

SEATTLE

# BUILDING TUNE-UP ACCELERATOR



Tune-Up Provider Training

September 14 & 15, 2017

SMART BUILDINGS CENTER

# Training Agenda

## Day 2

- Site Visit Debrief
- Tool Lending Library
- Building Renewal
- Utility Incentives
- Wrap up and next steps





SEATTLE  
BUILDING TUNE-UP ACCELERATOR

# SITE VISIT DEBRIEF



# King County Metro Transit Power Distribution

## **2016 Site EUI (Non-Norm):**

61.6 kBtu/sf

**Seattle EUI Rank:** Medium High

**ENERGY STAR:** NA

**GFA:** 21,947 SF

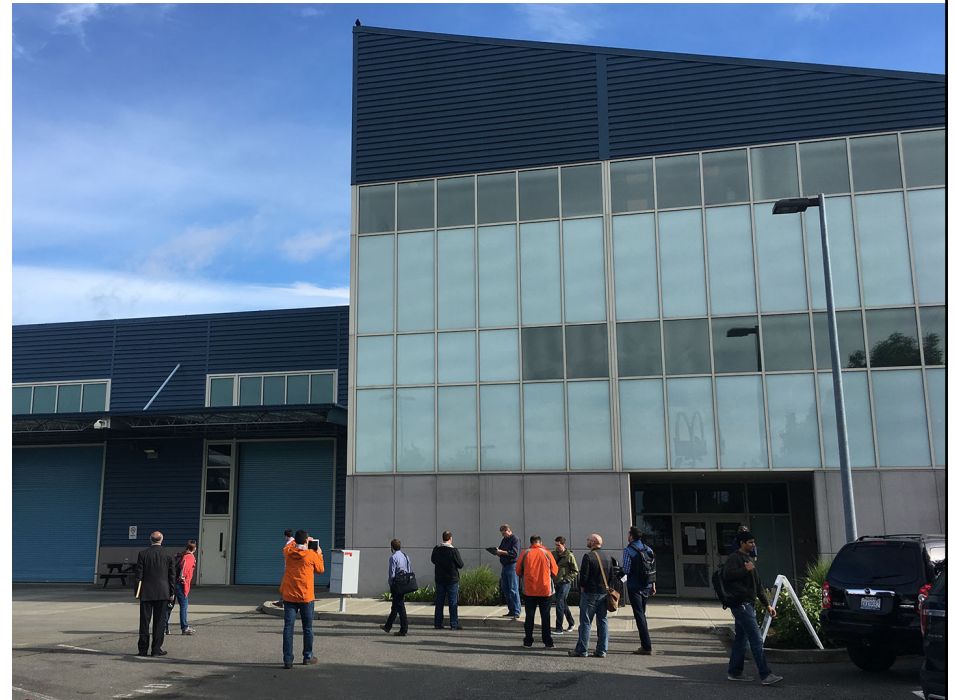
**Year Built:** 2004

## **2016 Total Site Use:**

1.55 million kBtus

Electric 62% / Gas 38%

**Property Types:** Office, Warehouse, Other, Parking

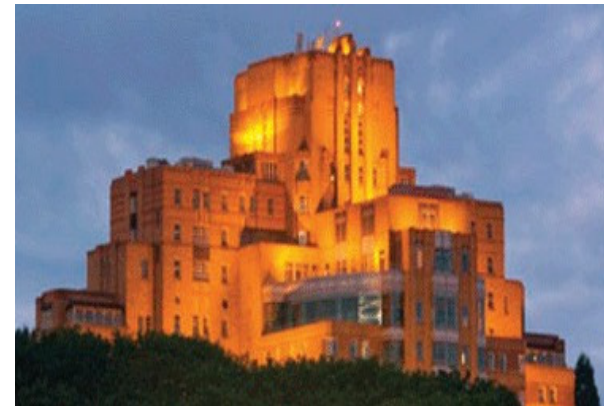






SEATTLE  
BUILDING TUNE-UP ACCELERATOR

# Diagnostic Tool Lending Library



**Duane Lewellen**

Tool Lending Library Director

Smart Buildings Center



**SMART  
BUILDINGS  
CENTER**

A project of NEEC

# Agenda

1. Introduction to the Tool Lending Library
2. Loan procedures and policies
3. Tune up diagnostic tool packages
4. Data analytics & resources
5. Q&A



# Tool Lending Library at SBC



- 85 tool types
- Online reservation system
- Loan period up to 4 weeks
- Local pickup or shipped
- Open 9am to 4pm Tue., Wed., Thur.

**FREE !!!**



# Tool List & Application Notes

## Tool Inventory

Available tools include loggers, logger sensors, power and light meters, air flow tools and more. Review our [Tool List \(PDF\)](#). If you don't see a specific tool you need, please contact us.

## Tool Resources – Notes, Guides, & Information

Our [library of videos and application notes](#) has information on measurement techniques, step-by-step instructions for some tools, and useful tips. It's a great place to start exploring all the potential applications of our inventory.



# Tool Lending Policies

## ➤ CUSTOMER AGREEMENT

- NEEC is not liable for any damages arising out of use of the tools
- Agree to return tools in good working order and on time
- Agree to replace tool(s) if they are damaged or lost
- Power and flowmeters are not revenue grade and should not be used for utility billing

## ➤ TOOL LENDING POLICY

- Tool availability on a first come, first served basis
- Tools can be reserved for future use
- Electric power meters must be installed by licensed, qualified electrician
- Infrared cameras and ultrasonic flow meters require certificate of insurance prior to loan



# Tool Request Form

we're open! Check out our [Tool Lending Library...](#)



**SMART  
BUILDINGS  
CENTER** A project of NEEC

Search this website



[HOME](#)

[ABOUT SBC](#)

[TOOL LIBRARY](#)

[USE OUR SPACE](#)

[SMART + EFFICIENT](#)

[SBC NEWS](#)

You are here: [Home](#) / [Tool Lending Library](#) / Tool Request Form

## Tool Request Form

Fill out this form to access resources at the Tool Lending Library. Borrowers must read and agree to our [Lending Policy](#) and [Customer Agreement](#) prior to submitting a request. We typically respond via email within 3 business days.

### Borrower Information

### TOOL LIBRARY CONTACTS

**Carol Lewellen**

Tool Librarian

☎ [206-538-0685](tel:206-538-0685)

[carol.lewellen@smartbuildingscenter.org](mailto:carol.lewellen@smartbuildingscenter.org)

**Duane Lewellen**

Sr. Project Manager

☎ [206-538-0856](tel:206-538-0856)



SEATTLE  
BUILDING TUNE-UP ACCELERATOR

# Tool Reservation System

Smart Buildings Center



[Create Account](#)

[Log In](#)

[Home](#)

[Inventory](#)



## Smart Buildings Center

Welcome to the Smart Buildings Center Tool Lending Library

The Smart Buildings Center Tool Lending Library stocks a wide variety of high grade diagnostic tools for facility engineers, building managers, and other professionals to evaluate energy use in their commercial buildings in Washington State.

Please see what we have to offer by either clicking the "Browse Inventory" button, or typing in the "Search Inventory" box.

If you see anything you would like to borrow for your commercial building in Washington State, please go to the main Smart Buildings Center website by clicking our icon on the right. There you can learn about our program and complete our application process.

<http://www.smartbuildingscenter.org>



**SMART  
BUILDINGS  
CENTER** A project of NEEC

### Address

Seattle 98104 USA

### Hours

Monday	Closed
Tuesday	9:00 AM - 4:00 PM (PDT)
Wednesday	9:00 AM - 4:00 PM (PDT)
Thursday	9:00 AM - 4:00 PM (PDT)
Friday	Closed
Saturday	Closed
Sunday	Closed




SEATTLE  
BUILDING TUNE-UP ACCELERATOR

# Reserve Tools & Check Out

[Home](#) [Inventory](#) [Admin](#) [Check In or Out](#) [Find User](#) [Search Inventory](#)


All Items 906 results

**SMART BUILDINGS CENTER**  
A project of NEEC

Search Within...

Availability  
☐ In-stock now  
☐ Show disabled items

Type  
[Air Flow Meters](#) (14)  
[Data Loggers](#) (643)  
[Detectors](#) (13)  
[Distance Meters](#) (2)  
[Hydronic Meters](#) (5)  
[Infrared Cameras](#) (1)




Alnor EBT701 Balometer (00907)

In-Stock

CAB1

Reserve

Admin [Check Out](#) [Edit](#)




Carbon Monoxide Meter (00894)

In-Stock

F3B

Reserve

Admin [Check Out](#) [Edit](#)



CO Logger (00902)

In-Stock

F1C

Reserve

Admin [Check Out](#) [Edit](#)

SEATTLE  
BUILDING TUNE-UP ACCELERATOR

12



# Tool Delivery & Return



**Pick up and return to the Smart  
Buildings Center  
Tuesday thru Thursday 9am-4pm**

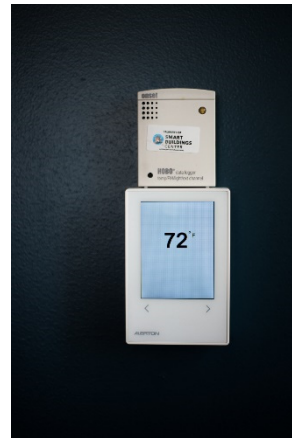


**Delivery and return via shipping**



# Diagnostic Tool Applications

- HVAC
- Lighting
- Domestic Hot Water
- Water Use



# HVAC Diagnostic Tool Packages

## Seattle Tune Up Accelerator Diagnostic Tool Packages



	Tune Up Assessment Elements	Diagnostic Approach	Diagnostic Tool Application(s)
<b>1.</b>	<b>Heating Ventilation, and Air Condition</b>		
a.	Review HVAC equipment schedules (Including daily weekly, seasonal, day/night, occupied/unoccupied hours).	Record start/stop operation of supply fans, return fans, exhaust fans pumps, chillers, and boilers associated with HVAC equipment and compare to occupancy schedule(s)	Electric motor logger Electric contact logger Energy/Power logger
b.	Review HVAC set points (including space temperatures, supply air temperatures, CO2, boiler temperatures, chilled water temperatures, economizer changeover temperatures, and building pressure).	Measure operating condition(s) and compare to setpoint:	<b>Static Measurements:</b> Vane Anemometer Thermal Anemometer Hand-held Infrared Thermometer Digital Psychrometer Digital Manometer  <b>Logging:</b> Temp/Humidity/Light Logger 4-Channel Logger With Remote Sensors WIFI Temp/Humidity logger Carbon Dioxide meter with data logger Desktop IAQ logger Carbon Monoxide logger Differential pressure transmitter with data logger



