Our Vision
All people live with dignity in safe, healthy and affordable homes within communities of opportunity
Today’s Discussion

- Background on the Exemplary Buildings (EB) Program
- An overview of the EB wall assembly/air leakage and balanced ventilation specifications and guidelines that have been developed
- Progress update on Phase 1 demonstration projects
Learning Objectives

1. Discuss the current Washington and Seattle targets for code-minimum energy efficiency of new building designs.

2. Describe the air leakage and balanced ventilation requirements required by the 2018 Washington and Seattle Energy codes.

3. Summarize the proposed specifications for air leakage and balanced ventilation defined by HDC's Exemplary Building Taskforce.

4. Identify the air/weather barrier and ventilation systems being used in HDC’s Exemplary Building Phase 1 demonstration projects.

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within communities of opportunity
We Have Both an Affordable Housing Crisis and a Climate Crisis
Our Affordable Housing Crisis is an Equity Crisis

Percentage of Cost-Burdened* King Co. Households, by Race (2017)

<table>
<thead>
<tr>
<th>Race</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLACK</td>
<td>56%</td>
</tr>
<tr>
<td>HISPANIC</td>
<td>51%</td>
</tr>
<tr>
<td>PACIFIC ISLANDER</td>
<td>47%</td>
</tr>
<tr>
<td>AMERICAN INDIAN</td>
<td>47%</td>
</tr>
<tr>
<td>MULTIPLE RACE</td>
<td>45%</td>
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<tr>
<td>ASIAN</td>
<td>36%</td>
</tr>
<tr>
<td>WHITE</td>
<td>35%</td>
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</table>

*A household is “cost-burdened” if their total housing expenses exceed 30% of their income.

SOURCE: King County Dept. of Community & Human Services; compiled by Community Attributes.
Pressures on the Affordable Housing Ecosystem

Housing Developers
- Deliver more units
- Adapt to ever-changing regulations
- Control construction costs

Asset/Property Managers
- Preserve quality inventory
- Recruit/retain great staff
- Spiraling maintenance & replacement costs

Community/Society
- Housing crisis
- Climate & environmental crises
- Evolving codes & regulations
Building Energy Efficiency Targets

- **WA State:** New buildings use 70% less energy by 2031
- **Seattle:** Carbon neutral by 2050 (maybe moving to 2030)
Building Energy Efficiency Targets

- **WA State:** New buildings use 70% less energy by 2031
- **Seattle:** Carbon neutral by 2050 (maybe moving to 2030)
- 2018 codes effective date moved from 7/1/20 to 2/1/21
On the Road to 2030

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Pressures on the Affordable Housing Ecosystem

- Deliver more units
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Exemplary Buildings Program

- Housing crisis
- Climate & environmental crises
- Evolving codes & regulations (see next slide for more on this)
What are Exemplary Buildings?

Exemplary Buildings are Ultra-Efficient Affordable Housing that:

• maximizes housing units produced,
• offers long-term life-cycle cost benefits, and
• provides an improved quality of life to residents.
EB Project Type Focus

- Affordable Multifamily Housing
  - Family
  - Senior
  - Supportive
- Midrise (4+ stories Type V or III over 1-2 stories of Type I construction)
- Electric resistance heat for dwelling units (no cooling)
- Central water heating systems
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**EB Program Goals**

- **2019-2021**
  - Demonstration Projects (4-8) and Program Materials Development
  - 6% Construction Premium

- **2022-2025**
  - Disseminate Learnings
  - Scale Up
  - 4% Construction Premium

- **2026+**
  - Ultra-Efficient Standard
  - All Affordable Housing
  - 2% Construction Premium

• Require Early Owner Commitment to High-Level EB Goals
• Pursue Utility Incentives and Other Grant Support
• Open-source Data Sharing of Project Design Information, Costs, and Performance
Our vision is rooted in data. The design and expected outcomes of our program are based on several successful implementations of the exemplary buildings model elsewhere, particularly those in Brussels, Pennsylvania, and Massachusetts.
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EBP Focus Topics
- Early Integrative Design
- Exterior Wall Assembly
- Domestic Water Distribution, Heating, and Management
- Balanced Ventilation & Heat Recovery
- Solar Integration
- Healthy Buildings
- Operations
## EBP Progress To Date

