Join PSE’s Accelerator Program

- Joined December 2021
- Assisted by Stillwater Energy
- PSE Engineers

Assembled Team

- Owner
- Bldg. Mgr.
- Data Champion-Planning & Systems Mgr.
- Awareness Specialist
- Energy Manager
- Qualified Energy Auditor

Clean up Portfolio Mgr.

- Originally Installed with ESCO's
- Some missing buildings
- Some missing data
- Now all up and running
- Setup Sharing with Engineers

Find Quick Wins

- Went through each bldg. on Metasys
- Fixed quick items / adjustments to BAS
- Looked at operating schedules
- Reviewed PSE/ Stillwater recommendations
- Prioritized recommendations
HOW UW BOTHELL / CASCADIA COLLEGE APPROACHED COMPLIANCE CONT..

5th
Review EUI targets vs Actual
- Still need to complete
- District CW usage for Bldgs.
- Added BTU meters all Bldgs.
- Need 12 months of data

6th
Create Energy Mgmt. Plan
- Still Need to Complete

7th
Create O & M Plan
- We have documentation in our CMMS
- Need to complete plan

8th
Submit Documentation
- Still Need to Complete
- After Approval from Commerce
- Resubmit in 5 years
THANK YOU!

Anthony Guerrero, MBA, CEFP, CFM
Associate Vice Chancellor for Facilities
Services and Campus Operations
UW Bothell / Cascadia College
aguerrero@uw.edu
Cell: 425-750-9727
Desk: 425-352-3557
WSU – Key Stats

• (5) Campuses

• (14) Research and Extension Centers

• DM backlog exceeding $1.6B

• Inventory exceeding 20,000 gsf
  • (115) buildings/complexes
  • Total area ~11.3M gsf
• Target “two-fers” and “three-fers”

• Metering and data analytics

• District energy improvements vs. building

• Audits only when necessary!
• 2021 Audits
  • (5) Pullman buildings of different use types
  • EEMs identified ~$10M

• Extrapolated system-wide cost ~$100M

• Potential annual penalty ~$11.3M

• Funding Targets:
  • Internal REF
  • Minor Works
  • Major Capital Projects
Clean Buildings
Approach to compliance, implications for capital planning and funding requests

Path to Compliance

CLEAN BUILDINGS REQUIREMENTS

- Designated Energy Manager
- ESPM Benchmarking and Reporting
- Develop & Execute Energy Management Plan
- Develop Operations and Maintenance Program
- Determine & Comply with EUlt
Familiarity

► Understand the Clean Building Requirements
► Form an Energy Team
► Prepare Building Energy Scans
Starting the Process

► Establish and update Energy Star Portfolio Manager

► Determine Energy Use Intensity (EUI) for all buildings

► Calculate Energy Use Intensity Targets for each building

► Benchmark buildings using Portfolio Manager

8/19/2022
Create Compliance Path

- Identify low-cost/no-cost energy saving opportunities

- Prioritize Buildings and savings opportunities

- Develop Energy Management Plan and O & M Program
Establish a Compliance Plan

Opportunity Register

Checklists

Training
Engagement

► Establish a Clean Energy Team

► Build awareness and Communicate to Institution Community

► Create surveys, questionnaires, and other feedback loops

► Integrate continuous improvements and document everything
Metering

Submetering Guidance
Section 5.2 Building Energy Monitoring requires that energy-use data for each type of energy imported into and exported from the building be collected from utility or energy delivery bills or by monitoring local energy meters. Owner-provided energy meters shall meet the metering accuracy, tolerances and testing requirements of Title 480 WAC.

In lieu of Title 480 WAC, Commerce will also accept owner provide energy meters that meet the standards of WAC 51-11C-40904 Section C409.4- Measurement devices, data acquisition system and energy display (Section 409.4 of the Washington State Energy Code (WSEC)).

