Seattle Building Enclosure Council

Fall 2020 Presentation Series

HDC Exemplary Buildings Guidelines on Air Tightness and Balanced Ventilation

November 19th, 2020

David Reddy, PE

O'Brien360

Our Vision

All people live with dignity in safe, healthy and affordable homes within **communities of opportunity**

HOUSING DEVELOPMENT *consortium*

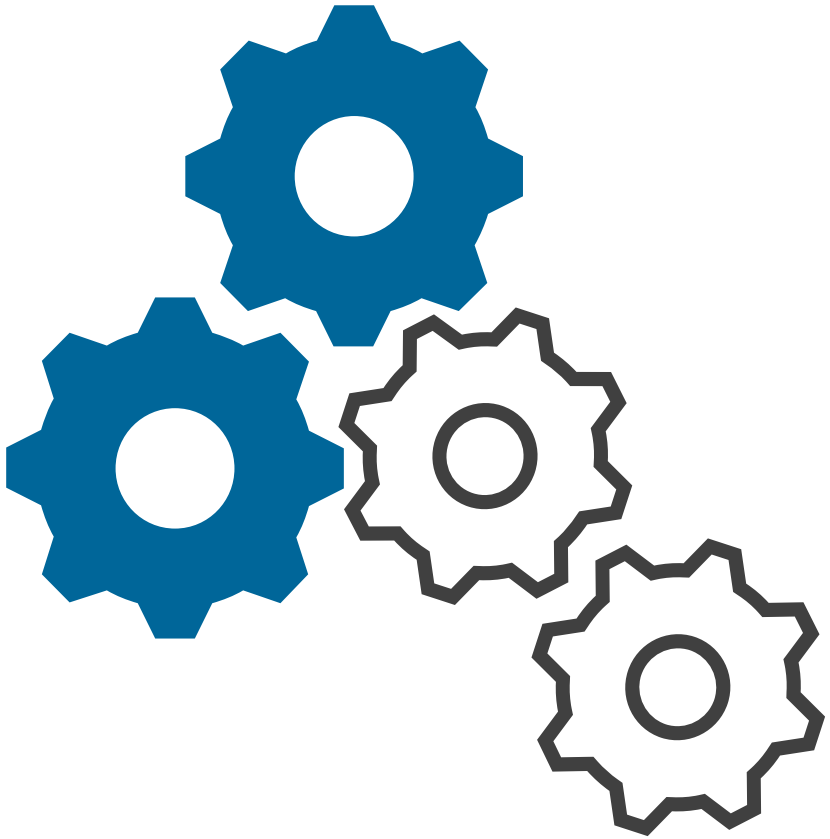
Today's Discussion

- 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

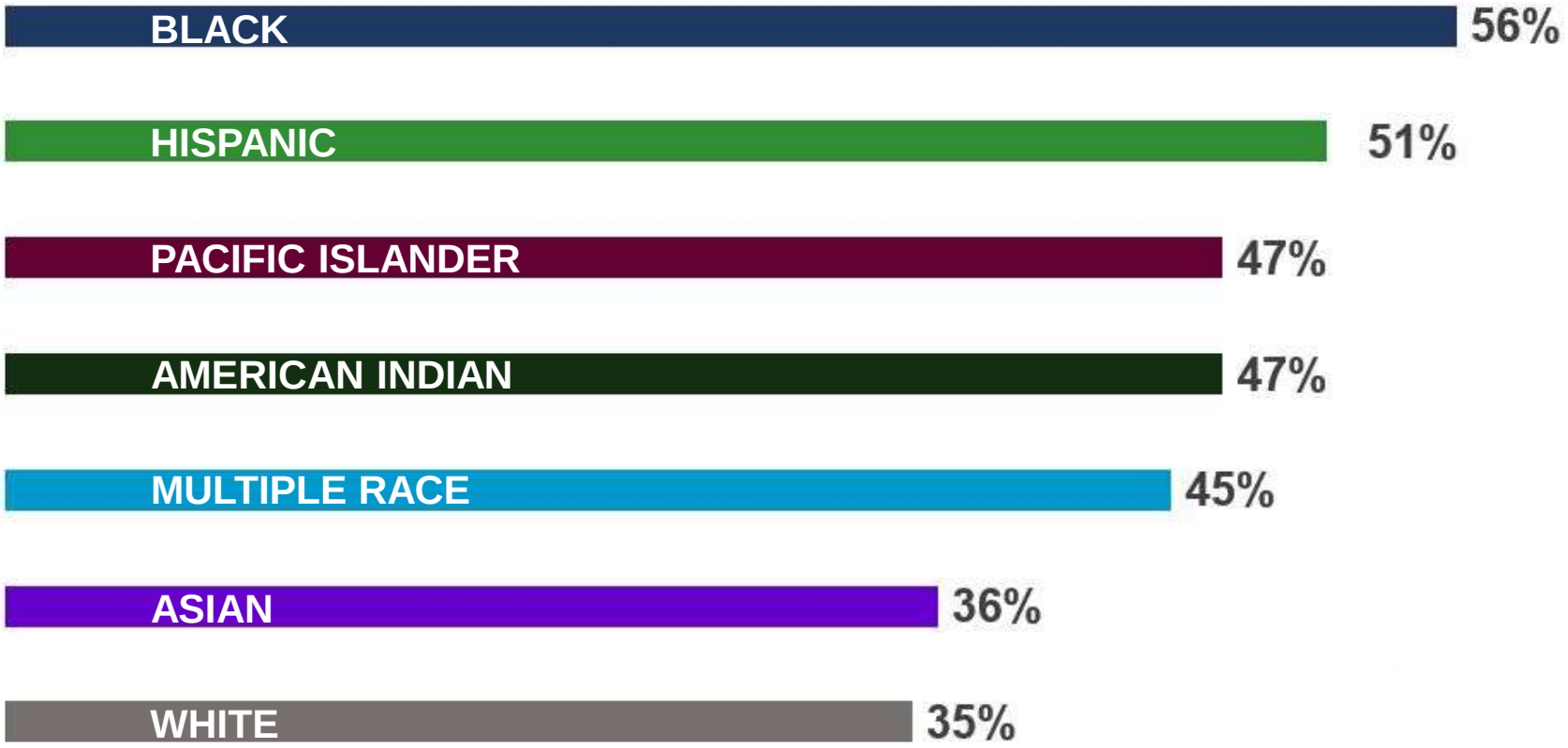
The Current Context



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)



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.