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Charettes</th>
<th>Design Guidelines</th>
<th>Promising Practices Workshop</th>
<th>Deeper Dive Workshops</th>
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<tr>
<td>Early Integrative Design</td>
<td>Completed, June 2020</td>
<td>In Process</td>
<td>Scheduled, 11/19/2020</td>
<td>2021</td>
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<tr>
<td>Wall Assembly</td>
<td>Completed, Oct 2019</td>
<td>Posted, May 2020</td>
<td>Completed</td>
<td>2021</td>
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<td>Solar Integration</td>
<td>Completed, July 2020</td>
<td>In Process</td>
<td>Completed, Nov 2020</td>
<td>2021</td>
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<tr>
<td>Healthy Building Materials</td>
<td>Future</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td>Future</td>
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</table>

https://exemplarybuilding.housingconsortium.org/our-results-practical-tools/
What is the Exemplary Buildings Task Force (EBTF)?
The EBTF is:

- Interdisciplinary team of professionals, primarily volunteers, coordinated by HDC.
- Broad scope & great depth of experience in the design, development, financing, and operations of affordable housing.
- Focused on eliminating the traditional cost trade-off between building performance and unit number.
- The promising practices we are documenting are being tested in several demonstration projects and are continuously revised based on project data.
## EBTF Core Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Company/Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Julie Banerjee</td>
<td>Seattle City Light</td>
</tr>
<tr>
<td>Becky Bicknell</td>
<td>Walsh Construction Co.</td>
</tr>
<tr>
<td>Brad Carmichael</td>
<td>JRS Engineering</td>
</tr>
<tr>
<td>Mark Deutsch</td>
<td>Volunteer, HDC</td>
</tr>
<tr>
<td>Steve Gelb</td>
<td>Emerald Cities Seattle</td>
</tr>
<tr>
<td>Joe Giampietro</td>
<td>JGA Consultants</td>
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<tr>
<td>Jon Heller</td>
<td>Ecotope</td>
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<tr>
<td>Alistair Jackson</td>
<td>O’Brien360</td>
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<tr>
<td>Marty Kooistra</td>
<td>HDC</td>
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<tr>
<td>Kasey Liedtke</td>
<td>Bellwether Housing</td>
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<tr>
<td>Ryan Meno</td>
<td>Rafn Company</td>
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<tr>
<td>David Reddy</td>
<td>O’Brien360</td>
</tr>
<tr>
<td>Loren Tierney</td>
<td>HDC</td>
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<tr>
<td>Dan Whitmore</td>
<td>RDH Building Science, Inc.</td>
</tr>
</tbody>
</table>

### Our Vision

All people live with dignity in safe, healthy and affordable homes within **communities of opportunity**
EBTF’s promising practices are relevant to all housing, not just to “exemplary” buildings.
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All people live with dignity in safe, healthy and affordable homes within communities of opportunity

EB Program Targets
High-Level

- All electric (no use of fossil fuels, with exception for emergency power systems).
- **Exemplary building envelope.**
- **Balanced ventilation with heat recovery.**
- Electric heat pump domestic hot water with efficient distribution design.
- Energy Star appliances and efficient lighting.
- Low-flow fixtures to conserve water and lower utility costs.
- Design for maximum renewable energy on-site & install when feasible.
- Ensure appropriate commissioning to achieve intended performance.
Whole Building Design

- Integrated design starting from Schematic Design [SD]
- Whole building energy modeling to inform energy & water optimization
- Recommended ratio of enclosure volume to floor area ≤ 1.0
- Advanced framing used in structure
- Back-to-back bathrooms recommended
- Window-to-wall ratio < 25%
- Target one of the following energy targets:
  - ≤ 20 EUI;
  - <50% of 2015 WSEC or <40% 2015 SEC baseline
  - Meet PHIUS+ 2018 standard

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Enclosure

- Review and reduce thermal bridging
- Window average U-value ≤ 0.22; optimize SHGC by facade
- Slab-on-grade ≥ R-10 continuous insulation w/ R-5 thermal break
- Above-grade floors ≥ R-35
- Above-grade wall assemblies ≥ R-22
- Roof assembly ≥ R-49
- Measured air leakage ≤ 0.17 cfm/ft² @ 75 Pa
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M/E/P