# HVAC Applications

- Verify equipment start/stop schedules
- Verify setpoints
- Calibrate critical sensors
- Verify equipment sequence of operation
- Troubleshoot airflow/air balance issues
- Identify simultaneous heating & cooling



# Equipment Start/Stop Schedules

Application: Supply fans, return fans, exhaust fans, terminal unit fans, boilers, chillers, circulation pumps

Diagnostic Approach: Log equipment operating schedule and compare to building occupancy



Onset Hobo Motor  
Logger



Dent Elitepro XC  
Energy logger



Fluke 1730 Energy  
Logger



Dent Motor  
Maglogger



# Verify Set Points & Sequence of Operation

Application: Zone temperature, supply air temperature, boiler supply water reset, chilled water reset, outside air temperature, mixed air temperature, economizer high limit

Diagnostic Approach: Measure or log temperature conditions and compare to set point



Digital psychrometer



Thermal Anemometer

Laser Thermometer



Wifi Temp Logger



Temp/Humidity logger



4-channel data logger



# Sensor Calibration

Application: Temperature sensors, humidity sensors, air/water flow sensors, CO2 sensors, CO sensors

Diagnostic Approach: Measure condition and compare to sensor output



**GE Ultrasonic Flow Meter**

**Fluke 975 Thermal Anemometer**



**Vaisala MI70 Temp/Humidity/CO2 meter**



**Extech CO meter**



**Onicon Insertion Flow Meter**





# Airflow & Ventilation Measurements

Application: Supply/exhaust/return air cfm, outside air cfm, CO2 levels, building pressure, duct pressure

Diagnostic Approach: Measure airflow or pressurization and compare to desired condition



Dwyer Digital  
Manometer



Flow Hood



TSI Vane  
Anemometer



Thermal  
Anemometer



Differential  
Pressure Logging



CO2  
Measurement &  
Logging





# Lighting Diagnostic Tool Packages

<b>2. Lighting</b>		
a. Identify any areas where lighting levels appear to be significantly higher than Appropriate for the space use and occupant needs.	Spot check lighting levels	<b>Static Measurement:</b> Light meter  <b>Logging:</b> Light level logger
b. Verify lighting sensors are working and located Appropriately for the current functioning of the building.	Spot check operation of occupancy daylighting sensors	Light/occupancy logger Lighting level logger
c. Review lighting controls schedules and sequences.	Verify lighting control schedules match occupancy	Light/occupancy logger



# Lighting Levels & Controls

Application: Evaluate light levels and automatic control systems

Diagnostic Approach: Measure light levels and compare to standards, verify correct operation of occupancy and daylighting sensors



Light Level Logger



Light Meter -  
Fluorescent



Light Meter - LED



Ballast Checker



Light & Occupancy  
Logger



# Domestic Hot Water Tool Packages

3.	<b>Domestic Hot Water</b>		
a.	Review domestic hot water temperature set points.	Measure hot water temperature at tap	<b>Static Measurement:</b> IR thermometer  <b>Logging:</b> WIFI temp logger with remote sensor Temp logger with remote sensor
b.	Review circulation pump controls.	Determine stop/stop schedule and/or aquastat temperature setting	Motor Logger Contact logger Data logger with external temperature sensor



# Domestic Hot Water Applications

Application: Verify hot water temperature and proper operation of recirculation system controls

Diagnostic Approach: Measure hot water temperature. Verify schedules for recirculating systems



**Laser  
Thermometer**



**4-channel logger with  
external sensors**



**Motor logger**



# Water Usage Tool Packages

4.	<b>Water Usage</b>		
a.	In irrigated areas over 500 square feet, verify irrigation schedule are in place, and review schedules.	Compare schedule to best practice	
b.	Verify irrigation rain sensors are calibrated, functioning properly, and located appropriately to collect relevant moisture data to trigger the system operating system.	Measure and calibrate rain sensor	Electric multimeter
c.	Verify cooling tower conductivity meter used to control blow down is calibrated and functioning properly.	Measure cooling tower sump conductivity and compare to setpoint	Handheld conductivity/PH tester
d.	Review water feature schedules.	Verify pump operation schedule	Motor logger Contact logger



# Water Usage Applications

Application: Verify irrigation sensors are calibrated, calibrate conductivity controller sensors, verify water feature schedules

Diagnostic Approach: Measure and calibrate sensors, log water feature pump operation