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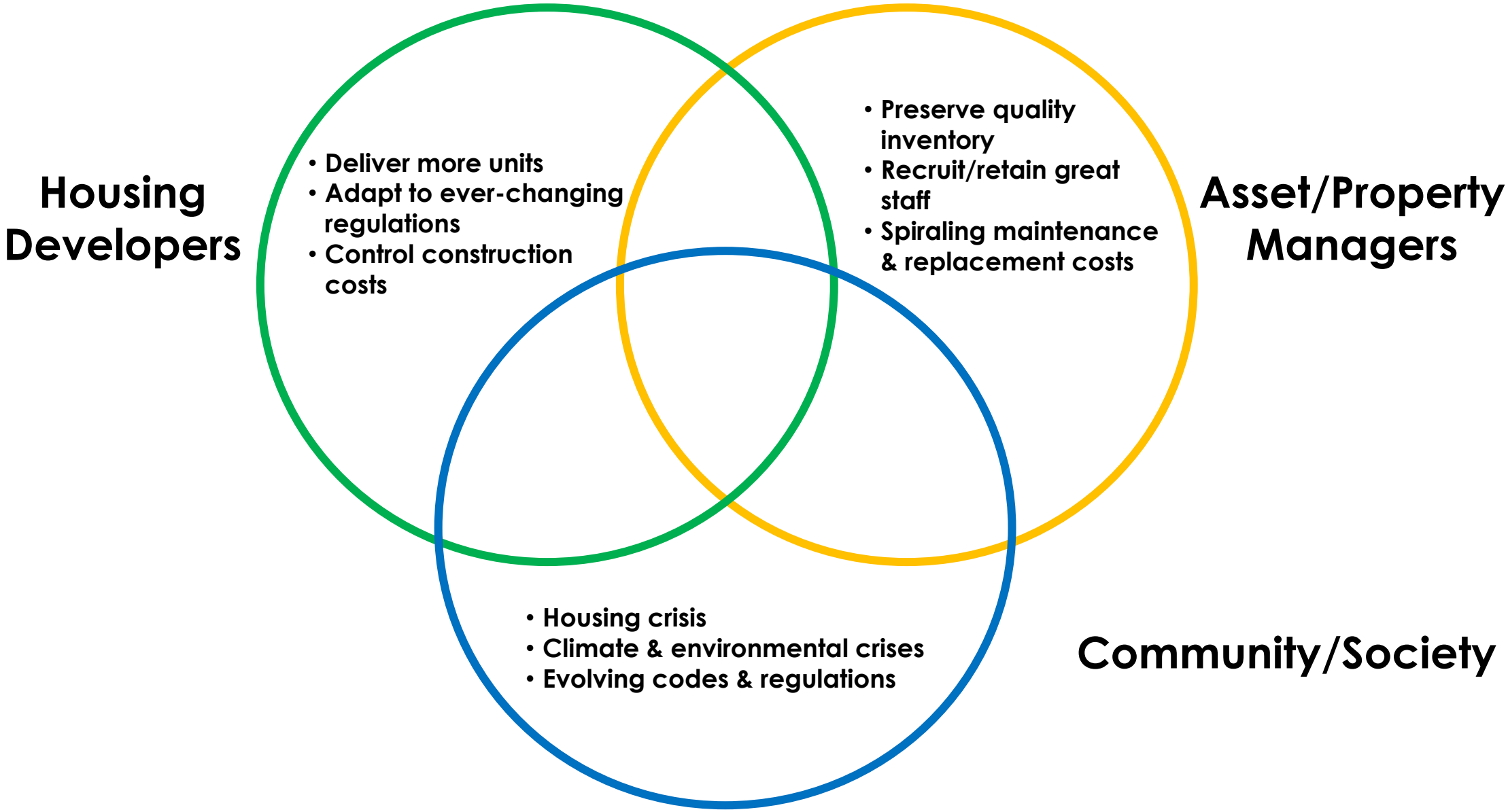
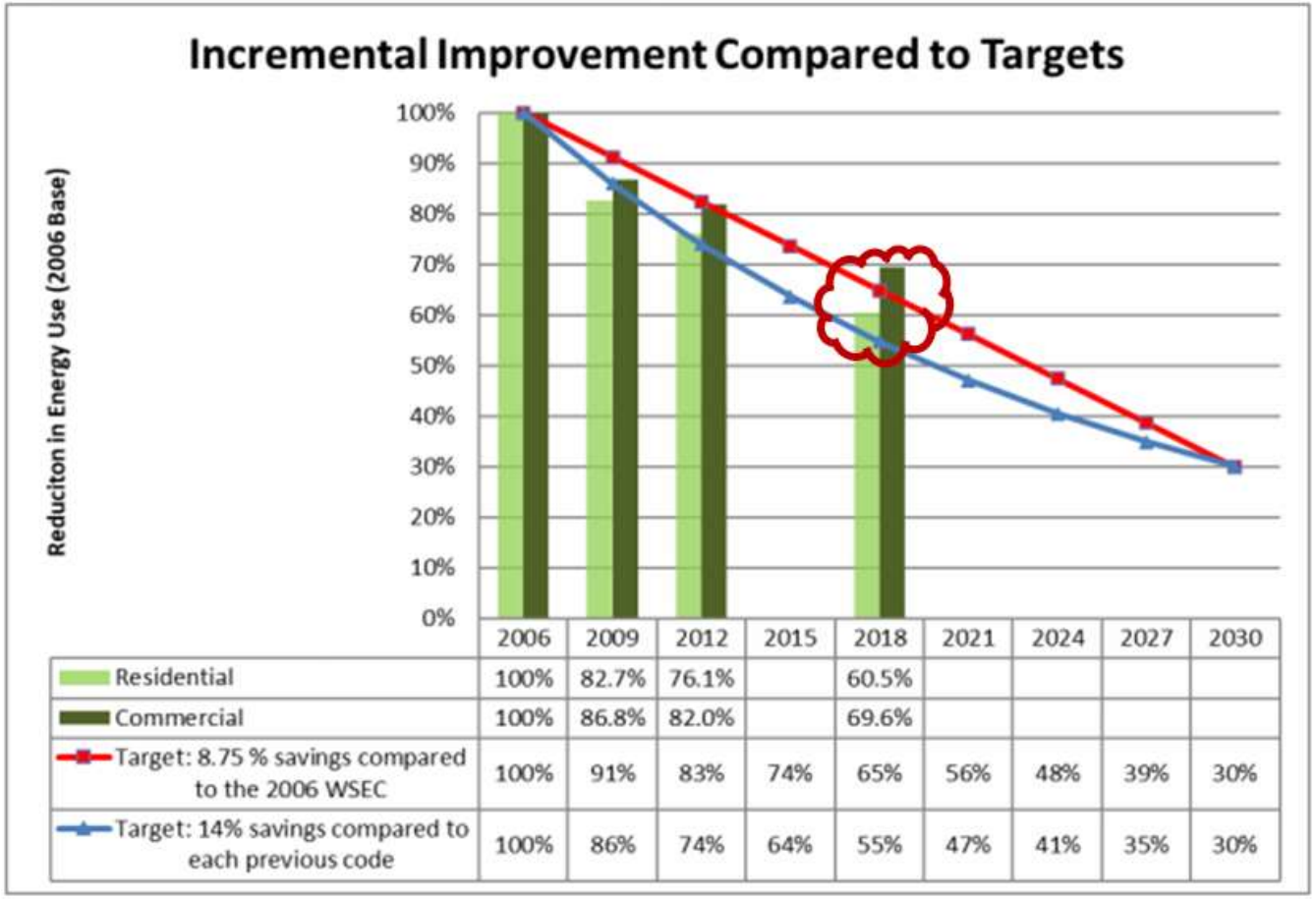
Pressures on the Affordable Housing Ecosystem