- Balanced ventilation with heat recovery
- Electric heat pump DHW with efficient distribution design
- Energy Star appliances and efficient lighting
- Design for maximum renewable energy
- Low-flow fixtures
- Third-party commissioning
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Wall Assembly Guideline Goals

• Provide cost effective wall assemblies that achieve Exemplary Building specs
• Use simple & commonly constructed approaches for easy adoption.
• Cover typical assembly structures – wood frame, steel stud, concrete.
• Address Air, Water, Thermal & Vapor Control.
Exemplary Wall Performance Targets

- Improved Building Air Tightness (<0.17 cfm75/sf)
- Wall Assembly Effective R-22 (U-0.045)
- Minimize Thermal Bridging
**Comparison To Codes – New and Old**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>U = 0.054 (R = 21)</td>
<td>U = 0.051 (R = 25)</td>
<td>U = 0.045 Effective (R = 31)</td>
<td></td>
</tr>
<tr>
<td>Airtightness (Typical)</td>
<td>0.30+ cfm75/sf</td>
<td>0.25-0.40 cfm75/sf</td>
<td>0.17 cfm75/sf</td>
</tr>
<tr>
<td>Airtightness (C406)</td>
<td>0.25 cfm75/sf</td>
<td>0.17 cfm75/sf</td>
<td>0.17 cfm75/sf</td>
</tr>
</tbody>
</table>
R-22 Overall Wood Wall Assemblies

https://exemplarybuilding.housingconsortium.org/2020/05/19/just-released-guidelines-for-wall-assemblies-1-0/
Current Recommendations for Achieving Air Leakage Target

- Attention to detailing, air barrier continuity
- Current thinking on achieving EBP air leakage target
  - Self-adhered membrane
  - Sheet good WRB with sealed sheathing
  - Sheet good WRB wrap with AeroBarrier
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Balanced Ventilation

- Why is the ventilation strategy important?
- Where has our ventilation air been coming from?
  - Trickle vents, leakage through the enclosure, open windows
- How does the strategy need to change as building envelopes improve?
- Given a choice, what is the best way to provide fresh air?

https://ejscreen.epa.gov/mapper/
# Balanced Ventilation + Heat Recovery (BV+HR)

**PLUSES (+)**
- Better indoor air quality
  - Reliable volume of filtered outside air
  - Not breathing your neighbors air
  - Don’t need to leave windows open
- Reduces risk of building envelope failures
- Reduces energy consumption, esp. if using electric resistance heat
- Can make building tighter

**MINUSES (-)**
- Increases capital and maintenance costs
- Takes more effort to design and optimize
- Takes up valuable roof and/or floor space
- Can use more energy if not optimized (particularly fan power)
## 2018 Commercial Energy/Mech Code

<table>
<thead>
<tr>
<th>Group R-2 Dwelling Unit Ventilation</th>
<th>2015</th>
<th>2018</th>
</tr>
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<tbody>
<tr>
<td>Wood-framed Wall Insulation</td>
<td>R-21 cavity (U-0.054)</td>
<td>R-25 cavity (U-0.051)</td>
</tr>
<tr>
<td>Envelope Air Leakage</td>
<td>0.40 cfm75/ft², do not need to achieve (remedy/retest only)</td>
<td>0.25 cfm75/ft², <strong>must</strong> achieve 0.40 cfm75/ft² at most</td>
</tr>
<tr>
<td>C406 Compliance</td>
<td>(2) <strong>options</strong> for Code, (3) for ESDS 5.1A</td>
<td>6* <strong>credits</strong> for code, <strong>No additional for ESDS (for now)</strong></td>
</tr>
<tr>
<td>Group R-2 Corridor Ventilation</td>
<td>0.12 cfm/ft²</td>
<td>0.06 cfm/ft²</td>
</tr>
</tbody>
</table>

* Draft Seattle Energy Code requirement is to require 8 credits
What is Balanced Ventilation?