Conductivity Meter



Electrical multi-meter

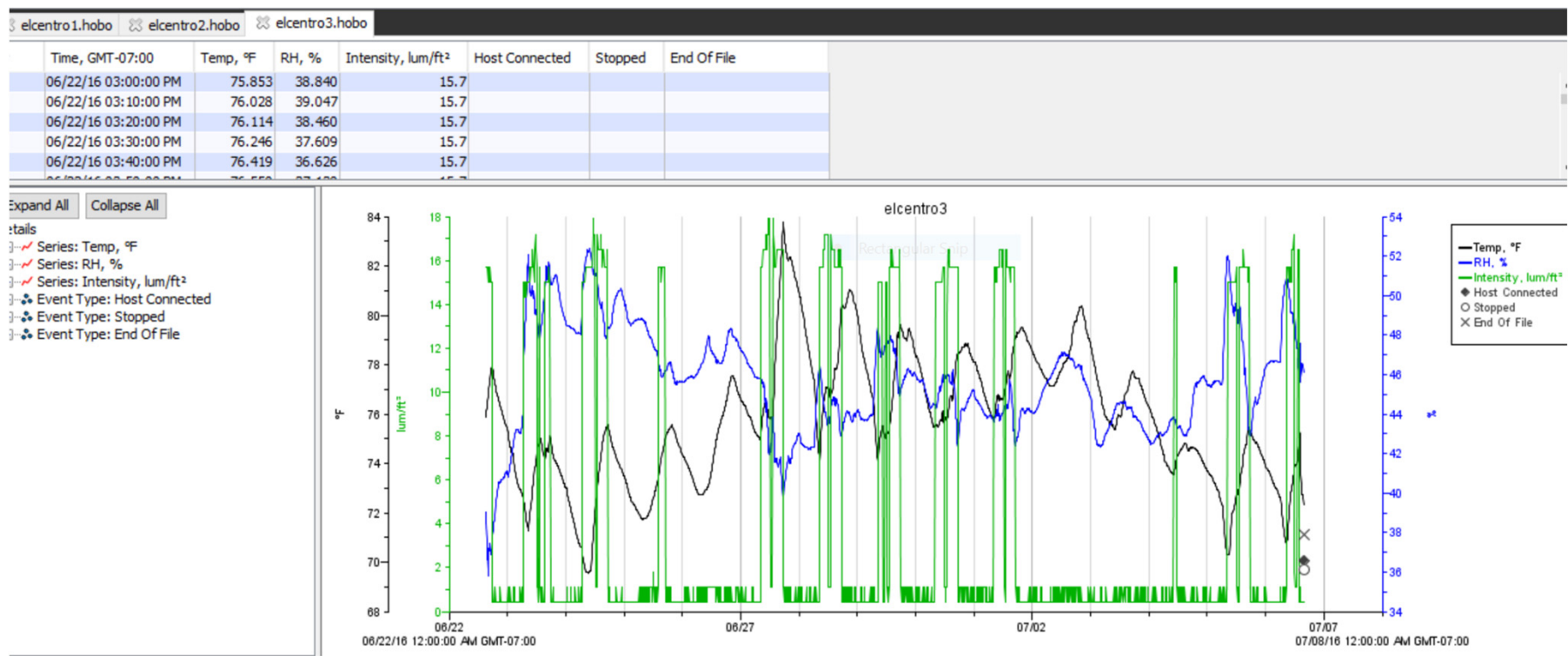


Motor logger



# Data Analysis Tools

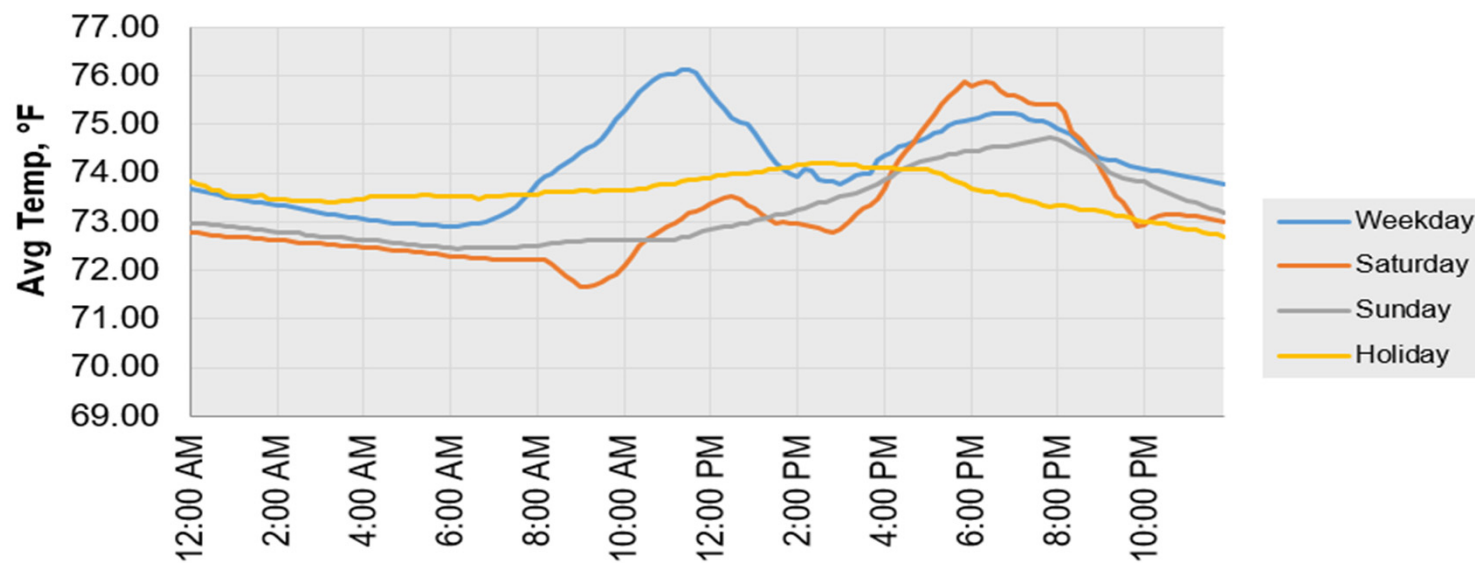
## Manufacturer Software



# Data Analysis Tools

## ECAM Excel Add-in

### El Centro de la Raza Dining Room Temperature



¶





# Signup For SBC Updates

## SIGN UP FOR UPDATES

Join the Smart Buildings Center mailing list for information about events and energy efficiency news.

**SUBSCRIBE**

## SBC NEWS

### Seattle City Light's Strategic Plan Update April 13

APRIL 8, 2016

## TOOL LENDING LIBRARY

### Logging CO2 at the Smart Buildings Center

DECEMBER 14, 2015



# Tool Library Resources

## Tool Lending Library

Duane Lewellen, 206-538-0856

[duane.lewellen@smartbuildingscenter.org](mailto:duane.lewellen@smartbuildingscenter.org)

<http://www.smartbuildingscenter.org/tool-library/>

## Tool Resources

<http://www.smartbuildingscenter.org/tool-library/tool-resources/>

<http://www.pge.com/mybusiness/edusafety/training/pec/toolbox/tll/appnotes/index.shtml>

## ECAM Excel Add-in

## Universal Translator

<http://utonline.org>



# QUESTIONS ?





SEATTLE  
BUILDING TUNE-UP ACCELERATOR



LUNCH BREAK



SEATTLE  
BUILDING TUNE-UP ACCELERATOR

# Building Renewal: A Roadmap to Deeper Savings

PRESENTED BY:

Christopher Meek, AIA, IES  
**Integrated Design Lab**

Associate Professor and Director  
University of Washington  
Department of Architecture  
[cmeek@uw.edu](mailto:cmeek@uw.edu)

**INTEGRATED DESIGN LAB**

UNIVERSITY of WASHINGTON // **W**



# SEATTLE BUILDING TUNE-UP ACCELERATOR

CENTER FOR INTEGRATED DESIGN   INTEGRATED DESIGN LAB   DISCOVERY COMMONS   PUBLICATIONS   PROJECTS   NEWS   PEOPLE   CONTACT



## INTEGRATED DESIGN LAB

UNIVERSITY of WASHINGTON // **W**

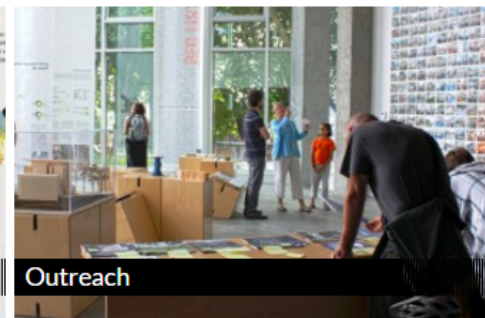
**About The Lab →**

### News

- [UW IDL Partners with City of Seattle on Federal Grant to Increase Building Energy Efficiency](#)  
Posted: Thursday, September 22, 2016
- [UW IDL shares research at ACEEE summer conference](#)  
Posted: Monday, September 12, 2016
- [Bullitt Center Breathes Life into Future of Urban](#)



Technical Assistance



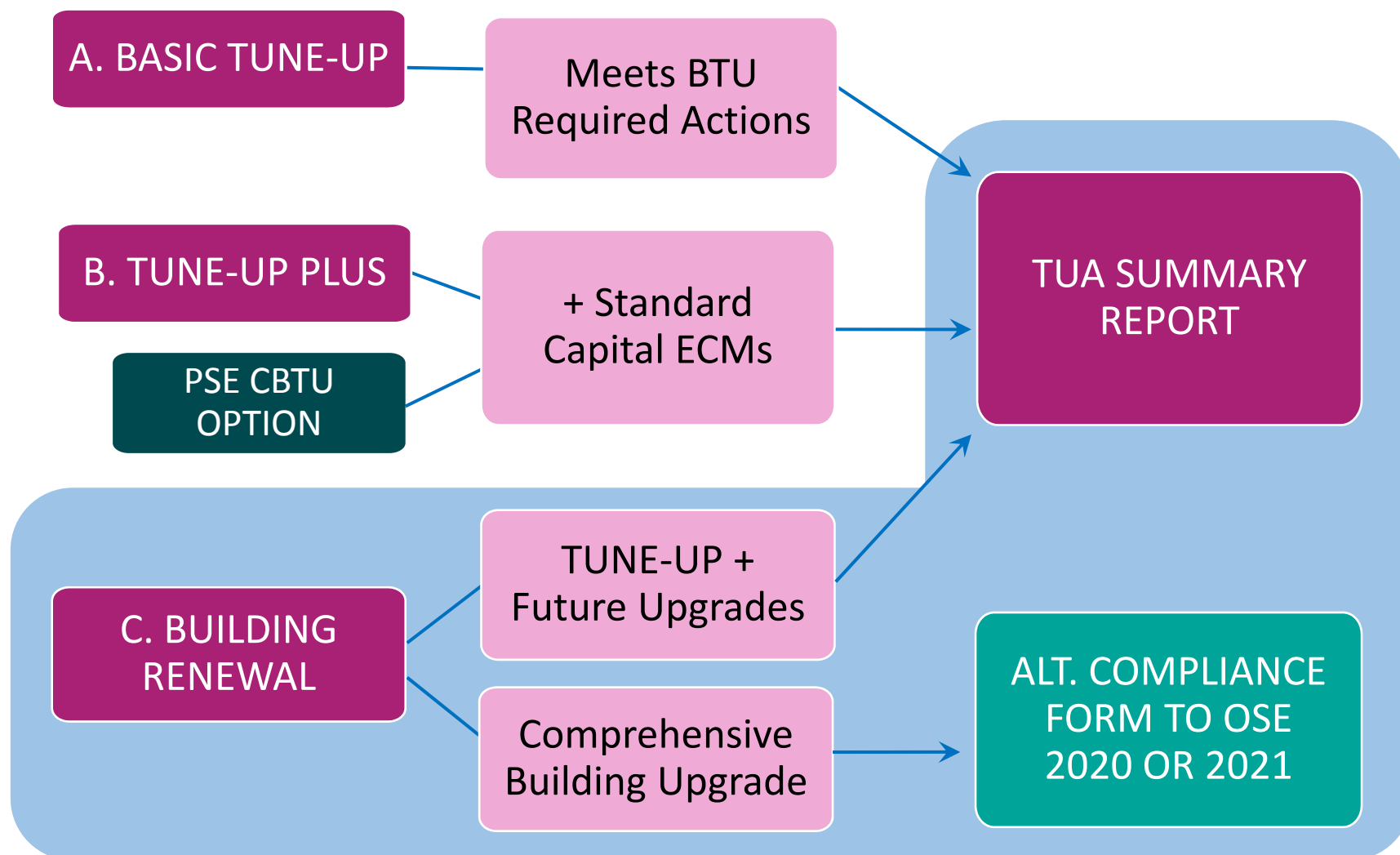
Outreach

# AGENDA

TIME	TOPICS
10 Minutes	What is Building Renewal?
15 Minutes	Opportunities and Technical Approach
10 Minutes	Resources
10 Minutes	SPARK Tool Intro and Demo
5 Minutes	Timeline and Contacts
10 Minutes	Q&A