Building Energy Efficiency Targets

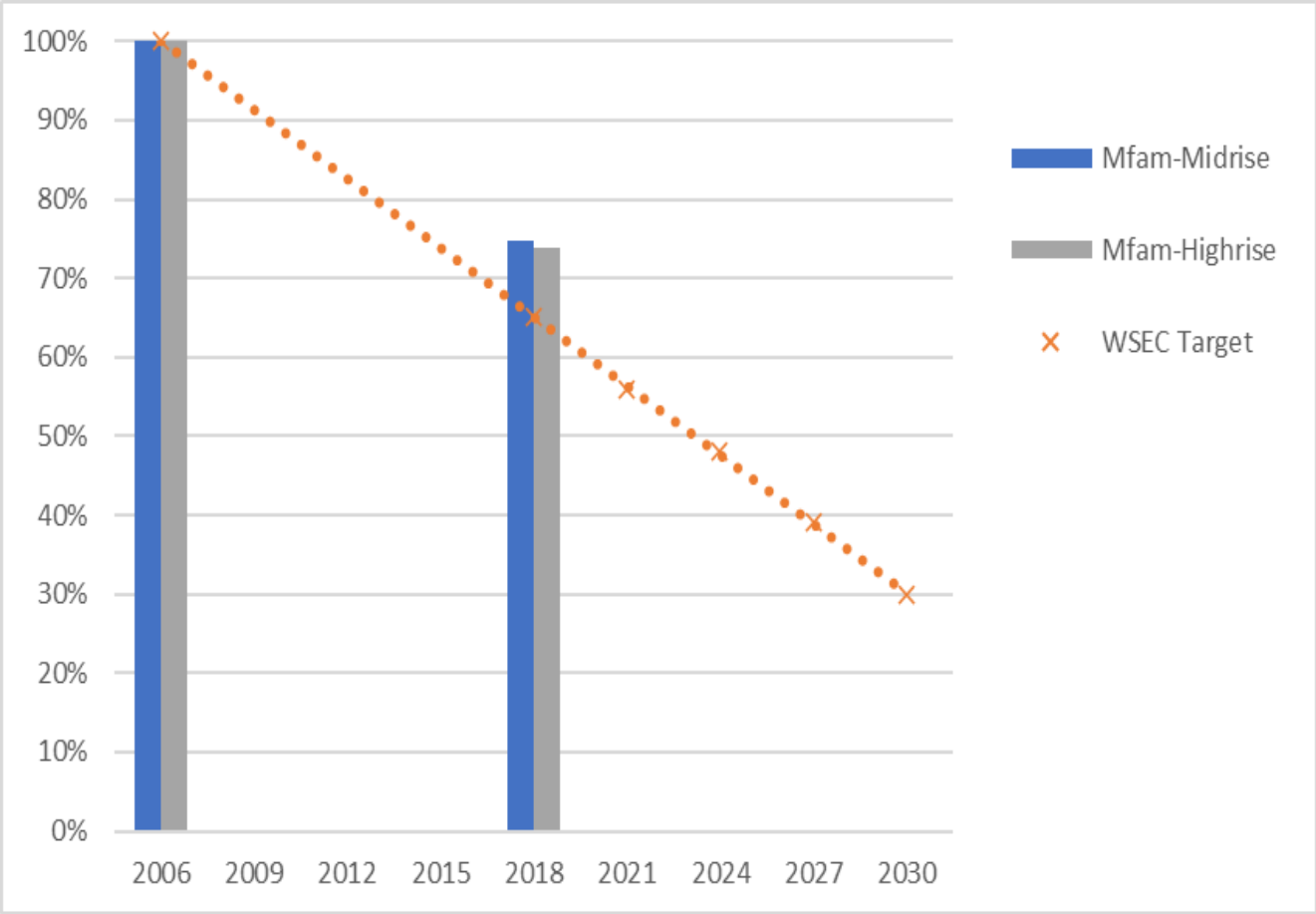
- **WA State:** New buildings use 70% less energy by 2031
- **Seattle:** Carbon neutral by 2050 (maybe moving to 2030)



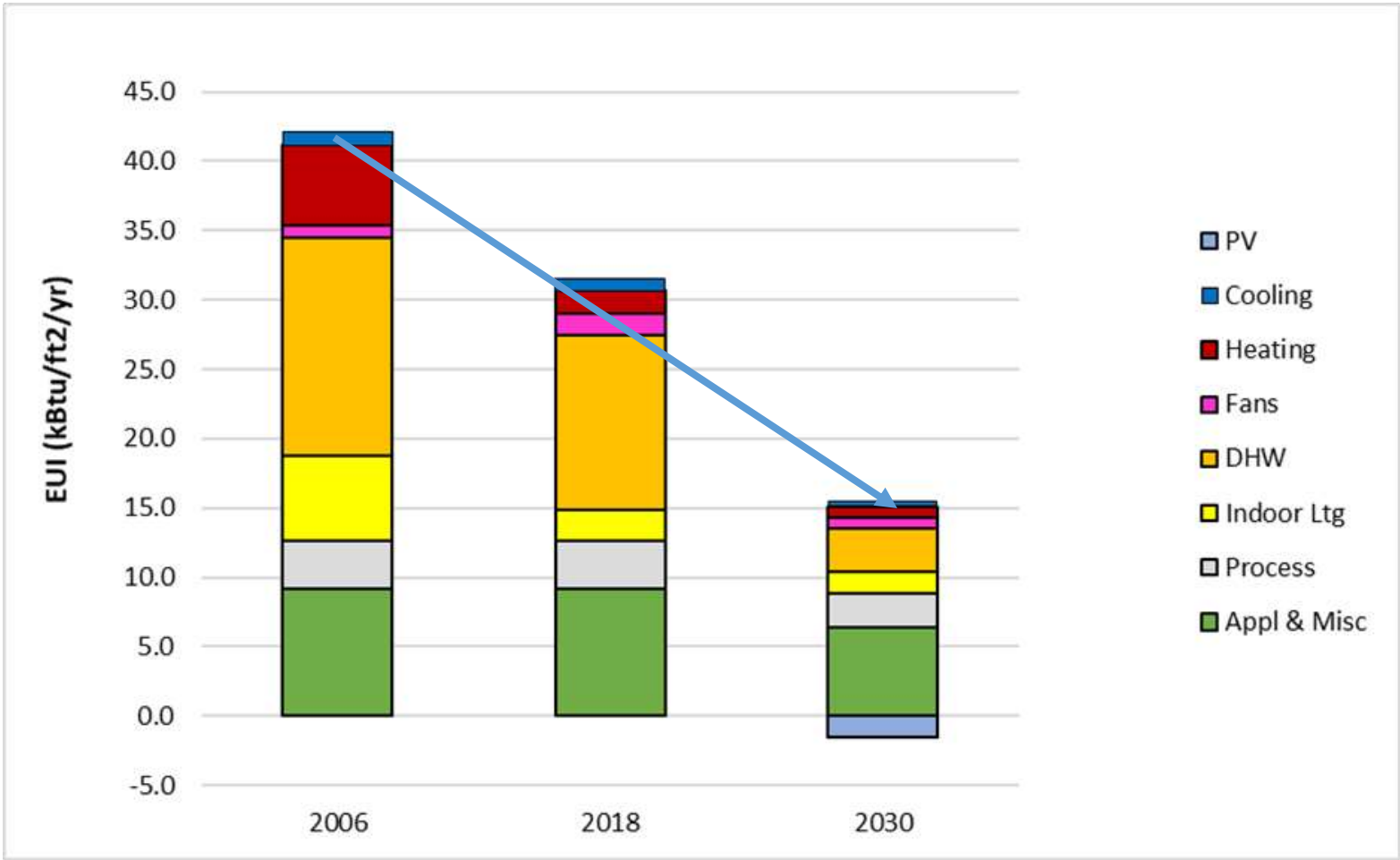
	2006	2009	2012	2015	2018	2021	2024	2027	2030
Residential	100%	82.7%	76.1%		60.5%				
Commercial	100%	86.8%	82.0%		69.6%				
Target: 8.75 % savings compared to the 2006 WSEC	100%	91%	83%	74%	65%	56%	48%	39%	30%
Target: 14% savings compared to each previous code	100%	86%	74%	64%	55%	47%	41%	35%	30%

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



Our Vision
All people live with dignity in safe, health and affordable homes within **communities of opportunity**

