing the number of fines issued through a compliance-focused approach, we also largely avoided tension with building owners and Tune-Up Specialists.⁹

Leading with Municipal Buildings Provided a Blueprint for the Private Sector

Ten municipal buildings 100,000 SF or larger completed tune-ups in advance of private sector deadlines and an additional fourteen city owned facilities less than 100,000 SF participated in the Tune-Up Accelerator program. Municipal tune-ups were designed to help Seattle track costs and explore the feasibility of completing voluntary measures. Early savings results and commonly found corrective actions became examples to share with the public through case studies. Municipal projects demonstrated the value of tune-up actions, illuminated upfront costs and payback periods, and proved how this new policy would save the City money and help us meet our energy and carbon reduction goals. These early tune-ups also allowed internal city staff to attain experience ahead of time to vet compliance and review processes. As a result, additional communication materials were developed or refined, and many ordinance requirements further clarified for the public to eliminate confusion ahead of time.

Tune-Up assessments generally provide an opportunity to learn about a building and budget for additional energy efficiency measures that can be implemented in the near and long term. Investing in a more robust and standardized building assessment report can reap great savings and create a roadmap for enhanced energy savings. In addition to completing the tune-up, Seattle created an audit template for city-owned facilities that went beyond tune-up requirements and captures the energy “story” of a building. The reports serve as an explanatory tool helping engineers convey a building’s efficiency opportunities and challenges to management. By adapting the tune-up process, the requirement has merged into a standard data collection process that includes identifying short, long and very long-term energy conservation measures. The citywide resource conservation management program has been able to quickly implement measures with high returns on investment regardless of mandate. Economies of scale can be applied when implementing required or voluntary corrective actions. Energy conservation

⁹ In addition to the use of the new IT tool, staff are able to manage the overlapping deadlines because the city allocated funding for technical assistance support (currently a temporary OSE FTE) during policy development and because OSE leveraged program staff from Benchmarking to implement the BTU policy.

measures were grouped or bucketed into similar project work and implemented in multiple buildings by the same contractor, saving on incremental project costs.

Early Evaluation Efforts Helped Identify Tweaks to Implementation

To help assess early implementation successes and challenges that could be used for iterative program changes, we conducted an early evaluation project in 2019 with the University of Washington's Evans School Consulting Lab. The evaluation had three main components: (1) a standard formative process evaluation to understand and tweak early program processes, (2) the development of key performance indicators based on interviews with internal and external stakeholders; and (3) a high-level outline of options for estimating energy and carbon impacts through a later, summative impact analysis.

The evaluation team conducted a literature review on relevant policy best practices and impact evaluation approaches, analyzed program process data (such as communication logs, previous survey results, and initial compliance data), and conducted in-depth interviews with both program staff and Tune-Up Specialists. Although difficult to execute due to time constraints, evaluating early and following up throughout program implementation – along with implementing a basic change management tracking and implementation process – allows for an adaptive management focused on iterative changes to improve program outcomes. Instead of using evaluation just to determine whether impact was achieved retroactively, this approach attempts to increase feedback during implementation and provide certainty about how to adapt on the fly to promote a culture of real-time learning (R4D 2020).

Close Tracking of Tune-Up Specialist Experiences Helped Target Support

This adaptive program implementation approach has been executed largely through close contact with Tune-Up Specialists, who are the key implementers in the field conducting the work. Over 900 buildings need to comply with Seattle's regulation, yet a small subset of professionals has been tasked with completing the work. Developing regular channels of communication with these market actors has helped uncover key barriers and allowed for more efficient allocation of program resources. Prior to the first compliance deadline, a survey was sent to approved Tune-Up Specialists to better understand how the market was adjusting to demand and determine if capacity issues were showing up. And to follow up, in-depth interviews during the evaluation and one-on-one feedback sessions during enforcement were conducted with service providers by firm. And technical assistance provided through a help desk has enabled regular communication with these service providers.

The initial survey helped identify the quantity of tune-ups underway or close to completion, confirming that a high compliance rate was feasible prior to enforcement action. The feedback also daylighted barriers for Tune-Up Specialists and for ownership and helped gauge awareness of the tune-up requirement among owners. Lastly, the survey helped determine how well outreach and educational materials were working or being used by Tune-Up Specialists and if there was demand for additional training.