Understand what types of submeters are acceptable
# SPSCC – (5) Buildings Compliance Considerations

<table>
<thead>
<tr>
<th>Building Name</th>
<th>Building #</th>
<th>Floor Area (s.f.)</th>
<th>kWh</th>
<th>Lighting Cost</th>
<th>Lighting Energy Savings in kWh</th>
<th>Lighting cost savings</th>
<th>Lighting EUIt point reduction</th>
<th>Equivalent Solar System Size</th>
<th>Cost to implement Equivalent Energy Solar EUIt reduction</th>
<th>Solar EUIt point reduction</th>
<th>Commissioning Implementatio n cost</th>
<th>Commissioning Energy Savings Kwh</th>
<th>Commissionin g EUIt point reduction</th>
<th>Existin g EUIt</th>
<th>Target EUIt</th>
<th>Level 2 Energy Audit</th>
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<tr>
<td>Center for Student Success</td>
<td>Bldg. 22</td>
<td>89,308</td>
<td>500,000</td>
<td>$223,770</td>
<td>62,500</td>
<td>$5,000</td>
<td>3</td>
<td>65 kWdc</td>
<td>$292,500</td>
<td>$5,000</td>
<td>$1,786.1b</td>
<td>15,000</td>
<td>1</td>
<td>54.7</td>
<td>91.8</td>
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<tr>
<td>Kenneth J. Minnaert Center for the Arts</td>
<td>Bldg. 21</td>
<td>67,500</td>
<td>350,000</td>
<td>$168,750</td>
<td>43,750</td>
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<td>3</td>
<td>45 kWdc</td>
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<td>$3,500</td>
<td>$135,000</td>
<td>10,500</td>
<td>1</td>
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<td>Technical Education</td>
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<td>56,258</td>
<td>550,000</td>
<td>$140,645</td>
<td>68,750</td>
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<td>5</td>
<td>100 kWdc</td>
<td>$315,000</td>
<td>$5,500</td>
<td>$112,516</td>
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<td>3</td>
<td>132.3</td>
<td>112.2</td>
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<td>Natural Sciences</td>
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<td>51,884</td>
<td>900,000</td>
<td>$129,710</td>
<td>67,500</td>
<td>$5,400</td>
<td>5</td>
<td>70 kWdc</td>
<td>$315,000</td>
<td>$5,400</td>
<td>$155,652</td>
<td>27,000</td>
<td>4-8</td>
<td>346</td>
<td>112.2</td>
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<tr>
<td>Lacey Campus Building 1</td>
<td>LC Bldg. 1</td>
<td>52,657</td>
<td>450,000</td>
<td>$131,643</td>
<td>33,750</td>
<td>$2,700</td>
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<td>35 kWdc</td>
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### Scenario Planning
### Know your Utilities

<table>
<thead>
<tr>
<th>Location Description</th>
<th>Meter Number</th>
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<tr>
<td><strong>Bldg 35</strong></td>
<td>1378928</td>
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<table>
<thead>
<tr>
<th>Billing Period</th>
<th>Usage (Therms)</th>
<th>Current</th>
<th>Last Year</th>
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<tr>
<td>06/24/21-07/26/21</td>
<td>989.77</td>
<td>715.53</td>
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<tr>
<td>07/26/21-08/25/21</td>
<td>856.34</td>
<td>547.22</td>
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<tr>
<td>08/25/21-09/24/21</td>
<td>2,562.17</td>
<td>681.39</td>
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<tr>
<td>09/24/21-10/26/21</td>
<td>5,226.16</td>
<td>1,999.19</td>
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<td>10/26/21-11/24/21</td>
<td>6,262.77</td>
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<td>11/24/21-12/27/21</td>
<td>9,346.56</td>
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<td>12/27/21-01/26/22</td>
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<td>5,231.78</td>
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<td>01/26/22-02/24/22</td>
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<td>2/24/2022-03/28/22</td>
<td>11,975.32</td>
<td>4,614.79</td>
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<td>03/28/22-04/26/22</td>
<td>6,333.74</td>
<td>3,683.78</td>
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<tr>
<td>04/26/22-05/25/22</td>
<td>3,750.13</td>
<td>2,184.90</td>
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</table>

**Total** | 83,486.60 | 34,374.81

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Whoa!
Procurement Considerations