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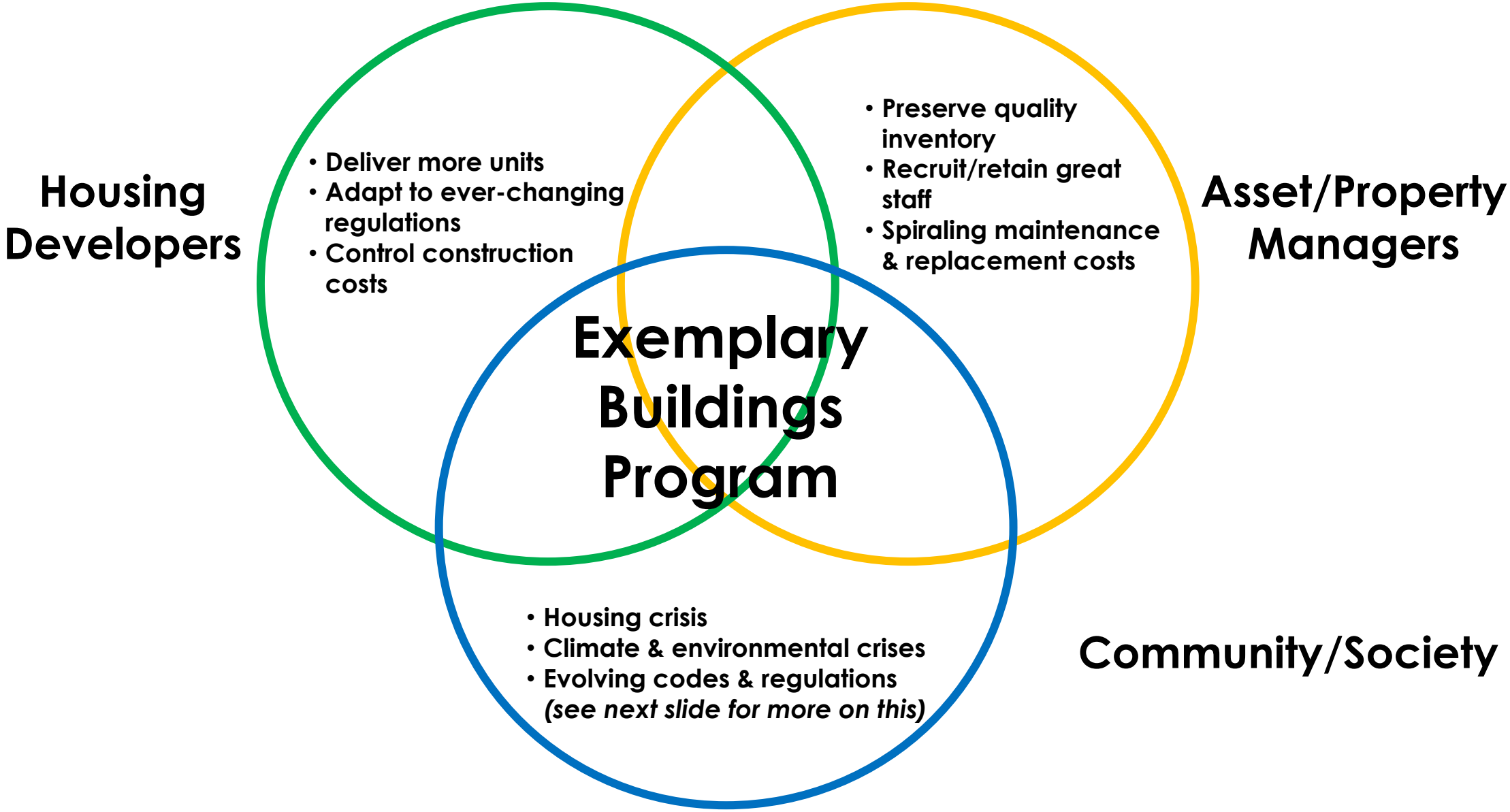
Pressures on the Affordable Housing Ecosystem



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

EB Program Goals

2019-2021

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

2022-2025

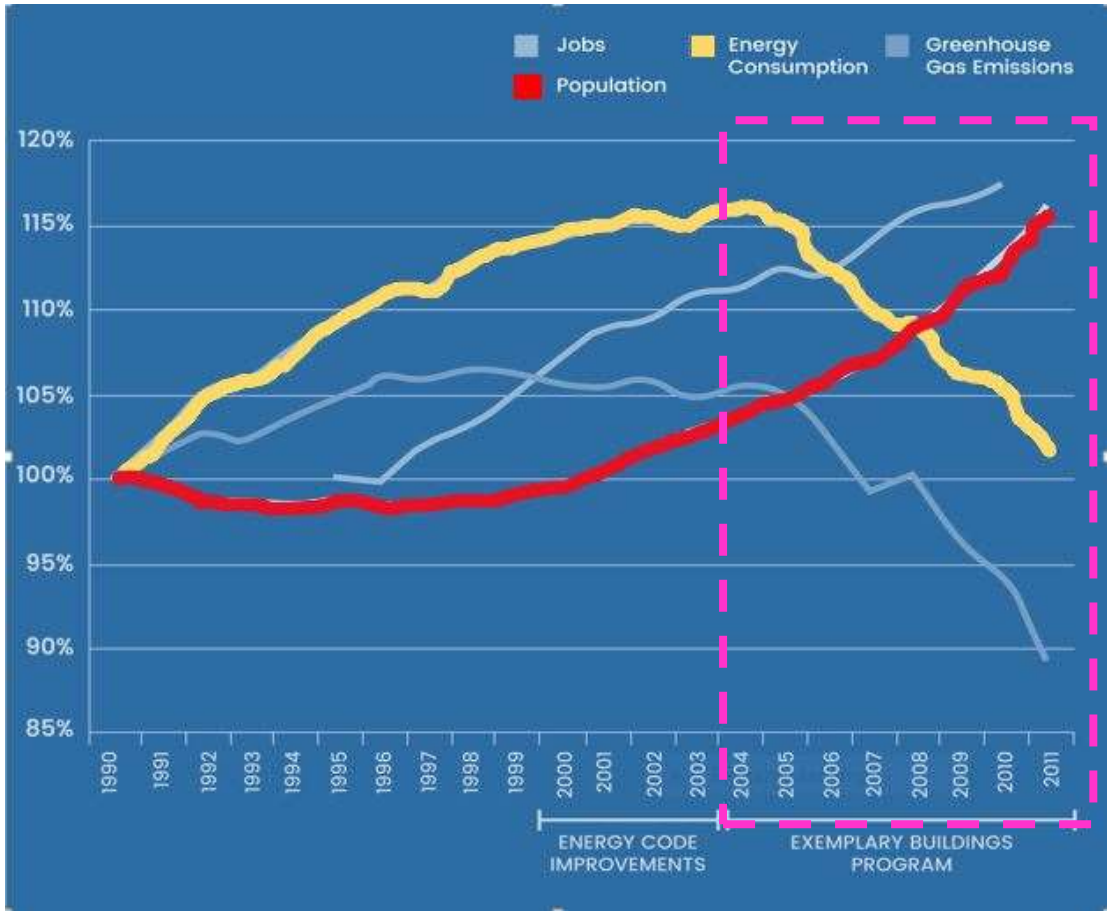
Disseminate Learnings
Scale Up
4% Construction Premium

2026 >

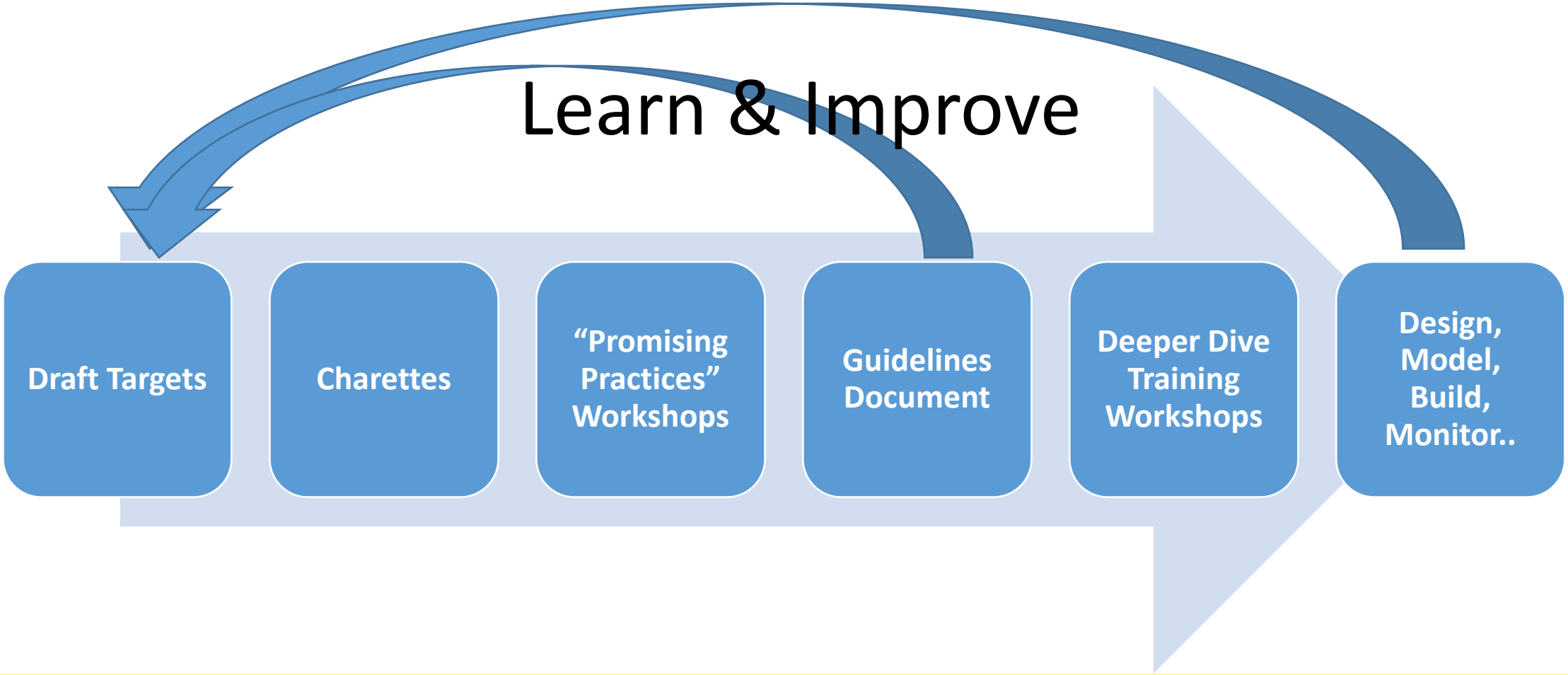
Ultra-Efficient Standard
All Affordable Housing
2% Construction Premium