Other key findings from the survey highlighted that the biggest barrier was generally a lack of building ownership knowledge of what a tune up entailed and how much time was needed. Through follow up interviews, it became clear that the concept of a prescriptive

operations and maintenance regulation was foreign to owners given that existing buildings had not previously had their energy use regulated post-occupancy. Building ownership was slow to understand the timeline required to fulfill their obligations and many owners started the process late, assuming compliance could be achieved in a few weeks. Another key theme was that due to the Tune-up policy owners have been forced to conduct operational work comprehensively, as opposed to piecemeal or per yearly maintenance schedules. Buildings that have on-site facility managers are often familiar with tune-up actions but have commented that this work is considered ongoing, work that occurs throughout each year and not at a set point in time. Seattle's ordinance has changed this pattern, forcing owners to comprehensively tune up all systems and conduct maintenance within a restricted, mandated timeframe. Unfortunately, budgets are often not in alignment with this type of one-time investment nor is the existing workforce able to dedicate the hours needed to execute required corrective actions. Additionally, many corrective actions require specialty services such as controls modifications. The need for additional budget or staffing to implement required corrective actions therefore extends the amount of time needed to comply with the regulation.

Tune-Up Specialists unanimously shared how helpful technical assistance has been to understand the requirement. Despite most help desk questions focused on non-technical issues, the complexity of the program has warranted full time help desk support. Providing consistent and timely feedback has been essential to program success. The qualifications of a Tune-Up Specialist ensure that providers have the technical knowledge needed to identify issues and recommend appropriate corrective actions yet navigating the required documentation, various alternative compliance options and meeting the intent of the regulation has required substantial interaction and regular communication.

Another theme across this work was that the policy has forced a profound change in relationship between an owner and a service provider. Prior to the regulation, service providers were hired by owners to implement energy saving measures, often "selling" an owner on their project or approach to optimize the operations of their asset. Providers would propose or bid on project work, conveying the return on investment and projected payback period. Now Tune-Up Specialists have been hired to help an owner comply and avoid fines. Inherently, the tune-up process requires the Tune-Up Specialist to expose all discovered required corrective actions regardless of their cost to correct. An owner is then required to act on the findings. Many providers have not included implementation of corrective actions in their contracts to create some separation of roles, with owners using internal staff or hiring contractors to implement fixes. Others have included contingency funding or flex hours that can be used to implement corrective actions uncovered during the assessment. Regardless of the arrangement, some providers perceive that they "work" for the city by upholding the new requirement at the same time that they have a legal contract for a scope of work for their client. The change in relationship and the tension that comes from having to "report" to two entities can present an uncomfortable challenge.

Together, this feedback helped shape key performance indicators, led to an earlier timeline for notifying buildings, drove changes to outreach materials to stress timelines and tailor content to owners, and exposed changes in the market to track moving forward.

KPIs Help Us Stay on Track

Through the early formative evaluation project and experience building out reporting systems, OSE developed a set of priority key performance indicators (KPIs) to help track progress against policy outcomes. KPIs were co-developed through in-depth interviews with relevant internal stakeholders at the City of Seattle and through the surveys and interviews conducted with Tune-Up Specialists. Detailed in Table 3, these indicators focus on easy to track processes and outputs for each cohort and fall into three main categories: corrective actions, compliance, and customer support.

Table 3. Summary of Tune-Up KPIs

Category	Indicator	Definition
Corrective Action Indicators	Required Corrective Actions Implemented	The number of required corrective actions implemented per building.
	Voluntary Corrective Actions Identified and Implemented	The number of corrective actions implemented by building owners beyond the minimum requirements.
	Voluntary Corrective Actions Identified and Not Implemented	This additional metric tracks what Tune-Up Specialists identify as corrective actions but are not being implemented by building ownership.
Compliance Indicators	Overall Compliance Rate	The percent of buildings in a cohort that have satisfied the compliance requirements for a given Tune-Up cycle.
	Compliance Impact Rate	The percent of buildings in a cohort that have satisfied the compliance requirements by either conducting a Tune-Up or through one of the tune-up equivalent alternative compliance pathways.
	Rate of Awareness	The percent of buildings in a cohort that are aware of the requirement and have communicated with us in some form.
Customer Support Indicators	Total Inquiries	The total number of inquiries per year as a measure of overall volume.
	Inquiry Response Rate	The percent of inquiries responded to within a three-day target response time.