• Has both supply and exhaust fans with airflow within 10% or 5 cfm (whichever is greater) of each other
• Intermittent dryer, range, and bathroom exhaust does not need to be balanced
• Can have “distributed” or not distributed exhaust system
• Operates continuously and must be separate from HVAC system*

*WSMC has provisions for intermittent operation and ventilation combined with HVAC equipment if additional requirements are met.
Minimum Flow Rates

Table C403.4.2*  
*25-30% Lower Than 2015 WSMC

<table>
<thead>
<tr>
<th>DWELLING UNIT</th>
<th>NUMBER OF BEDROOMS</th>
<th>0-1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 or more</th>
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<tbody>
<tr>
<td>FLOOR AREA (square feet)</td>
<td>Airflow in CFM*</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>&lt; 500</td>
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<td>30</td>
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<td>501 – 1,000</td>
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<td>65</td>
<td>75</td>
<td>80</td>
<td>90</td>
<td>95</td>
</tr>
</tbody>
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-OR-

Q_r = 0.01*A_floor + 7.5*(N_br + 1)  
Equation 4-10

<table>
<thead>
<tr>
<th>Floor Area (ft2)</th>
<th>0-1BR</th>
<th>2BR</th>
<th>3BR</th>
<th>4BR</th>
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<tr>
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<td>30</td>
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<tr>
<td>1200</td>
<td>30</td>
<td>35</td>
<td>45</td>
<td>50</td>
</tr>
</tbody>
</table>

a. Minimum airflow (Q_r) is set at not less than 30 CFM for each dwelling unit.

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Distributed vs Non-Distributed

**Distributed:** Ventilation system supplies outdoor air directly (not transfer air) to each dwelling or sleeping unit habitable space, (living room, den, office, interior adjoining spaces or bedroom), and **exhausts air from all kitchens and bathrooms directly outside.**

If system **is not** distributed, minimum flow rates are increased by 25%. This generally results in 30% more when rounding up to nearest 5 cfm.
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Floor Plan Image Credit: Walsh Construction Co. CEDC Project
Heat Exchanger (HX) Types

Plate

Wheel

Unitized “Ductless”

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EB BV+HR Guidelines

EB Guidelines focus on educating teams on performance factors and pros/cons of system types

• System Layout Options
• Heat Exchanger Types
• System Fan Power
• Effectiveness Ratings
• Cross Leakage
• Filters
• Commissioning Review and Testing
• O&M

Fill in gaps on code requirements and best practices
SARS-CoV-2 (COVID-19)

ASHRAE Position Statement on infectious aerosols and building type recommendations
https://www.ashrae.org/technical-resources/resources

Taylor Engineering white paper

Please provide any other resources you might have to share!
System Layout Options

Option A – Centralized, for entire building/wing
Option B – Centralized, stack by stack
Option C – Centralized, floor-by-floor
Option D – Unitized

GOAL is to eliminate costly requirements for fire and/or smoke dampers on any ducts that pass through or terminate in units
A) Centralized Layout #1

*Vertical duct work is 4” round metal duct home runs to trunk duct in ceiling on top floor. No rated shafts or fire/smoke dampers are required if duct penetrates <3 floor assemblies (IBC 717.6.1 Exception) and AHJ approves code alternate of trunk duct above rated corridor ceiling as being ‘exterior’ the building.

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Hobson Place S (DESC)

Centralized, Whole Building Layout
- 4 stories residential – 96 units
- Three roof-top ERVs
- Architect – Runberg Architecture
- Engineer – Rushing

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B) Centralized Layout #2

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**Stack by Stack**

**PLUSES (+)**

- LESS DUCTING THAN OPTION A)
- FEWER DWELLINGS AFFECTED BY EQUIPMENT SERVICE SHUT DOWN
- NO BUILDING HEIGHT IMPACTS
- MAY REQUIRE LESS SOFFITING DEPENDING ON WHERE VERTICALS ARE LOCATED
- TENANT CAN’T SHUT-OFF

**MINUSES (-)**

- MORE ERVs THAN OPTION A AND B)
- SERVING 5+ FLOORS OF UNITS ADDS MORE COSTLY REQUIREMENTS
- AIR FLOW RATE IS VARIABLE ONLY ON A STACK-BY-STACK BASIS
- INTAKE/EXHAUST SEPARATION MORE DIFFICULT TO ACHIEVE
- TYPICALLY HIGHER FAN POWER
- CROSS-LEAKAGE BETWEEN UNITS POSSIBLE