- 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**



EB Program Approach



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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

	Charettes	Design Guidelines	Promising Practices Workshop	Deeper Dive Workshops
Early Integrative Design	Completed, June 2020	In Process	Scheduled, 11/19/2020	2021
Wall Assembly	Completed, Oct 2019	Posted, May 2020	Completed	2021
Domestic Water Distribution, Heating, and Management	Completed, Nov 2020	In Process	Completed, Oct 2020	2021
Balanced Ventilation & Heat Recovery	Completed, June 2020	In Process	Scheduled, 12/3/2020	2021
Solar Integration	Completed, July 2020	In Process	Completed, Nov 2020	2021
Healthy Building Materials	Future			
Operations	Future			

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

Julie Banerjee
Seattle City Light

Becky Bicknell
Walsh Construction Co.

Brad Carmichael
JRS Engineering

Mark Deutsch
Volunteer, HDC

Steve Gelb
Emerald Cities Seattle

Joe Giampietro
JGA Consultants

Jon Heller
Ecotope

Alistair Jackson
O'Brien360

Marty Kooistra
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Sharon Libby
Walsh Construction Co.

Kasey Liedtke
Bellwether Housing

Ryan Meno
Rafn Company

David Reddy
O'Brien360

Loren Tierney
HDC

Dan Whitmore
RDH Building Science, Inc.

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…EBTF's promising practices are relevant to *all housing*, not just to "exemplary" buildings.

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**

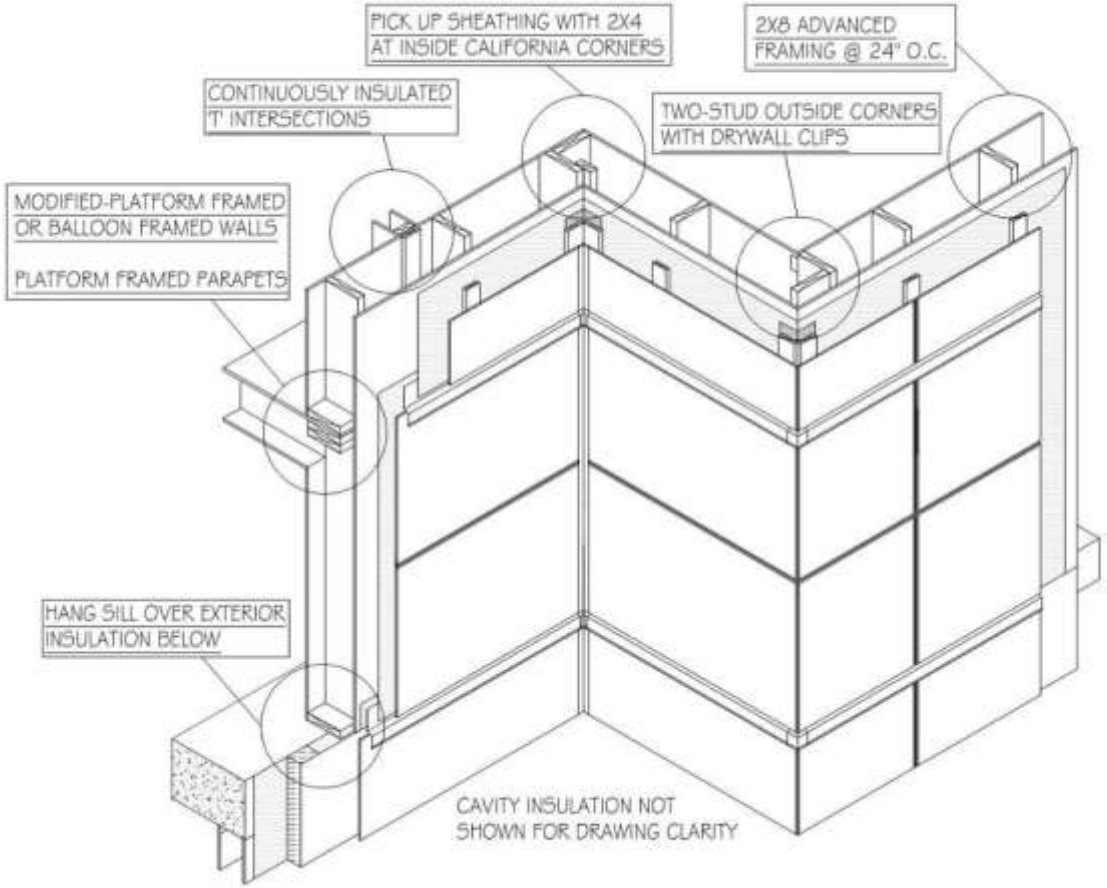
Enclosure

- 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

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

Wall Assemblies



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

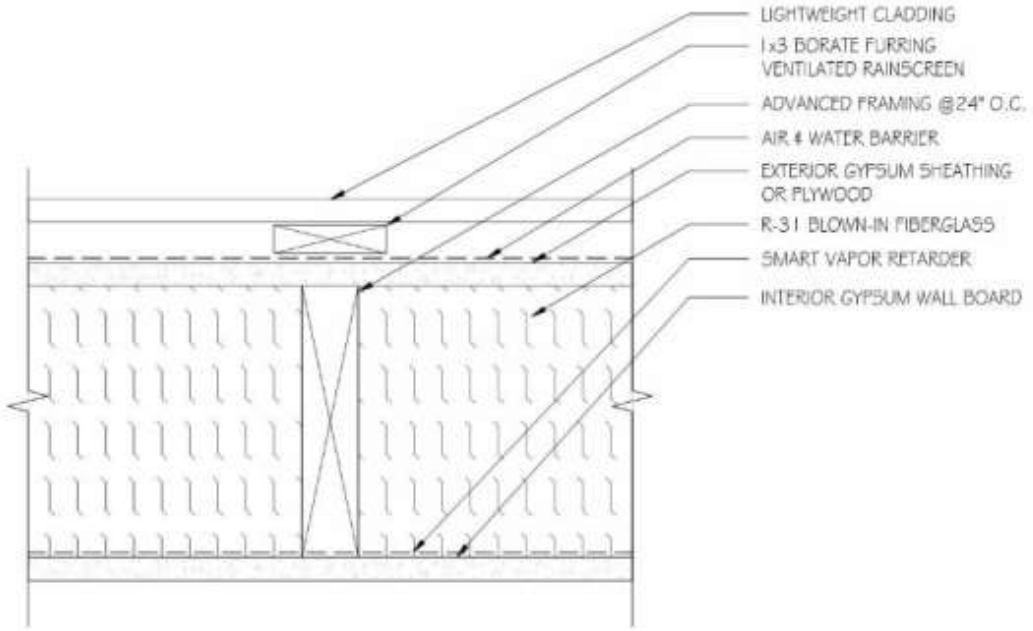
- Improved Building Air Tightness (<0.17 cfm75/sf)
- Wall Assembly Effective R-22 (U-0.045)
- Minimize Thermal Bridging