# How does Building Renewal fit into the TUA?





# What is Building Renewal?

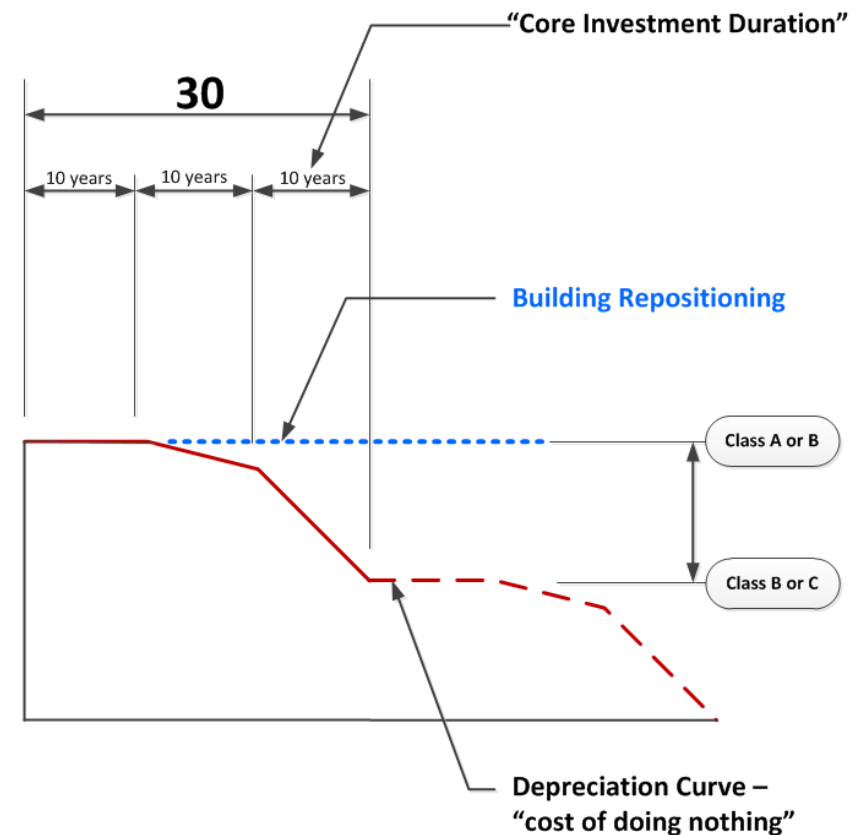
*“A customized technical approach for building modernization that significantly improves a building’s energy performance, revitalizes its market or operational position, and increases asset value.”*



# What is Building Renewal?

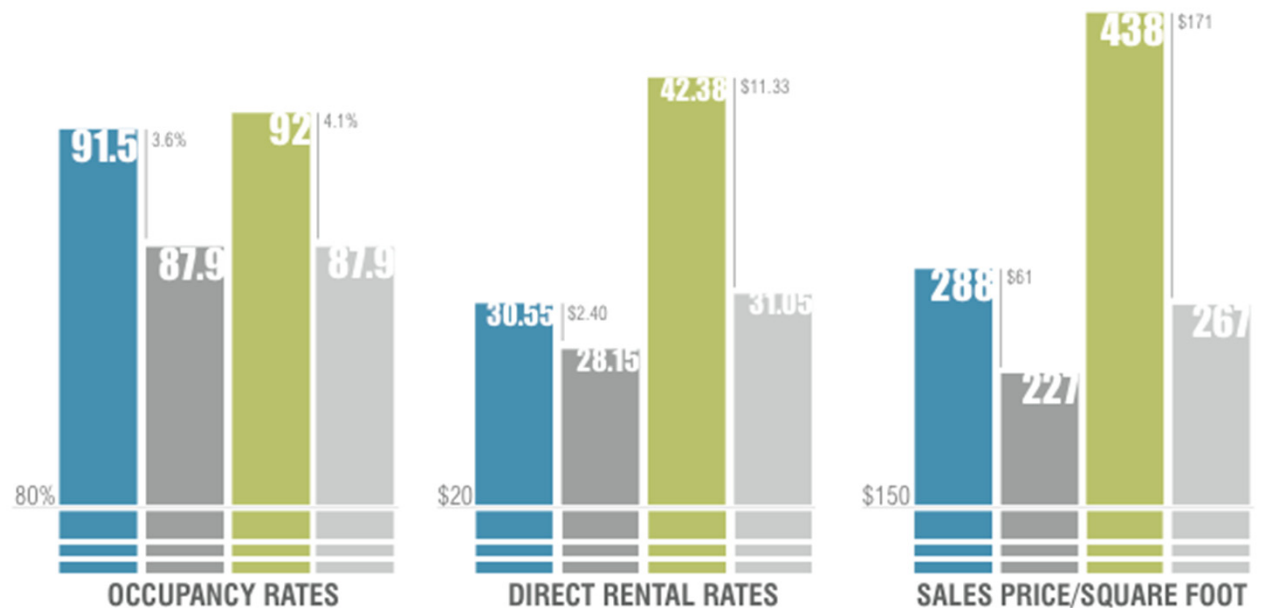
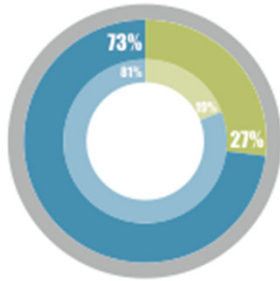
## Adds Value Beyond Energy Savings:

- Investments can be aligned with the existing building life cycle to build upon and reinforce each other
- Integrated measure package mapped out across a multi-year investment horizon to improve asset value



# What is Building Renewal?

Increases asset value/economic performance



<http://www.costar.com/UploadedFiles/Partners/CoStar-Green-Study.pdf>



# Opportunities: Leverage Points for BR

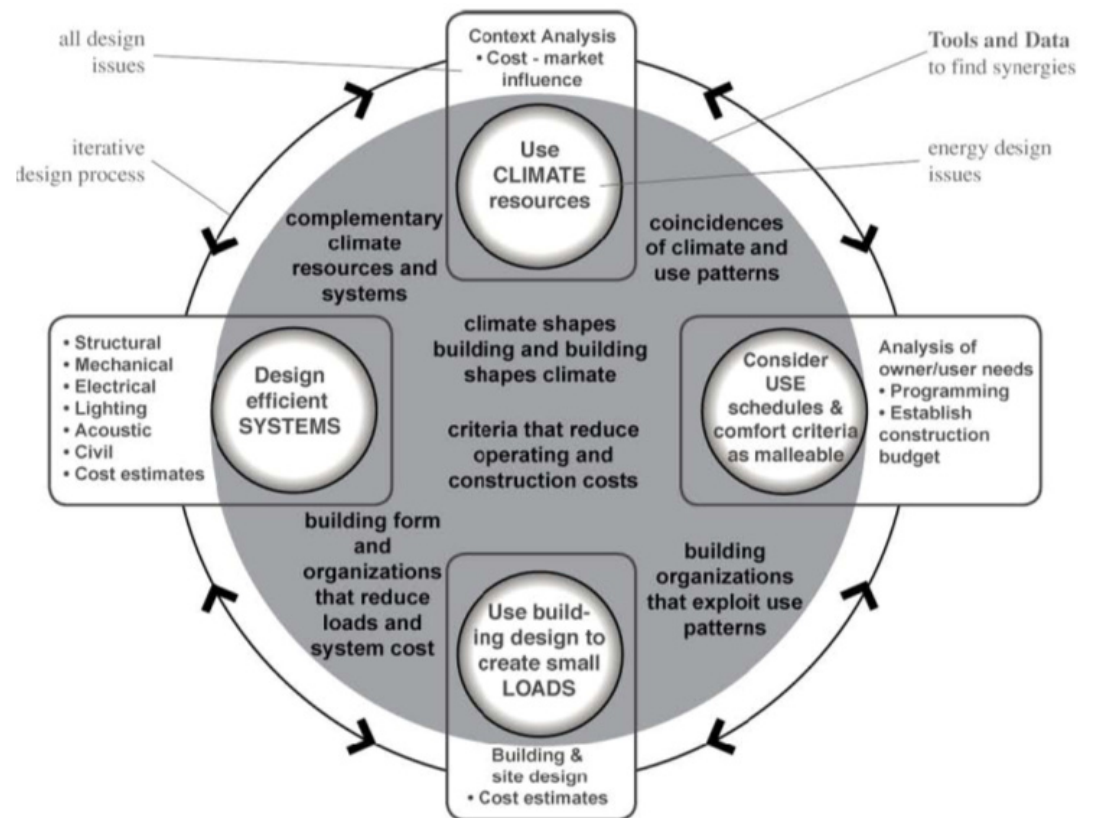
- Significant capital investments planned
- Major equipment at or near end-of-service life
- Building significantly under-performing the market
- Anticipated change of use
- New major tenant
- Planned future envelope/roof repairs or replacement
- Outdated systems (e.g. Lighting, HVAC)
- Considering aesthetic upgrade
- Energy use significantly higher than peer buildings



# What is Building Renewal?

The whole is greater than the sum of its parts...

*Integrated design synthesizes climate, use, loads and systems resulting in a more comfortable and productive interior environment, and a building that is significantly more energy-efficient.*



# What is Building Renewal?

## Identify Key Improvement Opportunities

*Integrated Measure Packages provide a suite of targeted energy efficiency measures that align investments in the building with deeper energy savings goals.*

O&M

ENVELOPE

LIGHTING

PLUG LOADS

BUILDING HVAC

PLANT HVAC

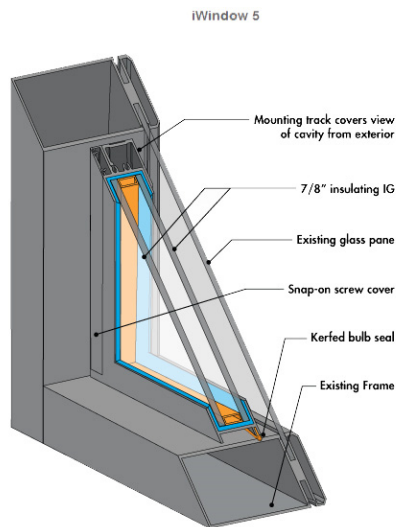
HVAC CONTROLS

IMP	Category	Measure Description
		<b>EUI</b>
O&M	1	Low cost
O&M	2	Medium cost
O&M	3	High cost
O&M	4	Resource Conservation Manager
Envelope	5	Wall Insulation
Envelope	6	New windows
Envelope	7	Envelope Sealing
Lighting	8	LPD Reduction (Improved Light Sources)
Lighting	9	Perimeter Daylighting
Lighting	10	Comprehensive Lighting Control
Plug Loads	11	LED Task Lighting
Plug Loads	12	Occupancy Sensor Controls
Building HVAC	13	VAV Retrofit (built-up)
Building HVAC	14	VAV Retrofit (packaged)
Building HVAC	15	Hydronic Heat Pump Retrofit
Building HVAC	16	New Advanced VAV System
Building HVAC	17	New De-coupled DOAS System
Building HVAC	18	New Heat Pumps
Plant	19	New Chiller Plant
Plant	20	Retrofit Chiller Plant
Plant	21	New Condensing Boilers
Plant	22	Variable Flow Pumping Retrofit (Chiller Plant)
Plant	23	Variable Flow Pumping Retrofit (Boiler Plant)
Plant	24	Variable Flow Pumping Retrofit (Hydronic Heat Pump System)
HVAC Controls	25	Optimized VAV-Central Plant Control Package (DDC)
HVAC Controls	26	Optimized Decoupled/DOAS-Central Plant Control Package (DDC)
HVAC Controls	27	Optimized Packaged VAV Controls (DDC)
HVAC Controls	28	Optimized Hydronic Heat Pump Controls (DDC)