Capital Improvements

Submeters

Contracts/agreements

Operational Budget

Grants, incentives, rebates, fund raising
Washington Clean Buildings
Performance Standard: Applied to Campus Settings
Clean Building/Clean Campus

Why:

• Campus environs are unique, relative to the commercial building sector

• benchmark targets are a blunt tool

• align compliance with goals: efficiency/reduce carbon

• respect benefits of District Energy Systems,
Clean Building/Clean Campus

What: Subject Matter/scope

• Campus level reporting vs. building level reporting
• Unique mixed occupancy types
• Complex energy flows among campus buildings
• Avoid pitting campus utilities against building investments
OUR PROPOSAL

Establish a “Green Revolving Fund”
- an approach that invests verified utility bill savings into future energy projects
  - permanently reduces utility charges
  - supports meeting unfunded state/city sustainability mandates
  - avoids costly penalties and risk to UW prestige/reputation

Invest $17.8M in foundational energy systems (from various sources)
- needed to meet unfunded state/city sustainability mandates
- avoids costly penalties and risk to UW prestige/reputation

Create 7 new operating positions
- invest in metering (3), building automation controls (1), and building system data analytics (3)
  - needed to meet unfunded state/city sustainability mandates
  - avoids costly penalties and risk to UW prestige/reputation
PROJECTED UTILITY BUDGET WITHOUT GRF

normalized

not adjusted to reflect
• new buildings,
• intensification of space
• electrification
• weather variation

$M paid to utility companies

Anticipated ~3.5% commodity price increase
PROJECTED UTILITY BUDGET WITH GRF

Not adjusted to reflect:
- New buildings,
- Intensification of space,
- Electrification

- Additional avoided cost
- $ added to GRF
- $ paid to utility companies

FY23 FY24 FY25 FY26 FY27 FY28 FY29 FY30 FY31 FY32 FY33 FY34 FY35 FY36 FY37
GREEN REVOLVING FUND GOVERNANCE

FUND MANAGER (Facilities)
FINANCIAL MANAGER (Treasury)

Projects are identified & entered into Screening Tool

Projects are implemented
These are carefully chosen to ensure they will reduce energy

For the given cycle, a Balanced Portfolio of projects is selected

SUPPORT TEAM (reviews)
Associate VP Treasury
Associate VP Facilities Finance
Environmental Stewardship Committee
Faculty Committee on University Facilities & Services
Other Participating UW Entities

SIGN OFF
Executive Director of Energy Utilities & Operations

ADVISORY GROUP (2x/year)
Provost
Vice Provost
Vice President of Finance
Vice President of Facilities

Plan involves investing verified utility savings for future GRF projects
GREEN REVOLVING FUND GROWTH

- Additional Cost Avoidance
- Accumulated Utility Savings available for investment

Plan to invest Accumulated Utility Savings into the Energy Transformation Strategy

- self-sustaining by year 3

- $3M spent on efficiency measures each year
HEATING AND FOSSIL FUELS

- We presently consume natural gas to produce steam at our central plant, for the primary purpose of providing heat to our buildings.
URGENT ACTION REQUIRED!

93% of reportable emissions comes from the steam plant.

UW initial annual carbon liability between $3.7 and $5.2M.

Need a significant shift away from carbon sourced heating!
WE HAVE A STRATEGY!

- Energy Efficiency: 15% GHG reduction (2023-2028)
- Convert to Hot Water: 20% GHG reduction (2024-2029)
- Re-use and store Energy: 45% GHG reduction (2035-2038)
- Final Decarbonization: 2035-2050 (20% use Renewable Natural Gas, carbon capture or newly developed technologies to reach zero emissions.