Comparison To Codes – New and Old

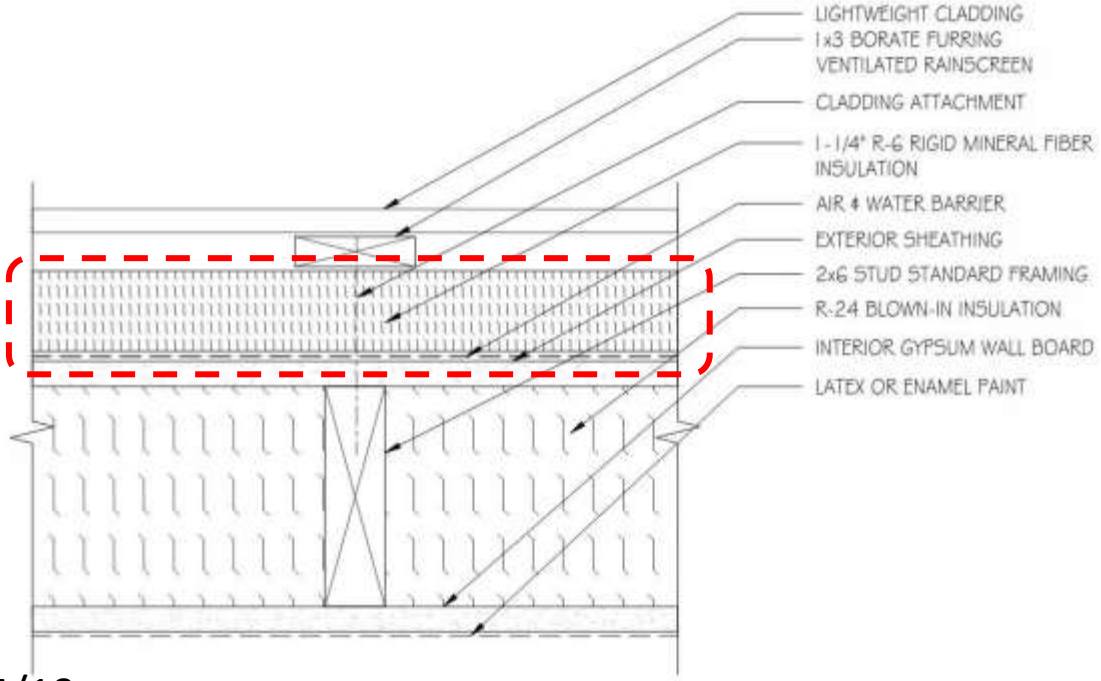
	2015 Seattle Energy Code	2018 Seattle Energy Code	Exemplary Building Specifications
Group R Wood Frame Wall Assembly U-Value (Cavity R-Value)	U = 0.054 (R = 21)	U = 0.051 (R = 25)	U = 0.045 Effective (R = 31)
Airtightness (Typical)	0.30+ cfm75/sf	0.25-0.40 cfm75/sf	0.17 cfm75/sf
Airtightness (C406)	0.25 cfm75/sf	0.17 cfm75/sf	0.17 cfm75/sf

R-22 Overall Wood Wall Assemblies

SAMPLE R22 WOOD-FRAMED 2x8 WALL



SAMPLE R22 WOOD-FRAMED 2x6 WALL



https://exemplarybuilding.housingconsortium.org/2020/05/19/just-released-guidelines-for-wall-assemblies-1-0/

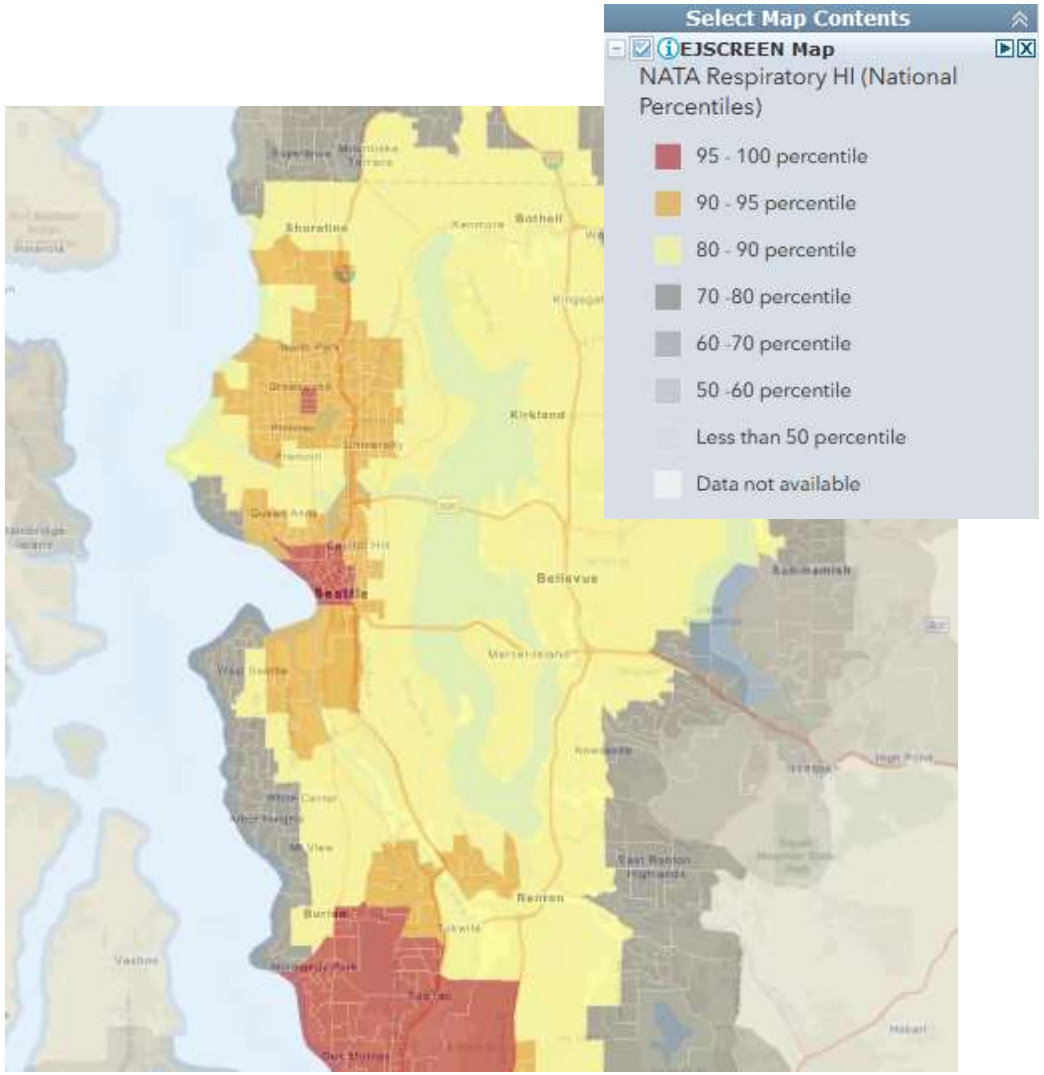
Current Recommendations for Achieving Air Leakage Target

- 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

Balanced Ventilation and Heat Recovery

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

	2015	2018
Group R-2 Dwelling Unit Ventilation	Whole house exhaust fans OK	Balanced ventilation with heat recovery required
Wood-framed Wall Insulation	R-21 cavity (U-0.054)	R-25 cavity (U-0.051)
Envelope Air Leakage	0.40 cfm75/ft2, do not need to achieve (remedy/retest only)	0.25 cfm75/ft2, ***must*** achieve 0.40cfm75/ft2 at most
C406 Compliance	(2) options for Code, (3) for ESDS 5.1A	6* credits for code, *No additional for ESDS (for now)*
Group R-2 Corridor Ventilation	0.12 cfm/ft2	0.06 cfm/ft2

* 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

DWELLING UNIT FLOOR AREA (square feet)	NUMBER OF BEDROOMS				
	0-1	2	3	4	5 or more
	Airflow in CFM[a]				
< 500	30	30	35	45	50
501 – 1,000	30	35	40	50	55
1,001-1,500	30	40	45	55	60
1,501 – 2,000	35	45	50	60	65
2,001 – 2,500	40	50	55	65	70
2,501 – 3,000	45	55	60	70	75
3,001 – 3,500	50	60	65	75	80
3,501 – 4,000	55	65	70	80	85
4,001 – 4,500	60	70	75	85	90
4,501 – 5,000	65	75	80	90	95