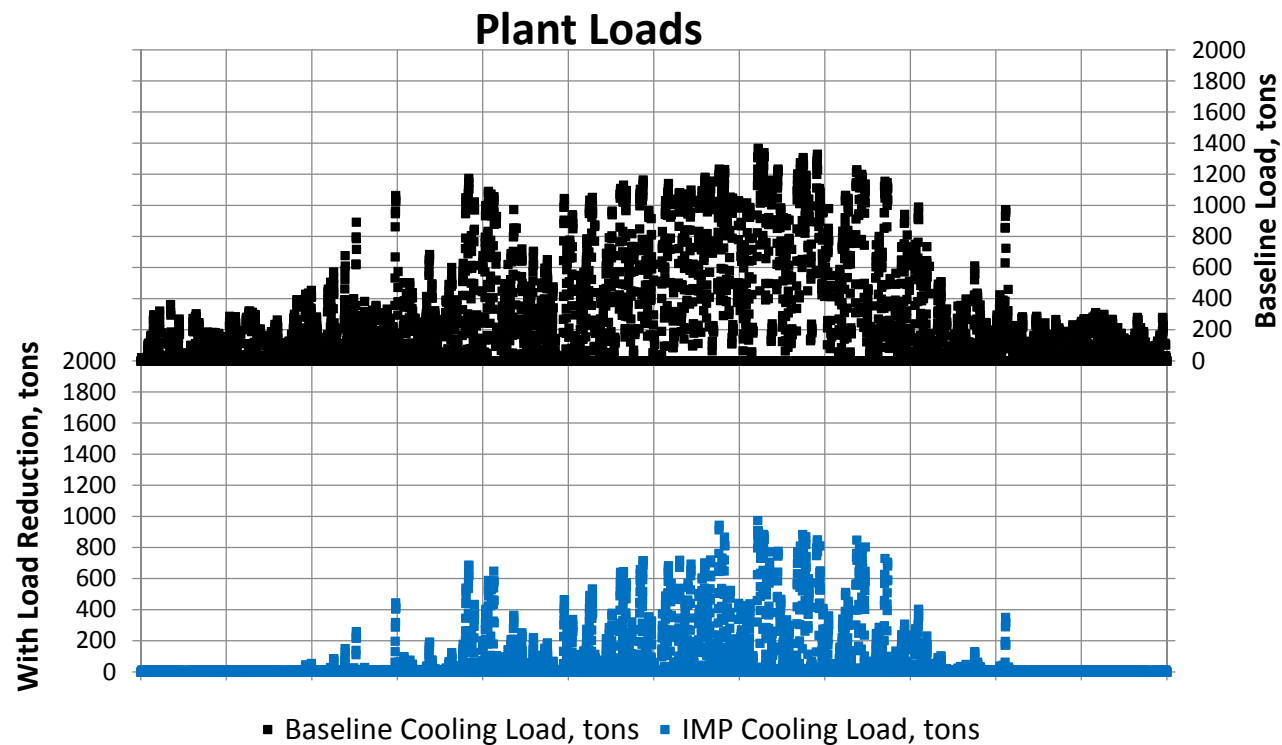
# Building Renewal Measures: Load Reduction

- Envelope/Glazing
- Lighting Systems
- Plug load/Process load management
- Tenant Engagement



# Building Renewal Measures: Efficient Systems

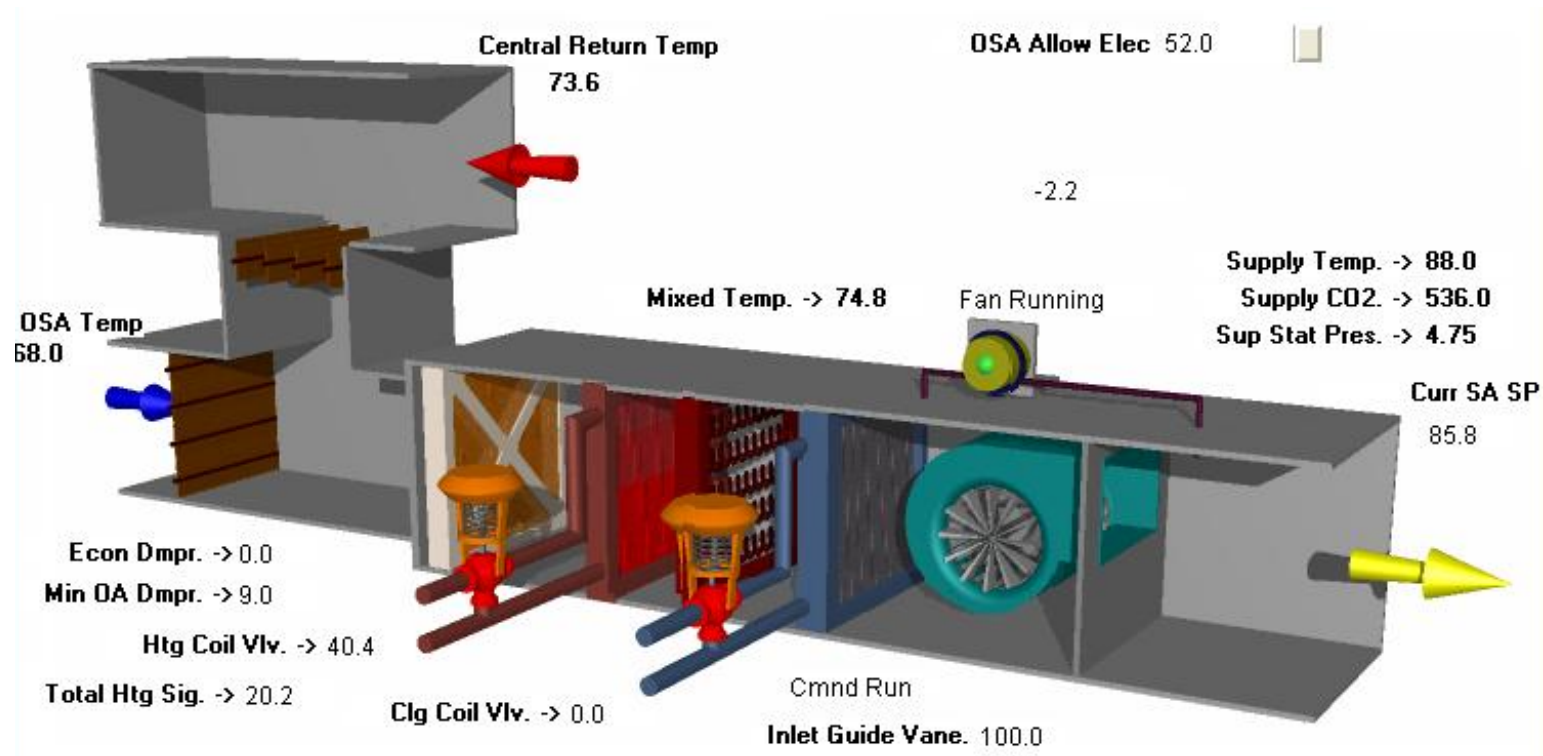
- Building/Suite-Level HVAC
- Central Plant HVAC





# Building Renewal Measures: Controls Improvements

- Controls Implementation/Upgrade



# Concept-Level Phasing

Develop Implementation Sequence and/or Timeline

Measure	2018												2019												2020							
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
Tune Up																																
Tenant Load Initiative/RCM																																
Task Lights/Plug Load Controls																																
Envelope Sealing																																
Secondary Window System																																
Lighting Upgrade																																
Perimeter Induction System VFDs																																
VAV Upgrade																																
Variable Flow Heat Rejection																																
Direct Digital Control																																

EXAMPLE



# Building Renewal: Development Resources

## INTEGRATED DESIGN LAB

UNIVERSITY of WASHINGTON // **W**

The University of Washington's Integrated Design Lab will provide technical assistance to owners and service providers as they work w/ consultants on engineering design, permit process, utility incentives and contractor selection.