UNIVERSITY of WASHINGTON
WE CAN/MUST USE LESS ENERGY

CLEAN BUILDING PERFORMANCE STANDARD
Mandate to reduce energy use ~45% by 2026
Non-compliance could result in fines as high as $26M/5 year by FY26

205K: UW average
160K: Research Peer average
118K: PAC12 average

(Sightlines data) Research peers:
Clemson U, MIT, Northwestern, The Ohio State U, U of Arkansas, U of Connecticut,
WHAT DO WE NEED TO DO?
OBJECTIVES

• Inspire & lead: model a path to meet environmental and financial challenges

• Support the UW mission:
  • cooling is no longer a luxury in the PNW
  • avoid regulatory penalties: avoid reputational risk of non-compliance
  • share: democratize actionable campus data and share with research
  • resilient: mitigate service disruption risk
    • no fossil fuels: eliminate dependency on fossil fuels
    • future proof: design to meet changing environmental conditions (climate adaptation)
    • optionality: flexibility to leverage future technologies
    • diversify: mitigate commodity risks/dependency

• Lowest cost: lowest total cost of ownership (CapEx/OpEx)
WHAT DO WE NEED TO DO...
FOUNDATIONAL SOLUTIONS

A. DATA

1. Metering
2. Controls
3. Data analytics
4. Accelerate energy efficiency (6x) - The "Green Revolving Fund"

B. DISTRICT ENERGY

1. Hot water (away from steam),
2. Centralized cooling,
3. Thermal storage & re-use, and
4. Reduce electrical demand.
2023-2028

DATA

- A4 Accelerate energy efficiency (GRF)
- Enable compliance

Add A1 meters
A2 building controls
A3 data analytics
# FUNDING REQUIRED – DATA (Part A) (in Millions)

<table>
<thead>
<tr>
<th></th>
<th>FY23</th>
<th>FY24</th>
<th>FY25</th>
<th>FY26</th>
<th>FY27</th>
<th>Total</th>
<th>Funded by</th>
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<tr>
<td>A.1 Metering</td>
<td>$1.5</td>
<td>$1.5</td>
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<td></td>
<td></td>
<td>$3.0</td>
<td>Capital Budget Request</td>
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<tr>
<td>A.2 Controls</td>
<td>$1.0</td>
<td>$1.0</td>
<td>$1.0</td>
<td>$1.0</td>
<td>$1.0</td>
<td>$5.0</td>
<td>“</td>
</tr>
<tr>
<td>A.3 Data analytics</td>
<td>$1.0</td>
<td>$1.0</td>
<td>$1.0</td>
<td>$1.0</td>
<td>$1.0</td>
<td>$5.0</td>
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<td>A.4 Accelerate energy efficiency</td>
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<td>Rebate Reserves</td>
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<td>Seed Funding</td>
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<td><strong>Total:</strong></td>
<td>$6.5</td>
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<td><strong>$17.8</strong></td>
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### SUMMARY OF POSITION NEEDS

<table>
<thead>
<tr>
<th>Position(s)</th>
<th>New positions</th>
<th>Impact ($M)</th>
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<tbody>
<tr>
<td>A.1 Metering</td>
<td>Establish metering crew</td>
<td>3 FTE</td>
</tr>
<tr>
<td>A.2 Controls</td>
<td>Building Automation Systems (BAS) Engineer</td>
<td>1 FTE</td>
</tr>
<tr>
<td>A.3 Data Analytics</td>
<td>Operations Technology Manager (BIT) Operations Technology Engineer Utilities Analyst</td>
<td>3 FTE</td>
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<tr>
<td><strong>Total:</strong></td>
<td><strong>7 FTE</strong></td>
<td><strong>$0.96</strong></td>
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</table>
HOT WATER

- Reduce waste
- Enable
  - Heat recovery
  - Non-fossil fuel

Transition from steam to hot water
CONSOLIDATE COOLING

- Increase reliability
- Most efficient use of electricity
- Enable heat recovery

Remove local chillers, At end-of-life
Add central chillers
2025-2035

STORE/REUSE ENERGY

- Improve reliability
- Help with electricity capacity constraint
- Improve equipment efficiency

Recover Heat from sewer

Recover Heat from central cooling towers

Add Thermal Storage
REDUCE ELECTRICITY DEMAND

- Free up capacity
- Increase resilience
- Reduce cost

On-site generation

Deep lake Cooling