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

-OR-

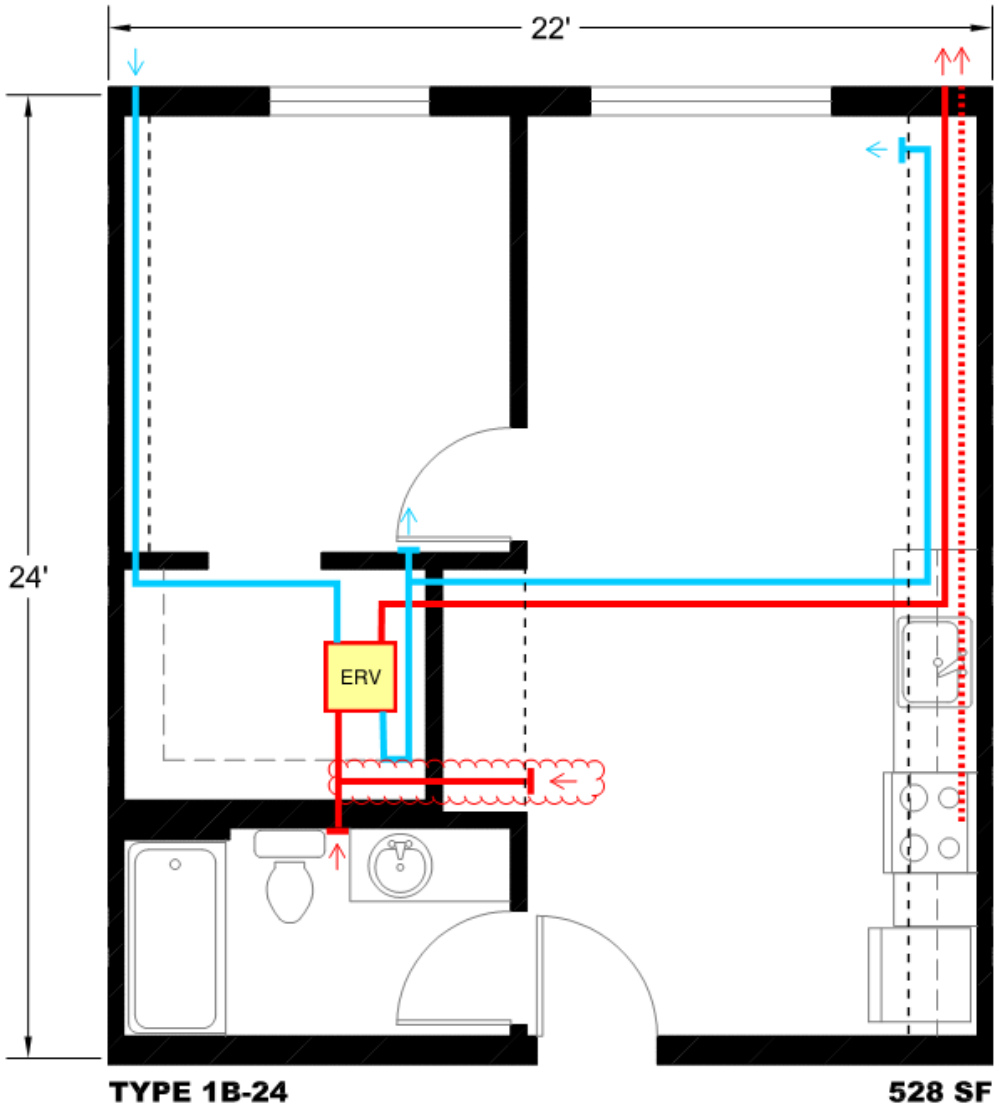
$$Q_r = 0.01 * A_{floor} + 7.5 * (N_{br} + 1)$$ **Equation 4-10**

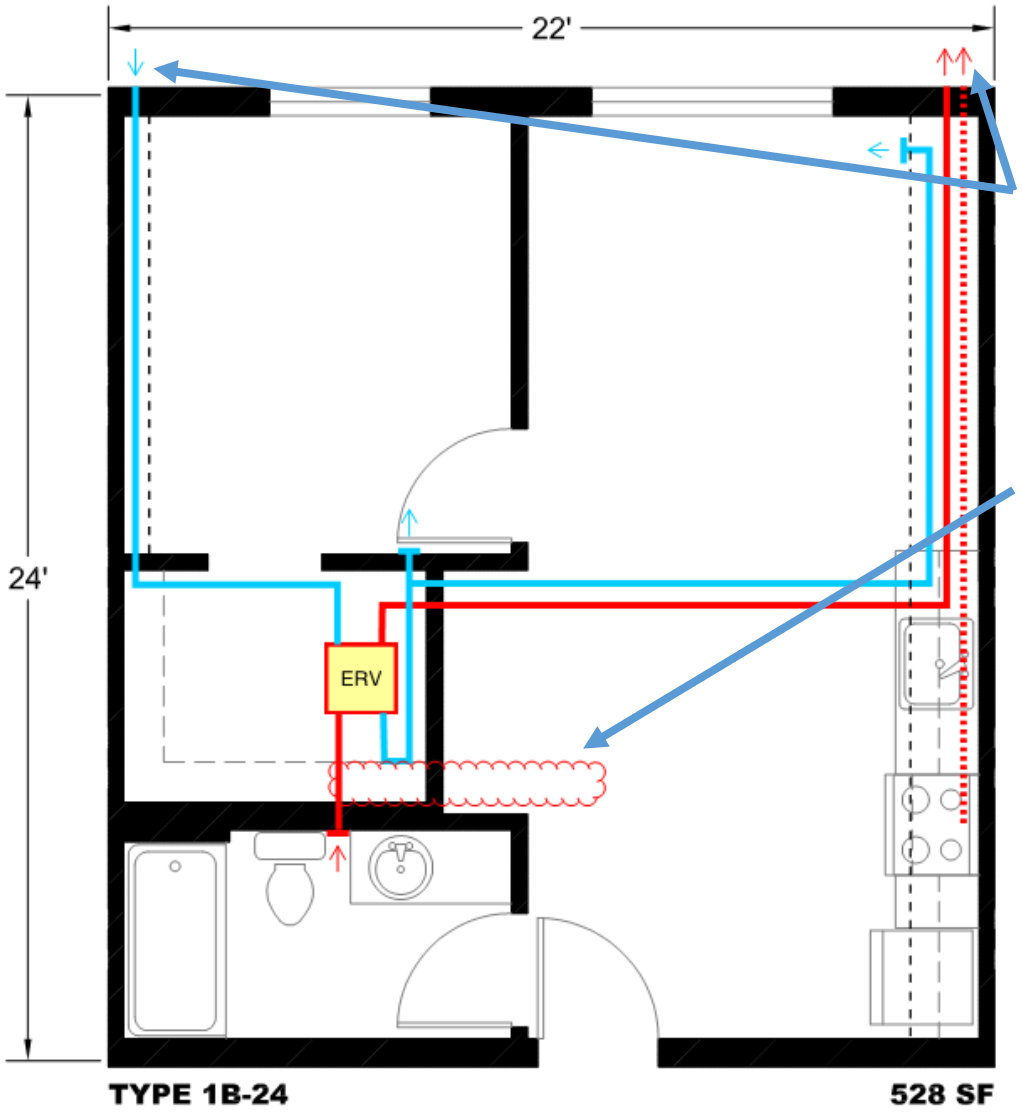
Floor Area (ft2)	0-1BR	2BR	3BR	4BR
500	30	30	35	45
550	30	30	40	45
600	30	30	40	45
650	30	30	40	45
700	30	30	40	45
750	30	30	40	45
800	30	35	40	50
850	30	35	40	50
900	30	35	40	50
950	30	35	40	50
1000	30	35	40	50
1050	30	35	45	50
1100	30	35	45	50
1150	30	35	45	50
1200	30	35	45	50

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.