Corrective action indicators provide a high-level sense of how much work is being done in each building and an understanding of potential for additional energy savings from more measures in a building. Compliance indicators are tracked to help understand how many buildings are likely to comply and how many of those buildings are doing something that has a direct energy impact. Awareness, when combined with the compliance rate, helps to understand who is missing in early outreach and gives us an upper bound of potential compliance in the near term. And customer service metrics track the number of inquiries responded to by the help desk and the average response time to measure how effectively key stakeholders are getting support as they implement the requirements in their buildings.

Taken together these indicators help track success in implementation of the policy and provide a guide to where attention might be needed. Among other things, these metrics help to quickly report progress to leadership and elected officials, prioritize outreach to non-compliant buildings, and quickly determine if certain Tune-Up Specialists might be systematically reporting fewer issues across multiple buildings.

Initial Tune-Up Findings from Seattle’s Largest Buildings

This section provides summary data on the first two cohorts of buildings, including findings from nearly two hundred approved tune-ups as well as initial results for key compliance and customer support indicators.

Unsurprisingly, HVAC Operations Dominate Commonly Found Deficiencies

The ten most reported required corrective actions are displayed in Figure 1 below. HVAC sensor calibration fixes were identified and made in nearly half of all buildings above 100,000 SF to date, the most among all assessment elements. Tune-Up Specialists identified HVAC sensors that were uncalibrated, not functioning, or located inappropriately in 47% of the 176 approved tune-ups. Similarly, correction of improper HVAC set points and HVAC controls were the next most found required corrective actions, both being corrected in 45% of the approved tune-ups.

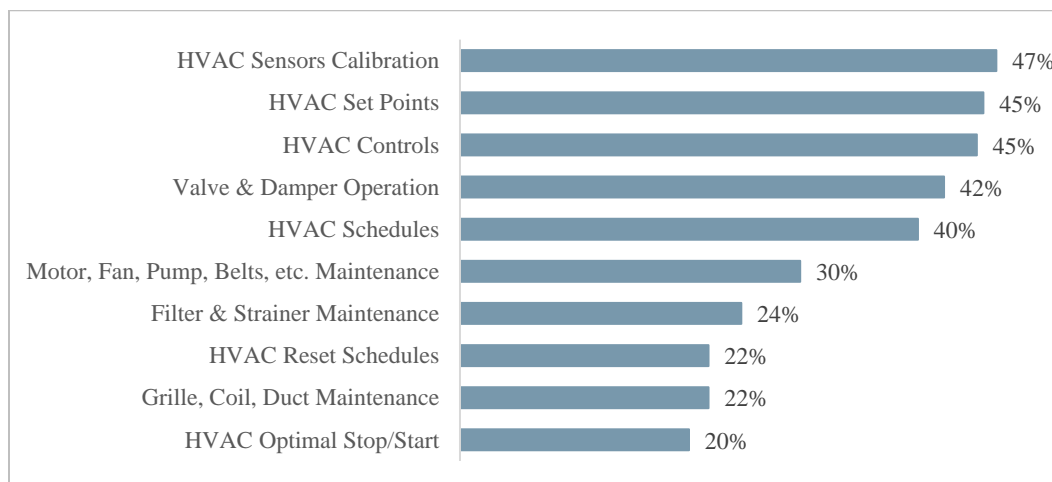


Figure 1. Ten most found required corrective actions in 176 tune-ups analyzed to date.

Similarly, the ten most found voluntary corrections actions can be seen in Figure 2 below. Inefficient lighting equipment was the leader in this category, with Tune-Up Specialists noting this deficiency in 44% of approved tune-ups, with approximately 15% of all buildings voluntarily taking action to improve the efficiency of lighting during or after the tune-up. The second most common deficiency of the voluntary corrective actions was the presence of equipment reaching the end of its service life, found in 40% of the approved tune-ups and acted upon in 9% of them. The voluntary corrective action that was the most implemented was repairing HVAC motors, fans, pumps, belts, pulleys, bearings, and steam traps according to

ASHRAE Standard 180. Corrective action was implemented on this deficiency in 19% of the tune-ups after being reported in 27% of them.