---

*Vertical duct work is 4” round metal duct home runs supply plenum. No rated shafts or fire/smoke dampers are required if duct penetrates <3 floors assemblies (IBC 717.6.1) and duct runs are up to “exterior”. Otherwise rated shafts are required or fire wrapping of duct(s) that pass through more than 3 floors.*
Estelle (DESC)

Centralized, Stack-by-stack Layout

- 5 stories residential – 92 units
- One HRV for stack of two units (9 ERVs)
- Architect – SMR Architects
- Engineer – US Mechanical
C) Centralized Layout #3

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*Fire dampers not required where passing through fire partitions like corridor walls or passing over dwelling units if meets one of the exceptions of WSBC 717.5.4.

Floor by Floor

PLUSES (+)
- LESS DUCTING THAN CENTRAL DISTRIBUTION
- MORE ROOF AREA AVAILABLE ON THAN OPTION A) OR B)
- SERVING 5+ FLOORS WON’T ADD MORE COSTLY REQUIREMENTS
- NO VERTICAL SHAFTS
- LIKELY LOWEST EQUIPMENT REPLACEMENT COST
- TENANT CAN’T SHUT-OFF

MINUSES (-)
- MORE ERVs THAN OPTION A)
- SPACE REQUIRED ON EACH FLOOR FOR ERV, MAY REQUIRE ADDITIONAL HEIGHT ON EVERY FLOOR
- EXHAUST SEPARATION MORE CHALLENGING
- RATE IS VARIABLE ONLY ON A FLOOR-BY-FLOOR BASIS
- TYPICALLY HIGHER FAN POWER
- CROSS-LEAKAGE BETWEEN UNITS POSSIBLE
C) Centralized Layout #3

Common variations on the floor-by-floor distribution approach:

• ERV on each floor, but exhaust and/or supply ducts up to roof (instead of horizontally out of building)
• ERV on roof, and duct down to each floor (requires F/S dampers at each floor)
• Trunk duct running in ceiling above units
SOLIS (Solterra)

Floor by Floor layout
• 5 stories residential – 45 units
• One HRV on each floor
• Architect – Weber Thompson
• Engineer – Emerald Aire
Ductwork in Corridor

How to get more height in the corridor for ductwork?

Use car-decking instead of joists!

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Image credit: Walsh Construction Co. CEDC Project
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D) Unitized Layout

**PLUSES (+)**
- **ALL DUCTING WITHIN UNITS**
- **VARIABLE AIR FLOW CONTROL ON PER UNIT BASIS**
- **FEWER DWELLINGS AFFECTED BY EQUIPMENT SERVICE SHUTDOWN**
- **NO BUILDING HEIGHT IMPACTS**
- **NO REDUCTION OF ROOF AREA**
- **NO CROSS-LEAKAGE BETWEEN UNITS**
- **TYPICALLY LOWER FAN POWER**

**MINUSES (-)**
- **A LOT MORE ERVs THAN CENTRALIZED OPTIONS**
- **NEED TO ENTER UNIT TO MAINTAIN**
- **TENANT CAN SHUT OFF**
- **HIGHER INITIAL AND REPLACEMENT EQUIPMENT COSTS**
- **A LOT MORE EXTERIOR WALL PENETRATIONS, INTAKE/EXHAUST SEPARATION MAY BE DIFFICULT TO ACHIEVE**

*WSMC 401.4 includes exception to 10ft supply/exhaust separation is using factory-built intake/exhaust combination termination fitting. Seattle may not adopt this Exception.*
## Centralized vs In-Unit