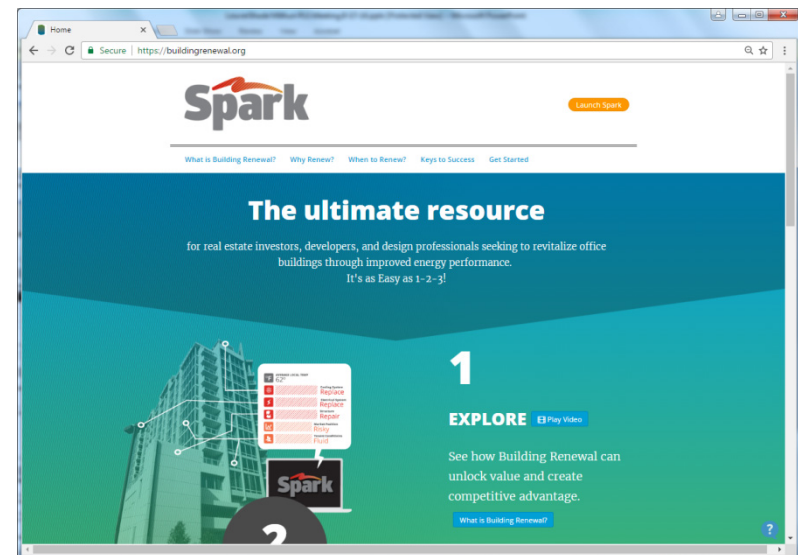
Resources exist for approximately **25 participant buildings** pursuing deeper energy savings through building renewal at three levels of project engagement.



# Building Renewal: Development Resources

**Level 1** (+/- 25 Buildings) – IDL will provide best-practices recommendations, and where appropriate, SPARK Tool-derived measure packages

- **Document areas for improvement**
- **Best practices recommendations**
- **Spark Tool assessment and report**



**INTEGRATED DESIGN LAB**  
UNIVERSITY of WASHINGTON // **W**



SEATTLE  
BUILDING TUNE-UP ACCELERATOR

# Building Renewal: Development Resources

**Level 2 (+/- 15 Buildings) – Level 1 activities and walk-through with Vendor/Building Owner and technical recommendations.** In collaboration with OSE and project Vendors, UW IDL will provide, supplemental technical assistance which may include:

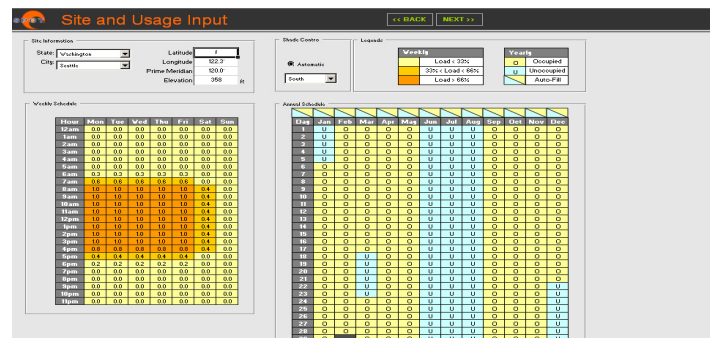
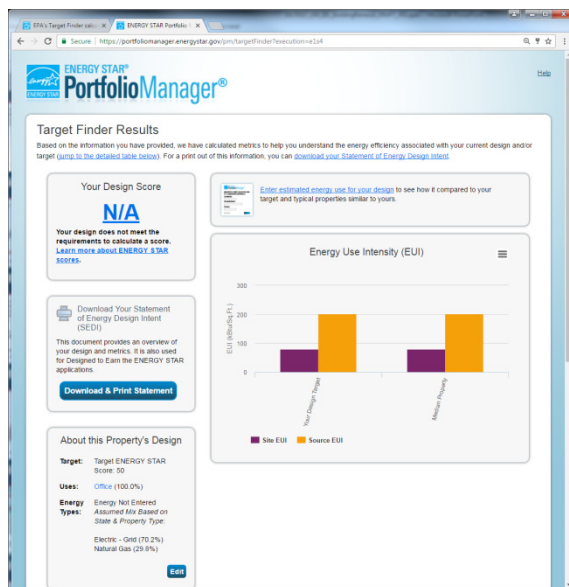
- Setting performance goals
- Implementation process
- System integration recommendations
- Efficient building envelope
- Efficient electric lighting
- Efficient mechanical HVAC systems
- Passive systems integration



# Building Renewal: Development Resources

## Level 2 (+/- 15 Buildings) Examples of Activities

### Specific measure analysis:



## Goal Setting/Lighting/Controls Retrofit Evaluation/Envelope upgrades

**INTEGRATED DESIGN LAB**  
UNIVERSITY of WASHINGTON // **W**



SEATTLE  
BUILDING TUNE-UP ACCELERATOR

# Building Renewal: Development Resources

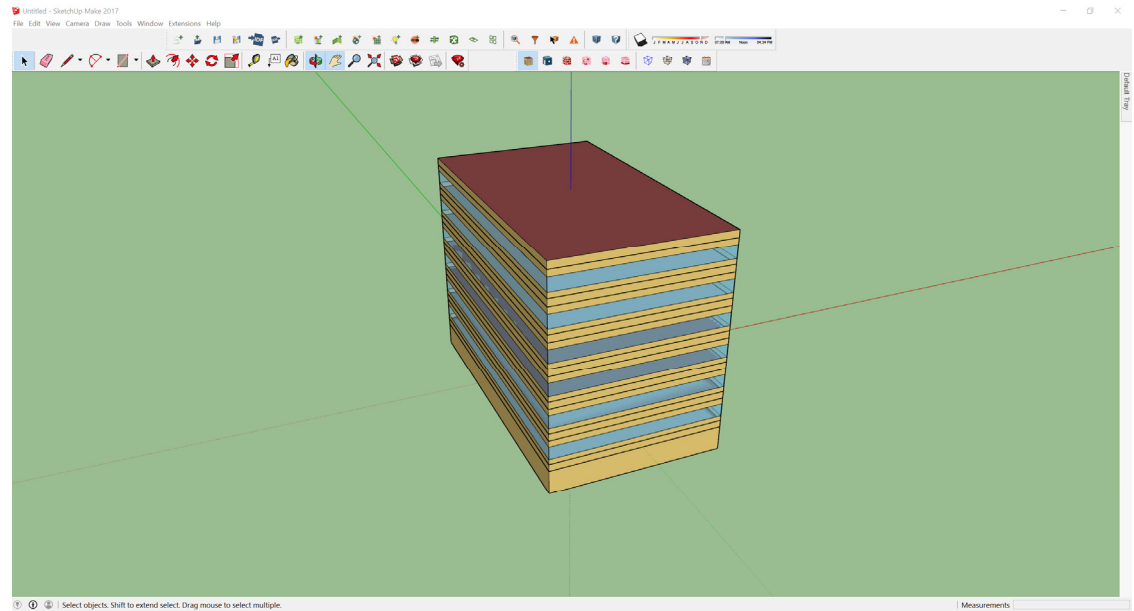
**Level 3** (+/- 5 Buildings) – Level 2 activities plus Technical Assistance including **simulation-based analysis and recommendations**. In collaboration with OSE and project Vendors, UW IDL will provide, as time and resources permit, project-specific analytical assistance including:

- Climate and site analysis
- Demonstration of thermal and visual criteria
- Daylight and electric lighting simulation modeling
- Energy simulation modeling
- System integration analysis
- Establishment of performance verification methods

# Building Renewal: Development Resources

**Level 3 (+/- 5 Buildings ) Detailed whole building energy analysis including unique EEMs tailored to specific project opportunities**

Asset Score simulation includes Open Studio Model that can be modified using Open Studio, EnergyPlus, and/or other interfaces to refine analysis of possible measures.





# Building Renewal: Action Items...

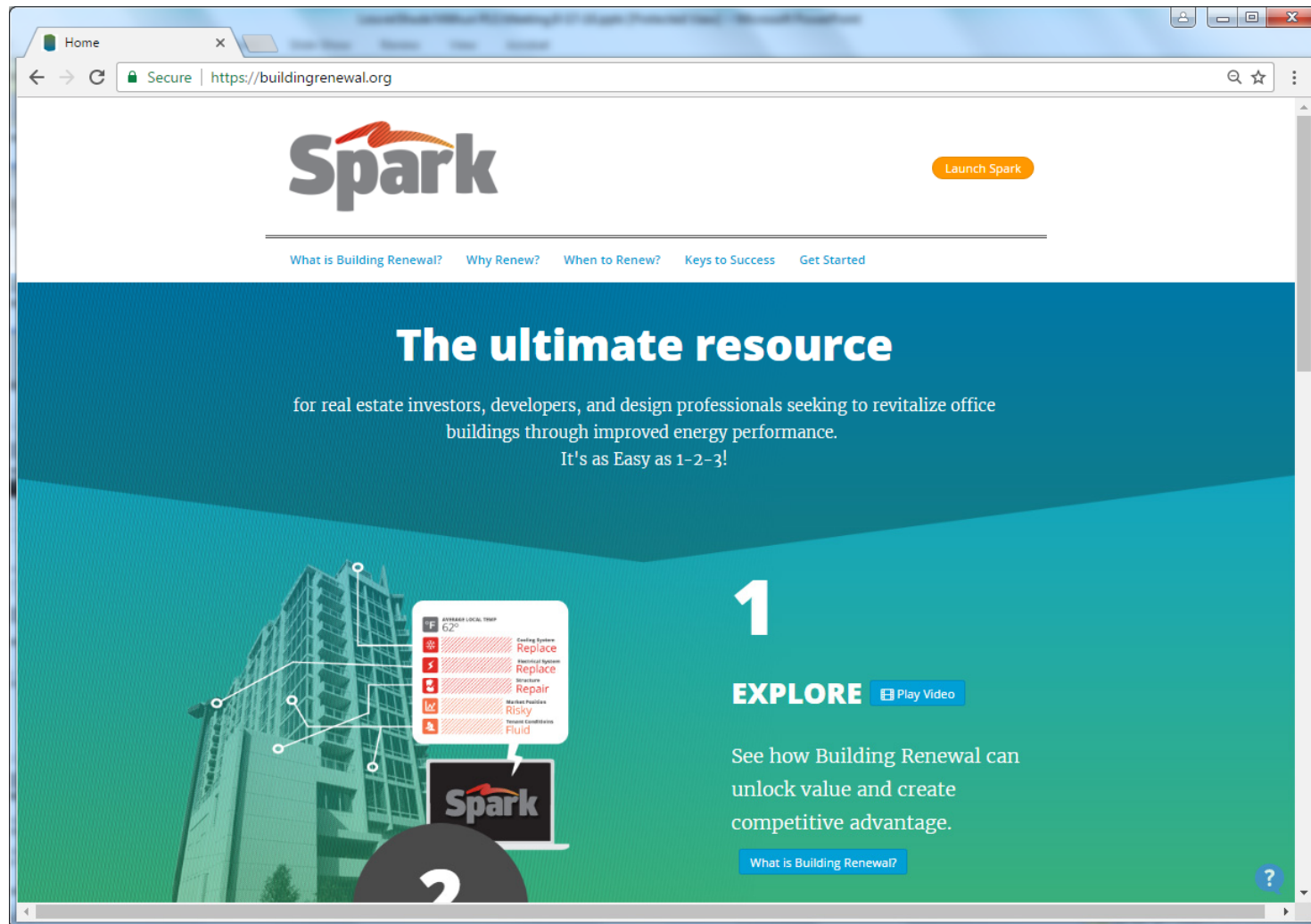
## **Contact IDL or OSE if you see Building Renewal opportunities:**