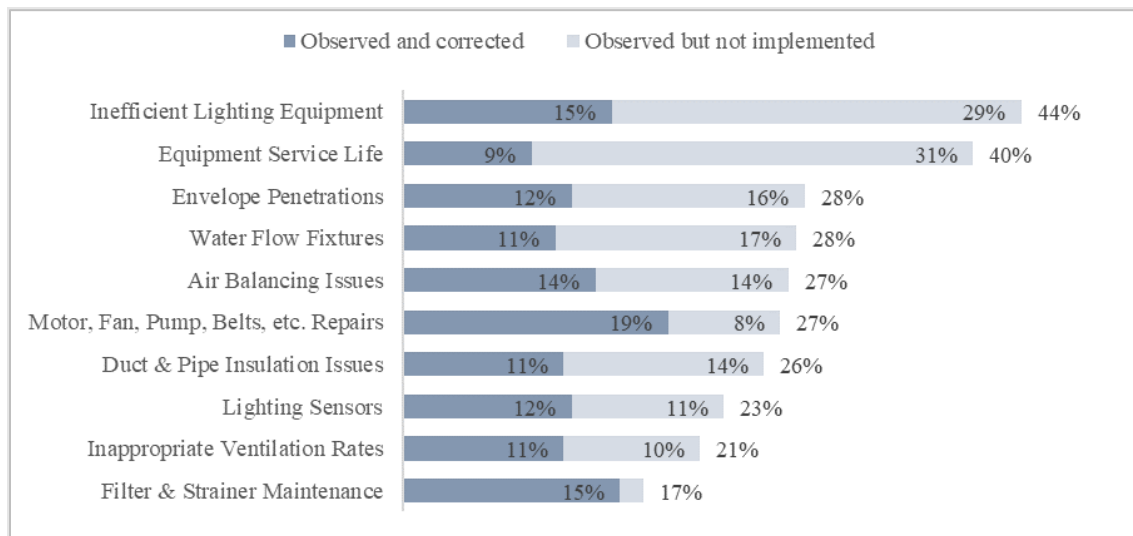


Figure 2. Ten most found voluntary corrective actions in 176 tune-ups analyzed to date, with those observed and corrected shown separately from those observed but not implemented.

Schools Lead on Corrections Made

To date, more total required and voluntary corrective actions have been found in schools than any other building type, as shown in Figure 3. On average, 5.7 required corrective actions and 1.9 voluntary corrective actions (a total of 7.7 corrective actions) have been implemented across 26 tune-ups in K-12 schools. The Seattle Public School system hired a small team of in-house retro-commissioning staff that met the Tune-Up Specialist requirements and conducted the entire school system's tune-ups. After analyzing their tune-up submittals, it became evident that a well-motivated internal staff of Tune-Up Specialists can find and correct an impressive number of corrective actions despite having a limited budget. Schools were closely followed by mixed-use buildings (5.0; 2.3; 7.3) and medical offices (4.5; 2.5; 7.0). Although hospitals implemented the fewest number of corrective actions (1.8; 0.6; 2.4) due to their complex operations, a handful have started or are considering implementing ongoing commissioning programs.

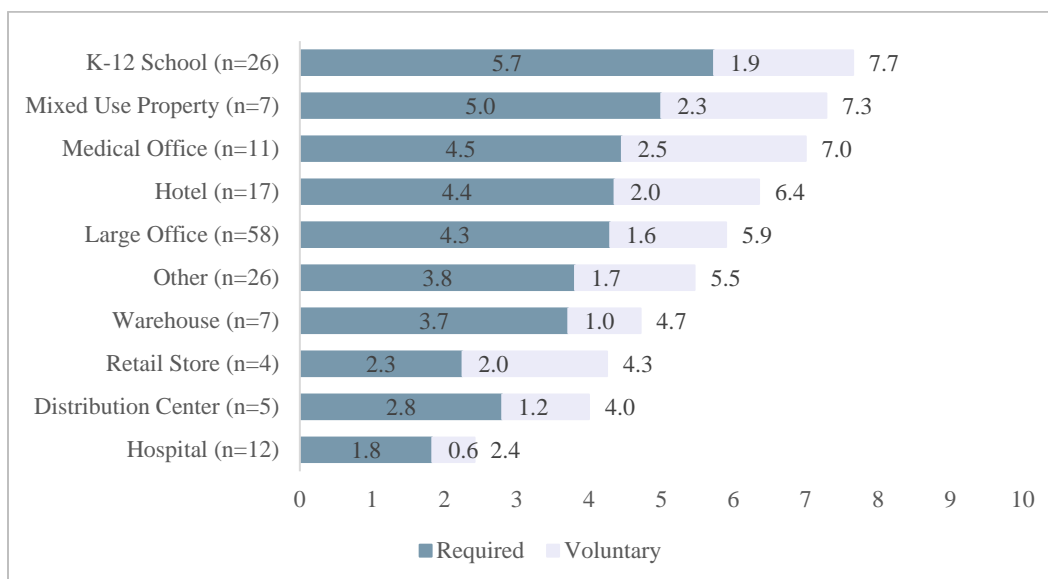


Figure 3. Number of required and voluntary corrective actions implemented by building type.