<table>
<thead>
<tr>
<th>Centralized Ventilation System(s)</th>
<th>In-Unit Ventilation Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PLUSES (+)</strong></td>
<td></td>
</tr>
<tr>
<td>• Tenants can’t turn off ventilation</td>
<td>• Potentially lower total first cost</td>
</tr>
<tr>
<td>• No intake/exhaust penetrations at each unit exterior</td>
<td>• No cross-leakage of air between units</td>
</tr>
<tr>
<td>• Consolidates equipment maintenance/replacement</td>
<td>• Energy to run system is on tenant meter</td>
</tr>
<tr>
<td>• Can provide both unit and common area ventilation</td>
<td>• Some models offer an occupant-controlled boost (temporarily increase ventilation rate)</td>
</tr>
<tr>
<td>• Can have bypass, and even heating/cooling coils</td>
<td>• Fan energy typically lower</td>
</tr>
<tr>
<td>• Typically can have higher energy recovery efficiency</td>
<td></td>
</tr>
<tr>
<td>• Usually easier to isolate unit for sound</td>
<td></td>
</tr>
<tr>
<td>• Can accommodate larger filters</td>
<td></td>
</tr>
<tr>
<td>• Filter replacement less costly</td>
<td></td>
</tr>
<tr>
<td><strong>MINUSES (-)</strong></td>
<td></td>
</tr>
<tr>
<td>• Potentially higher first cost (primarily for ductwork)</td>
<td>• Maintenance/replacement is highly distributed</td>
</tr>
<tr>
<td>• Energy to run system(s) is on house meter</td>
<td>• Residents can turn off</td>
</tr>
<tr>
<td>• Can be a small amount of cross-leakage of air between units</td>
<td>• More costly to replace</td>
</tr>
<tr>
<td>• No boost control for individual units</td>
<td>• Intake/exhaust penetrations at each unit*</td>
</tr>
<tr>
<td>• Balancing of air flows across many registers or using constant airflow regulators.</td>
<td>• Lower cost models don’t include a bypass</td>
</tr>
<tr>
<td>• Fan energy typically higher</td>
<td>• Can be noisy if not properly designed/isolated</td>
</tr>
</tbody>
</table>

*Per WSMC C401.4, integrated supply/exhaust factory hoods are anticipated to be an approved option outside Seattle.
### Ventilation Layout Matrix

<table>
<thead>
<tr>
<th>System Option</th>
<th>Costs</th>
<th>Building Design</th>
<th>Bldg/Mech Codes</th>
<th>Service/Operations</th>
</tr>
</thead>
</table>
| **A) Centralized, for Building** | Equipment: Lower  
Ducting: Highest  
*Overall Initial: Likely highest*  
Replacement: Lowest | Likely increases height of top floor for horizontal ductwork  
Space required on roof | Serving 5+ floors triggers added cost for rated shaft  
Intake/exhaust separations on roof | Home access not required  
Service interruption impacts most/all of homes  
Fewest filter replacement locations |
| **B) Centralized, by Stack** | Equipment: Medium  
Ducting: Medium  
*Overall Initial: Medium*  
Replacement: Medium | No impact on building height  
More space required on roof | Serving 5+ floors triggers added cost for rated shaft  
Intake/exhaust separations on roof | Home access not required  
Service interruption impacts only one stack  
Reduced filter replacement |
| **C) Centralized, by Floor** | Equipment: Medium  
Ducting: Medium  
*Overall Initial: Medium*  
Replacement: Medium | Likely no impact on building height  
Space required on each floor | Fire/smoke dampers generally not required  
Intake/exhaust separations on façade (unless ducted to roof) | Home access not required  
Service interruption impacts only one floor  
Reduced filter replacement |
| **D) Unitized** | Equipment: Higher  
Ducting: Lowest  
*Overall Initial: Likely lowest*  
Replacement: Highest | No impact on building height  
Penetration(s) at each unit | No fire/smoke dampers required  
Intake/exhaust separations on façade | Home access required  
Service interruption impacts only one home  
More filters to replace |
EB Ventilation Recommendations

- Analyze distribution approaches early in schematic design using an integrative design team, including at minimum the architect, engineer, GC, and mechanical subcontractor.
- Sensible effectiveness ≥75%
- System design fan power ≤0.8 W/cfm, including MERV-13 filtration
- Continuous operation, separate from heating/cooling system
- Serve corridors and other common areas with DOAS to achieve C406.6
- Central systems have <3% cross-leakage
- Local kitchen exhaust ducted to exterior, make-up air by opening operable window. Recirc hoods only considered for studio/1-BR units where less cooking is anticipated
- In-unit laundry area, if provided, is within bathroom or kitchen area, and uses heat pump dryer
## EB Recommendations (Compared to WSEC)