- Owner/service provider interested in exploring building renewal alternatives at no cost
- Any office building – free confidential SPARK Analysis by IDL
- Owner planning to replace a major system/component and would like to consider Building Renewal alternatives
- Owner considering major renovation/tenant improvement
- Complex/larger/unique building that would benefit from modeling multiple scenarios

*Resources will be distributed to projects with in consultation with and approval by OSE*



# SPARK Tool



[www.buildingrenewal.org](https://www.buildingrenewal.org)



SEATTLE  
BUILDING TUNE-UP ACCELERATOR

# SPARK Tool: Target

Built on a framework that can apply to multiple project types

**Developed for non-owner occupied commercial leased office buildings over 20,000 SF**

Tool users: Professionals tasked with planning, designing or implementing building renovation projects

Tool report: Targeting building investors and owners



# SPARK Tool

## Tool Objectives

1. Inform and inspire investigation of building renewal
2. Assess technical project potential for a specific building
3. Estimate the total value of the investment



# SPARK Tool: Non-Energy Benefits

## Value Creation

Drive financial success throughout the pro-forma



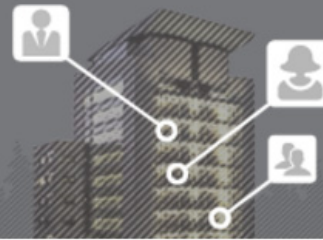
## Market Position

Improve your buildings competitive stature



## Tenant Attraction

Make your building more appealing to tenants



## Risk Reduction

Insulate your building from future risks and surprises



# Project Identification/Suitability



<https://buildingrenewal.org/>

Developed by BetterBricks

- Uses EnergyPlus seed models to simulate energy performance
- Incorporates business case
- Exports report and technical appendix

## QuickScreen

Rapidly diagnosing market, financial, tenant and technical factors, QuickScreen will deliver a short report based on your responses. The summary report characterizes your building as a "Strong", "Potential" or "Limited" as a candidate for a Building Renewal project.

The higher your score the more you should consider using Spark to investigate Building Renewal for your building.

1	Are utility incentives, grants, or other financial subsidies available for helping to offset project costs?	<input type="button" value="Yes"/>	<input type="button" value="No"/>
2	Are significant capital investments planned for the building?	<input type="button" value="Yes"/>	<input type="button" value="No"/>

17 Questions to determine if  
appropriate for further evaluation



# SPARK Tool: Quick Screen Report

## Result: **STRONG Candidate**

Your building is a strong candidate for a successful Building Renewal – a whole-building energy savings project that reduces the building's energy use by over 35%.

### BR Index Score

**15/20**

Market Position: 3 Risky

Tenant Conditions: 3 Fluid

Financial Flexibility: 5 Unleveraged

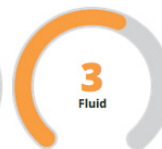
Systems + Structures: 4 Aging

#### Market Position



The building is at risk of losing market appeal from tenants and/or investors, shows signs of decreasing asset value, and may need to incur additional costs to comply with codes. Risky buildings are good candidates for an BR project because the energy efficiency focus can anchor a repositioning strategy and deliver reduced operating costs and improved tenant comfort.

#### Tenant Conditions



Significant opportunity exists to implement major construction projects within the building, either through current or future vacancies, the ability to relocate tenants, or tenant willingness and desire to improve environmental performance.

#### Financial Flexibility



The building's financial situation is such that a variety of options are available to fund the BR project, including a willingness to explore additional debt, energy services agreements, equity infusions, or other unique financial resources. Furthermore, planned capital projects offer an ideal window of to facilitate an BR project, integrating systems and envelope upgrades with other building enhancements.

#### Systems + Structures



The building has systems or structures in need of repair or replacement, such as the envelope or central plant. Aging buildings are good candidates for BR projects, where necessary investments in equipment and upgrades can be integrated to deliver deep energy savings.





# Input Building Information

	information requested
	information requested in simplified form
	not requested

Category	Asset Score - Short Form	Asset Score - long form	Spark - Building Renewal
<b>General Information</b>			
Name and address			
Year Completed			
Gross Floor Area			
Rentable Square footage			
# of Floors			
Building Use Type			
Portfolio Manager Score			
Planned modernization or renovation			
<b>Construction</b>			
Roof Type			
Roof Thermal Properties			
Cool Roof (yes/no)			
Floor Type			
Floor Thermal Properties			
Slab on grade insulation			
Wall Type			
Wall Thermal Properties			
Window Framing Type			
Window Glass Type			
Window U-value			
Window SHGC			
Window VT			
# of Windows			
Skylight Type			
Skylight U-value			
Skylight SHGC			
Skylight VT			
Skylight Layout			
Envelope been resealed in last 15 years			



BUILDING ENERGY  
Asset Score

## Categories

- General
- Utility Data
- Envelope
- Lighting/Plugs
- Chillers
- Boilers
- VAV
- Business

## Categories

- Geometry
- Use Types
- Construction
- Lighting
- Heating & Cooling
- Water Heaters
- Operations
- Business





# Inputs – Energy Data

General **Utility Data** Envelope Lighting/Plugs HVAC Boilers Business

## Utility Questions

What is the primary heating fuel used in the building? ⓘ

Electricity

Fossil fuel provider? ⓘ

Cascade

What is the cost of the building's fossil fuel (\$/unit)? ⓘ

\$ 1 Therms -

Annual fossil fuel consumption(units)? ⓘ

250 Therms

What is the name of the electric utility serving the building? ⓘ

PacifiCorp

What is the average kilowatt-hour cost of electricity? ⓘ

\$ 0.077 kWh

What is the annual electricity consumption in kilowatt-hours (kWh)? ⓘ

268734 kWh

Do you have a data center with consequential energy use, e.g. dedicated computer room air conditioning, raised floor, server racks with blade servers? ⓘ

Yes No

Continue



# Inputs – Major Systems

[General](#) [Utility Data](#) [Envelope](#) [Lighting/Plugs](#) [HVAC](#) [Boilers](#) [Business](#)

## Envelope

Are your building walls insulated? ⓘ

Spark recommends adding insulation. Do you want to add wall insulation at this time? ⓘ

Are the building windows, predominantly, single pane? ⓘ

Spark recommends installing double pane windows. Do you want to add double pane windows at this time? ⓘ

Are you aware of air/water leakage around building windows, into the interior? ⓘ

[General](#) [Utility Data](#) [Envelope](#) [Lighting/Plugs](#) [HVAC](#) [Boilers](#) [Business](#)

## Lighting and Plugs

What percentage of your building lighting has an ultra low lighting power density (LPD) of 0.7 watts/sf or less? ⓘ  %

What percentage of your building floor area has occupancy sensor control of lights? ⓘ  %

What percentage of your building perimeter has (0-10 volt) photosensor control continuous dimming, within 10 feet of the windows? ⓘ  %

What percentage of workstations in the building have LED task lighting? ⓘ  %

What percentage of the workstations in the building have occupancy sensor controlled plug strips? ⓘ  %



# Inputs – Major Systems

General Utility Data Envelope Lighting/Plugs HVAC Boilers Business

## HVAC

What is the age of the building's hydronic heat pump system? ⓘ

31-40

Is the building's HVAC ductwork more than 20 years old? ⓘ

Yes

No

What is the age of the loop circulation pump on your hydronic heat pump system? ⓘ

10 years or less

Continue



# Inputs – Business Analysis

[General](#) [Utility Data](#) [Envelope](#) [Lighting/Plugs](#) [HVAC](#) [Boilers](#) [Business](#)

## Business Analysis

What is the current vacancy percentage for this building? ⓘ

20 %

What is the stabilized vacancy percentage for this building? ⓘ

3%

Please fill out the following table, indicating 10-year lease rollover percentages:

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
25 %	0 %	0 %	5 %	0 %	0 %	20 %	0 %	15 %	0 %

What is the building's average annual lease rate per rentable square foot/year? ⓘ

\$ 26 sqft/year

Enter the appropriate capitalization ("cap") rate for this property. ⓘ

7 %

Finish



# Assessment Report - Opportunities



## Business Case Proposal

**Metro Tower  
Bellevue, WA.**

**Prepared by:  
Gilda Goodwrench**

**November 18, 2014**

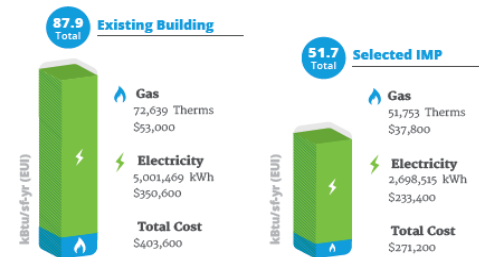


### **BUILDING RENEWAL** THE OPPORTUNITY

By implementing the complete package of energy efficiency measures recommended in this report, the Metro Tower has an opportunity to undergo a modernization that will significantly improve its energy performance, revitalize its competitive market position and increase asset value. The proposed project scope package of measures will result in total estimated energy savings of 41% at an estimated return of 15.6%.