On average, 4.2 required corrective actions and 1.7 voluntary corrective actions were implemented per tune-up, for a total of 5.8. As expected, the number of corrective actions implemented varied greatly by firm (often according to area of focus – mechanical, controls, etc.), Tune-Up Specialist (background, experience, etc.), and whether the tune-up was conducted by an in-house or external Tune-Up Specialist. Across the 176 tune-ups that were analyzed, there were 21 firms who submitted at least two tune-ups (15 other firms submitted only tune-up each). The number of corrective actions implemented by firm varied from 1.5 to 18.7.

The initial expectation was that building owners who contracted third-party Tune-Up Specialist firms to conduct their tune-up would see more corrective actions identified compared to those who conducted the tune-up with in-house Tune-Up Specialists. That was proven incorrect. In-house (internal) Tune-Up Specialists, on average, implemented 6.7 required corrective actions and 3.0 voluntary corrective actions for a total of 9.7. That was more than double the 3.2 required corrective actions and 1.2 voluntary corrective actions (4.4 total) implemented by third party (external) Tune-Up Specialists.

Extremely High Compliance Rates for Cohort 1

By the end of the first cohort's compliance period one year after the due date, 96% of buildings were compliant. Only a small number of buildings received the larger fine and a few buildings were still working on tuning up their buildings. As shown in Figure 4, compliance at the deadline differs significantly from after the two grace periods, reinforcing the need for long lead times and a lot of follow up. The compliance impact rate for the first cohort of buildings ended up at 71%, with 62% of buildings conducting a tune-up and 9% of buildings pursuing alternative compliance pathways that went beyond a tune-up. And the rate of policy awareness reached 100% well before violations were issued, meaning that no buildings in the first cohort could claim to be unaware of the requirements during the enforcement process.

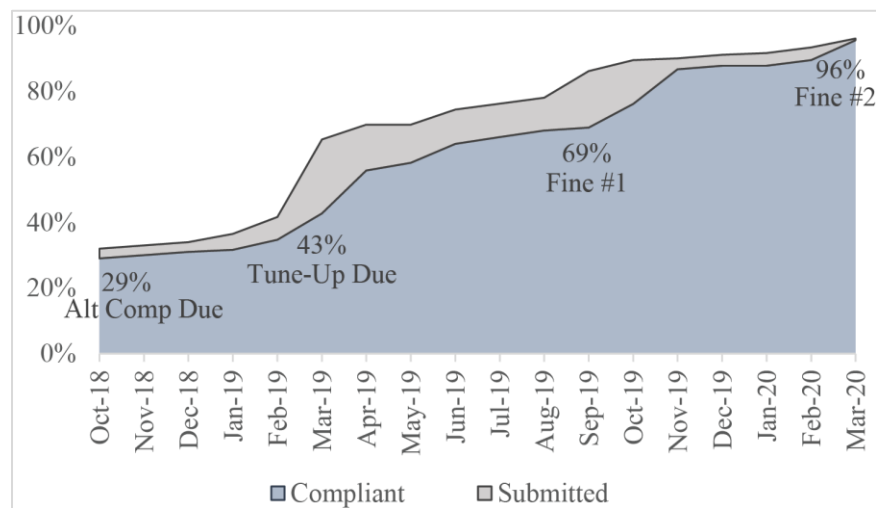


Figure 4. Compliance patterns for Cohort 1 (200,000+ SF) over time, with compliance rate shown at the alternative compliance deadline, the tune-up deadline, the first grace period, and the final violation date.

Though results from the second cohort are not final, compliance at the end of the grace period (six months after the Tune-Up due date) were identical to the first cohort at 69%. Some early indications for the remaining buildings suggest this long drawn out compliance process will get more difficult as smaller buildings with less management need to comply. But the success of the Tune-Up Accelerator Program in working with buildings under 100,000 SF – and the market transformation occurring through awareness campaigns and as providers conduct more and more tune-ups – provide some reason for optimism.