<table>
<thead>
<tr>
<th></th>
<th>2018 WSEC</th>
<th>Exemplary Building</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Effectiveness</strong></td>
<td>≥60% sensible</td>
<td>≥75% sensible</td>
</tr>
<tr>
<td></td>
<td>C406.6: 60%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C406.7: 80%</td>
<td></td>
</tr>
<tr>
<td><strong>Fan Power</strong></td>
<td>Unitized, &lt;400cfm: No limit*</td>
<td>0.8 W/cfm</td>
</tr>
<tr>
<td></td>
<td>Centralized, &lt;5hp: No limit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Centralized, &gt;5hp: ~0.8 W/cfm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C406.6: 1.0 W/cfm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C406.7: 0.5 W/cfm</td>
<td></td>
</tr>
<tr>
<td><strong>Distribution</strong></td>
<td>Distributed or not distributed exhaust</td>
<td>Distributed exhaust</td>
</tr>
<tr>
<td><strong>Cross-Leakage</strong></td>
<td>&lt;10%</td>
<td>&lt;3%</td>
</tr>
</tbody>
</table>

* Limit for ERV/HRV systems in 2018 WSEC Residential code is 0.83 W/cfm
BV+HR Summary and Conclusions

Balanced ventilation with heat recovery:

• Has IAQ/building durability benefits in addition to saving energy

• Is a significant change, we need to collaborate and share knowledge to help reduce cost

• Requires an early integrative design approach to be maximize efficiency and sustain long-term operation.
## EBP Demonstration Projects

<table>
<thead>
<tr>
<th></th>
<th>Othello Square Bldg D</th>
<th>Hobson Place South</th>
<th>Sawara (Yesler 7.3)</th>
<th>North Lot</th>
<th>Samma</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Developer</strong></td>
<td>Homesight</td>
<td>DESC</td>
<td>SHA</td>
<td>SCIDpda</td>
<td>Imagine Housing</td>
</tr>
<tr>
<td><strong>Project Type</strong></td>
<td>Family (Coop)</td>
<td>Supportive</td>
<td>Family</td>
<td>Family</td>
<td>Senior</td>
</tr>
<tr>
<td><strong>Phase</strong></td>
<td>CDs</td>
<td>Construction</td>
<td>CDs</td>
<td>DD</td>
<td>SD</td>
</tr>
<tr>
<td><strong>Wood Walls</strong></td>
<td>2x6 R-21 Int.</td>
<td>2x8 R-31 Int.</td>
<td>2x8 R-31 Adv</td>
<td>2x8 R-31 Int</td>
<td>2x6 R-21 Int.</td>
</tr>
<tr>
<td><strong>Air Leakage Target</strong></td>
<td>0.25 cfm75/sf</td>
<td>0.08 cfm75/sf</td>
<td>0.17 cfm75/sf</td>
<td>0.17 cfm75/sf</td>
<td>0.08 cfm75/sf</td>
</tr>
<tr>
<td><strong>Air/Weather Barrier</strong></td>
<td>Building Wrap</td>
<td>SAM</td>
<td>SAM</td>
<td>SAM</td>
<td>SAM</td>
</tr>
<tr>
<td><strong>Ventilation Strategy</strong></td>
<td>WH Exhaust</td>
<td>Centralized #1</td>
<td>Unitized</td>
<td>Unitized</td>
<td>Centralized #1</td>
</tr>
<tr>
<td><strong>Certification Target</strong></td>
<td>ESDS</td>
<td>ESDS PHIUS+ 2018</td>
<td>ESDS</td>
<td>ESDS</td>
<td>ESDS PHIUS+ 2018</td>
</tr>
<tr>
<td><strong>Additional Funding Sources</strong></td>
<td>SCL EB</td>
<td>SCL EB HTF UHEE</td>
<td>SCL EB</td>
<td>SCL EB</td>
<td>HTF UHEE</td>
</tr>
</tbody>
</table>

### Our Vision
All people live with dignity in safe, healthy and affordable homes within communities of opportunity.
Our Vision
All people live with dignity in safe, healthy and affordable homes within communities of opportunity
Thank You!

Check out the Exemplary Buildings Program website
https://exemplarybuilding.housingconsortium.org

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