Energy efficiency improvements and economic indicators are presented as if the entire package of energy efficiency measures is completed at the same time and as part of the same integrated, project scope. Reducing heating and cooling loads first optimizes HVAC system sizing and energy and economic performance. From a practical perspective, we understand that the proposed package of measures may need to be phased as opportunities and tenant rollover permit. The aim of this Building Renewal proposal is to provide an integrated package of measures with suggested measure sequencing to optimize results and provide the basis for a building roadmap to significantly higher energy performance.

### **ENERGY SAVINGS**



Energy Use: **↓ 41%**  
Energy Cost: **↓ 33%**  
Annual Energy Savings: **\$132,400**

Building Renewal Report | 2



# Comparative Analysis

Projects

First Project

Scenarios

Team

Reports

Second Project

Third Project

test project

Resources

Back to Building Renewal

First Project

Current Building

Proposed Scenario

Most Energy Saving

Current Building	Proposed Scenario	Most Energy Saving
Single Pane Windows	Keep Windows As Is	New Windows
Some Wall Insulation	Added Insulation	Added Insulation
Leaky Envelope	Keep Envelope As Is	Keep Envelope As Is
Lighting Power Density Above 0.7	Keep Lighting Power Density As Is	Keep Lighting Power Density As Is
No Perimeter Daylighting	Keep Perimeter Lighting As Is	Keep Perimeter Lighting As Is
No Comprehensive Lighting Controls	Do Not Add Comprehensive Lighting Controls	Do Not Add Comprehensive Lighting Controls
30% LED Task Lighting	Do Not Add LED Task Lighting	Do Not Add LED Task Lighting
20% Occupancy Sensor Controls	Do Not Add Occupancy Sensor Controls	Do Not Add Occupancy Sensor Controls
Aging Chillers	Keep Chiller Plant As Is	New Chiller Plant
No VFD on Chiller	Do Not Add VFDs To Chillers	Add VFD To Chillers
Aging Boilers	Keep Boilers As Is	Keep Boilers As Is
No VFD on Boilers	Do Not Add VFDs To Boilers	Do Not Add VFDs To Boilers
No DDC	Do Not Add DDC Package	Optimized DDC Package
HVAC - Built-up VAV	As Is	As Is
EUI	EUI	EUI
	68.20 kWh/ft <sup>2</sup>	67.25 kWh/ft <sup>2</sup>
Cost	Cost	Cost
	\$3.35 /sq ft	\$3.35 /sq ft
Energy Saving	Energy Saving	Energy Saving
	3%	12%

Impacts

NPV	\$3,916,271.71	NPV	\$2,993,286.31
IRR	128.37%	IRR	98.73%
NOI	\$425,585.00	NOI	\$324,847.00

Sensitivity adjustments

Capitalization Rate

3 %

Project Cost

0%

Discount Rate

0 %

Energy Savings

0%

Incentives

\$ 100

Rent Increase

\$1.00

Enter title of report

Prepared by (ex: John Smith)

Proposed Solution

Most Energy Saving

Save and Generate Report



# Assessment Report – Key Indicators Excerpt

## BUSINESS CASE

### KEY INDICATORS

Internal Rate Of Return: **15.6%**

Net Present Value: **\$1,521,900**

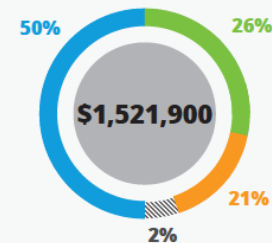
Estimated Project Costs		\$/rsf	\$/gsf
Incremental Project Cost	\$3,355,100	\$13.69	\$13.54
Project Incentives (est)	\$ 350,000	\$1.43	\$1.41
Net Project Cost	\$ 3,005,100	\$12.26	\$12.13

#### Stabilized Impact On Net Operating Income \$/yr

Energy savings	\$132,400
O&M expense reduction	\$12,400
Rent differential	\$10,100
	\$154,900

#### NPV of value components (10 year discounted cash flow)

Asset Appreciation	\$2,279,700
Rent differential	\$1,191,500
Energy savings	\$969,600
Reduced O&M expense	\$86,200



#### Key assumptions

Time horizon for analysis	10 years fixed
Consumer price index (CPI) or Inflation	3%
Capitalization (CAP) Rate	8.5%
Discount Rate	9.5%
Energy Cost Escalation	4%



# Assessment Report – Project Scope Excerpt

## PROJECT SCOPE

### PACKAGE OF MEASURES

The following project scope energy efficiency measures have been envisioned as an integrated, bundled solution, to achieve 41% energy savings

#### **New windows**

Replace old, inefficient window assemblies with newer double pane units offering better thermal performance.

#### **Envelope sealing**

Reduce air leakage through the building enclosure.

#### **LPD reduction**

Reduce lighting load by delivering lower ambient lighting and high quality task lighting at each workstation.

#### **Comprehensive control (*daylight and vacancy controls throughout*)**

Reduce and/or turn off electric lights when unnecessary.

#### **New chiller plant**

Install a new high efficiency chiller (or chillers), with efficiency improvement of 20% to 30% compared to the existing chillers.

#### **New condensing boilers**

Replace aging boilers; improve plant part load operation by installing modulating boilers and/or modular boiler plants that can effectively operate at low load conditions, without excessive cycling.

#### **Variable flow pumping retrofit - chiller plant**

Pump replacement offers the opportunity to improve the mechanical efficiency of the pumps. This measure applies primarily to chilled water pumping systems but can also be applied to condenser water systems in some plants.

#### **Variable flow pumping retrofit - boiler plant**

Upgrade of existing constant flow heating water systems to energy-saving variable flow can involve some or all of the following: new piping, new pumps and motors, valve upgrade or replacement, VFD installation, and new controls.

#### **Optimized VAV-central plant DDC package**

Optimize existing controls, or Install a direct digital control system that controls all elements of the HVAC system and is tightly scheduled for building occupancy and other exterior influences. The system should not only execute control functions, but also collect and archive relevant building performance data for use in M&V activities.

---

#### **Technical Addendum**

A technical addendum can be downloaded from Spark, with descriptions of each energy efficiency measure, in sufficient detail to understand the measure intent and performance assumptions. These measure descriptions also discuss certain implementation issues and construction options.





# SPARK Tool: Testimonial Video



<https://www.youtube.com/watch?v=biURp1P1jl8>



# SPARK Resources/Training

This page has registration links to all webinars: [www.betterbricks.com/trainings](http://www.betterbricks.com/trainings)

And here is a link to a recorded Spark webinar on the BetterBricks YouTube page:  
<https://youtu.be/yBxh2fTXxFA>

**UPCOMING:** Spark Tool – Assess your building’s potential (September 13th, 2017, 10 am)

Register Here: <https://attendee.gotowebinar.com/register/8245099538930073858>

The webinar will focus on how to leverage Spark’s integrated technical and financial reports to communicate the business case for building renewal projects. The webinar will include an overview of the building renewal strategy, a live demonstration of the Spark Tool, and a look at the customized integrated measure packages the Tool can create.

Presenters to include:

- Stan Price, Smart Building Center
- Emily Pearce, Waypoint
- Jeff Cole, Konstrukt

Earn Building Operator Certification Points



# Resources and Contacts

## University of Washington Integrated Design Lab (UW IDL)

- Technical Support – Building Renewal
- Recommended Opportunities
- Targeted Data Evaluation
- Targeted Simulation Support
- SPARK Tool Assistance

### Contact:

Christopher Meek: [cmeek@uw.edu](mailto:cmeek@uw.edu)

UW Integrated Design Lab

206-616-6566

<http://www.cidseattle.com/idl/>



# Project Goals: Refinement and Scalability

- UW IDL will document implementation of Building Renewal progress through June 2019
- Our aim is to better understand opportunities and barriers for implementation of deeper savings and building renewal concepts
- Our intent is documenting project specific services delivered, outcomes, and lessons learned, to share with service providers and the City of Seattle OSE
- Long term owner engagement and assistance will be developed through the SBC and IDL





SEATTLE  
BUILDING TUNE-UP ACCELERATOR

QUESTIONS OR  
FEEDBACK?

Thank you!





SEATTLE  
BUILDING TUNE-UP ACCELERATOR

# UTILITY INCENTIVE PROGRAMS

SEATTLE CITY LIGHT  
PUGET SOUND ENERGY  
SEATTLE PUBLIC UTILITIES  
(slides in other slide deck)



# Training Wrap Up & Questions

## Day 2 Review

- Building walk down and Asset Score practice
- Diagnostic Tool Lending Library resource
- Building Renewal and Spark Tool
- Utility Presentations



# Training Wrap Up & Next Steps

## **Next Steps**

- Please fill out the Evaluation Form
- Service Provider Agreement
- Help sign up buildings!







# SEATTLE BUILDING TUNE-UP ACCELERATOR



## EVALUATION FORM

# Helpdesk Support from SBC

Help Desk Hotline  
206-800-7211

Help Desk Email  
[accelerator@seattle.gov](mailto:accelerator@seattle.gov)





SEATTLE  
BUILDING TUNE-UP ACCELERATOR

THANK  
YOU!