Customer Support Has Been Responsive – And Steady

The smaller number of buildings relative to Seattle’s benchmarking requirement and the consolidation of actors in the compliance process through the use of Tune-Up Specialists has made tracking customer inquiries in detail more manageable. In over three years of fielding and tracking questions, the Building Tune-Up help desk has responded to over 1,500 inquiries outside of the tune-up review process and met the target turnaround of three business days for over 97% of phone calls or emails.

Takeaways for Jurisdictions Considering Similar Policies

From three years of experience implementing an innovative, prescriptive, existing building policy we've developed a list of key takeaways that other jurisdictions considering or designing existing building climate policies might consider.

Adjust Required Corrective Actions to Drive Higher Savings

Since tune-ups are required only once every five years, voluntary corrective actions that are identified but not corrected represent a missed opportunity. Although owners and managers are made aware of the issue and can potentially take action on their own, many simply will not.

Some voluntary measures align well with the tune-up ethos of solid savings for relatively small fixes, such as assessing and adjusting ventilation rates when a system can handle it. Currently, we do not require a fix if a space is being ventilated when unoccupied or overventilated during occupied hours.

Other changes to voluntary actions require a more substantial shift in scale or focus of a tune-up. To date, the overwhelming majority of required and voluntary fixes have been on the HVAC side. This is in part because the tune-up was designed to focus on HVAC systems as they are the most carbon-intensive savings – especially in Seattle where we have carbon-neutral electricity. But the skew towards HVAC is also exacerbated by most Tune-Up Specialists having a background in the HVAC industry. However, a lot of energy and water savings are still out there in inefficient lighting technologies, higher than appropriate lighting levels, envelope penetrations, or similar voluntary measures beyond HVAC systems.

Finally, a common challenge is in defining when new equipment is required as part of a tune-up. The tune-up is focused on maintaining and improving existing systems rather than forcing new capital costs – but owners and Tune-Up Specialists often push back when requiring replacement of smaller parts that are needed to optimize a system, such as HVAC sensors. Philadelphia’s new tune-up legislation defines ‘minor repair’ as “low-cost repairs to existing equipment such that the scope of work does not require permits” and might offer a slightly higher threshold for equipment replacements that does not drift into costly capital measures (City of Philadelphia 2019).

Start Educating the Market Early – And Follow Up Often

To ensure building owners were aware of this new requirement, OSE sent out early mailings to all covered buildings in addition to the broad outreach conducted during policy development. However, *formal* notifications went out one year prior to a building’s deadline for buildings in the first cohort. Due to the long timelines needed to execute a tune-up from start to finish – and complex nature of building management and ownership structures– it became clear that notifications needed to go out earlier to give adequate time for the process.

Similarly, training for Building Tune-Up Specialists took several forms but was not a defined curriculum and is not required. Dozens of Tune-Up Specialists have said that a mandatory training regimen is desired and should be focused more on compliance processes and specific requirements within the tune-up than on technical building education around operations and maintenance of commercial buildings. Developing a multi-stage training regimen that starts with O+M basics to ensure a baseline of common understanding but that focuses primarily on education around compliance processes can help address systemic issues in submittals and avoid high volumes of help desk inquiries.

Explore Random Audits or Quality Assurance Measures in Policy

One core concern is that relying on professionals outside the City as the core implementers of the policy is a potential race to the bottom – if service provide offers a bare bones tune up for cheap and city staff cannot enforce standardization or quality control, then a significant number of buildings looking for quick compliance can fake it. A mandatory training program can help mitigate some of this by ensuring a base understanding of building O+M

knowledge and program requirements, but jurisdictions should consider auditing tune-ups or exploring options to maximize consistency in Tune-Up Specialists work in policy design.

Compliance and Process Support is as Important as Technical Support

Although some technical knowledge of commercial buildings systems is necessary to review tune-ups and help field more technical questions from providers, most customer support and Tune-Up Summary report review had more to do with program processes and general policy questions. About 80-90% of technical assistance falls under basic compliance processes, IT and process help, and clarifying requirements. Only 10-20% of inquiries and tune-up review work requires technical building knowledge. Cities might consider staff or third-party vendors that can offer both.

Ensure Reporting Enables Easier Impact Analysis

Through the process of designing a data collection tool, reviewing hundreds of tune-ups, coordinating with the Accelerator, and preparing for evaluation, OSE has come up with a list of future changes to reporting that can help us better track success – and can help other cities designing these processes. In general, collecting more specific data on changes made in corrective actions to help estimate impact – like how much of a building or space the change applied to – can greatly refine impact estimates. Tracking and reporting occupancy and scheduling changes in more detail is a lot of work, but variation in occupancy can make estimating O+M impacts difficult. Since tune-ups happen in many stages, collecting dates on when the assessment was conducted and when corrections were made can help determine a cutoff date for pre-post analysis. And asking more specific questions about the quality and functionality of the building automation system (BAS), especially for smaller buildings, can help regulators determine if what the Tune-Up Specialist did or did not do on a number of corrective actions makes sense.

Building Tune-Ups – Living in a Performance Standard World

Through the course of the first five-year implementation cycle, early formative evaluation and change management processes were mechanisms designed to make tweaks to implementation on the fly to improve outcomes in the near term. But a rapidly changing climate policy environment is forcing longer term assessments of how this type of prescriptive operations and maintenance policy fits within the larger context of more aggressive policies to achieve our carbon neutral goals. In the time since the Building Tune-Ups policy was passed, cities and states have dramatically ramped up their climate actions as increasingly dire reports on rising emissions have spurred further action.

Most of these policies take an outcome-based approach, setting standards for performance that allow owners flexibility and long lead times to meet targets, like those in Washington D.C. and New York City. But some are starting to take a hybrid or holistic approach. Last year, the State of Washington passed the Clean Buildings Act which had at its core a building performance standard combined with prescriptive requirements for

benchmarking, operations and maintenance, and equipment replacement standards based on ASHRAE 100.

Although the future of tune-up policies in a performance standard world is uncertain, this first step into regulating energy and carbon in existing buildings at scale has provided a foundation for future policies to build on. Seattle has set the precedent with its building owners and managers of requiring investment to reduce energy and carbon in their buildings. And the market transformation required to scale these policies has been initiated, though getting to zero will require far greater changes. And until all our electricity is clean, all systems are electrified, and the grid is in perfect harmony, there will be a place for low-cost operations and maintenance programs.

References

- City of Philadelphia. October 2019. Bill No. 190600. “Building Energy Performance Policy.” <https://www.imt.org/wp-content/uploads/2020/02/Final-legislation-CertifiedCopy19060001.pdf>.
- City of Seattle. June 2013. Seattle Climate Action Plan. http://www.seattle.gov/Documents/Departments/Environment/ClimateChange/2013_CAP_20130612.pdf.
- . April 2018. Seattle Climate Action Strategy. http://greenspace.seattle.gov/wp-content/uploads/2018/04/SeaClimateAction_April2018.pdf.
- . 2019. Municipal Code Chapter 22.930 – Building Tune-Ups https://library.municode.com/wa/seattle/codes/municipal_code?nodeId=TIT22BUCOCO_SU_BTITLE_XMIRURE_CH22.930BUTUS.
- . 2019. Municipal Code Chapter 22.920 – Energy Use Benchmarking. https://library.municode.com/wa/seattle/codes/municipal_code?nodeId=TIT22BUCOCO_SU_BTITLE_XMIRURE_CH22.920ENUSBE.
- . 2020. “Building Tune-Up Accelerator Final Technical Report”. http://www.seattle.gov/Documents/Departments/OSE/Tune-Ups/DE-EE0007556_Seattle_Final_Technical_Report_May2020.pdf
- City of Seattle Office of Sustainability and Environment. 2019. “Building Tune-Ups.” <http://www.seattle.gov/buildingtuneups>.
- . 2017. OSE Director’s Rule 2016-01: Building Tune-Ups Requirement. http://www.seattle.gov/Documents/Departments/OSE/OSE_DIRECTORS_RULE_2016-01.pdf.
- Hsu, David. 2014. “How much information disclosure of building energy performance is necessary?” *Energy Policy* 64 (1): 263-272.

Pacific Northwest National Laboratory (PNNL). 2019. “Building Re-tuning™.”
<https://buildingretuning.pnnl.gov/>.

Results for Development (R4D). 2020. “Evaluation & Adaptive Learning.” Accessed March 2020. <https://www.r4d.org/how-we-work/evaluation-adaptive-learning/>.

Seattle City Council. February 2016. Resolution 31652. “A RESOLUTION requiring a schedule for periodic building tune-ups for City-owned facilities.”
<http://clerk.seattle.gov/search/resolutions/31652>.