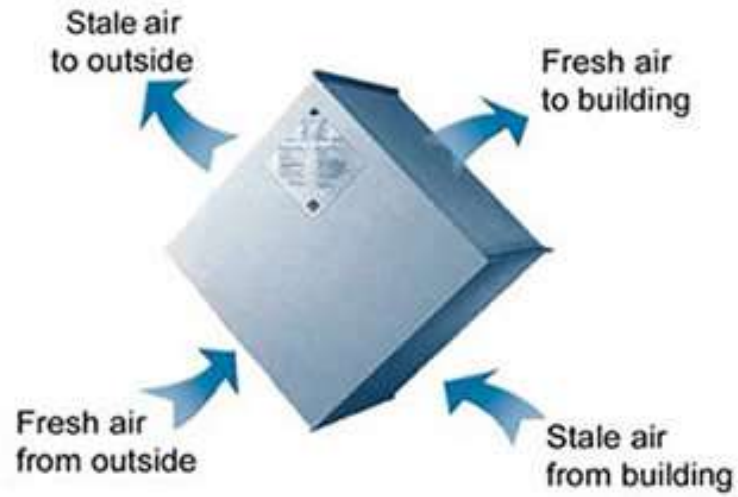


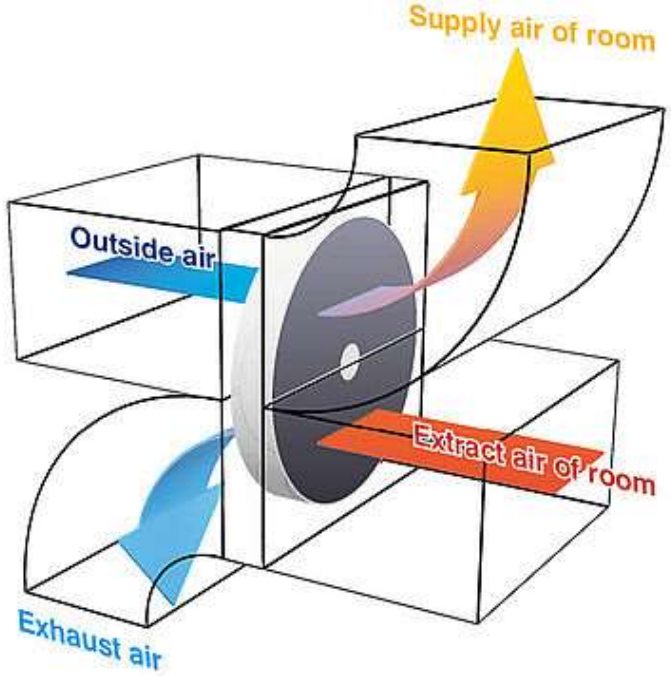
10' separation between supply/exhaust

Omitting exhaust grill in kitchen results in needing 25% higher airflow

Floor Plan Image Credit: Walsh Construction Co. CEDC Project

Heat Exchanger (HX) Types





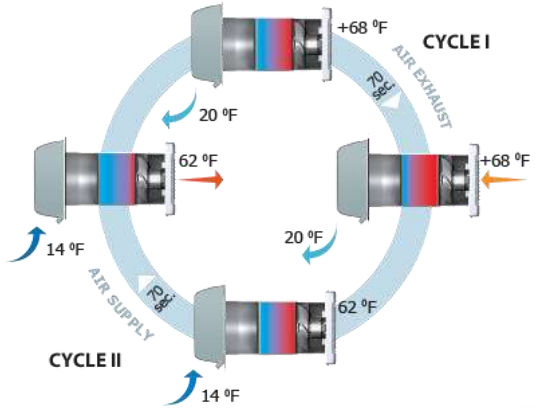


Plate **Wheel** **Unitized "Ductless"**

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

https://taylorengineers.com/taylor-engineering-covid-19-whitepaper

Please provide any other resources you might have to share!

System Layout Options

Option A – Centralized, for entire building/wing

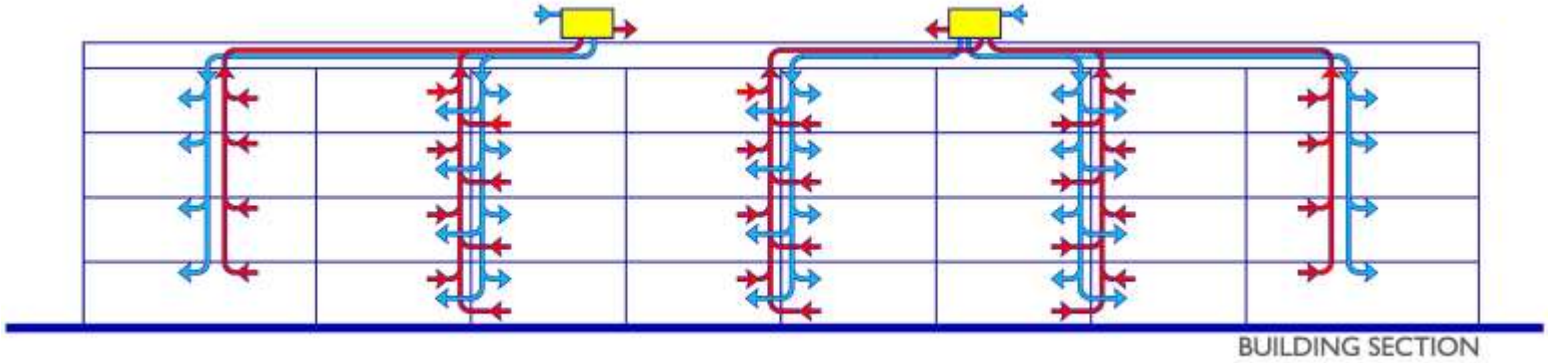
Option B – Centralized, stack by stack

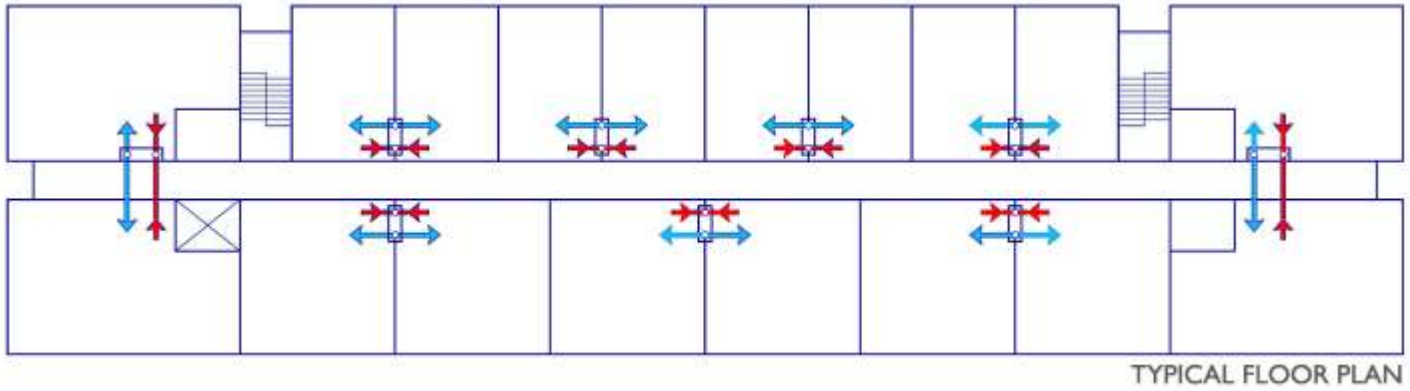
Option C – Centralized, floor-by-floor

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.

For Entire Building/Wing

PLUSES (+)

- FEWER ERVs TO INSTALL AND SERVICE THAN OTHER OPTIONS
- LOWER EQUIPMENT REPLACEMENT COST
- MORE AREA AVAILABLE ON ROOF THAN OPTION B)
- MAY REQUIRE LESS SOFFITING DEPENDING ON WHERE VERTICALS ARE LOCATED
- TENANT CAN'T SHUT-OFF

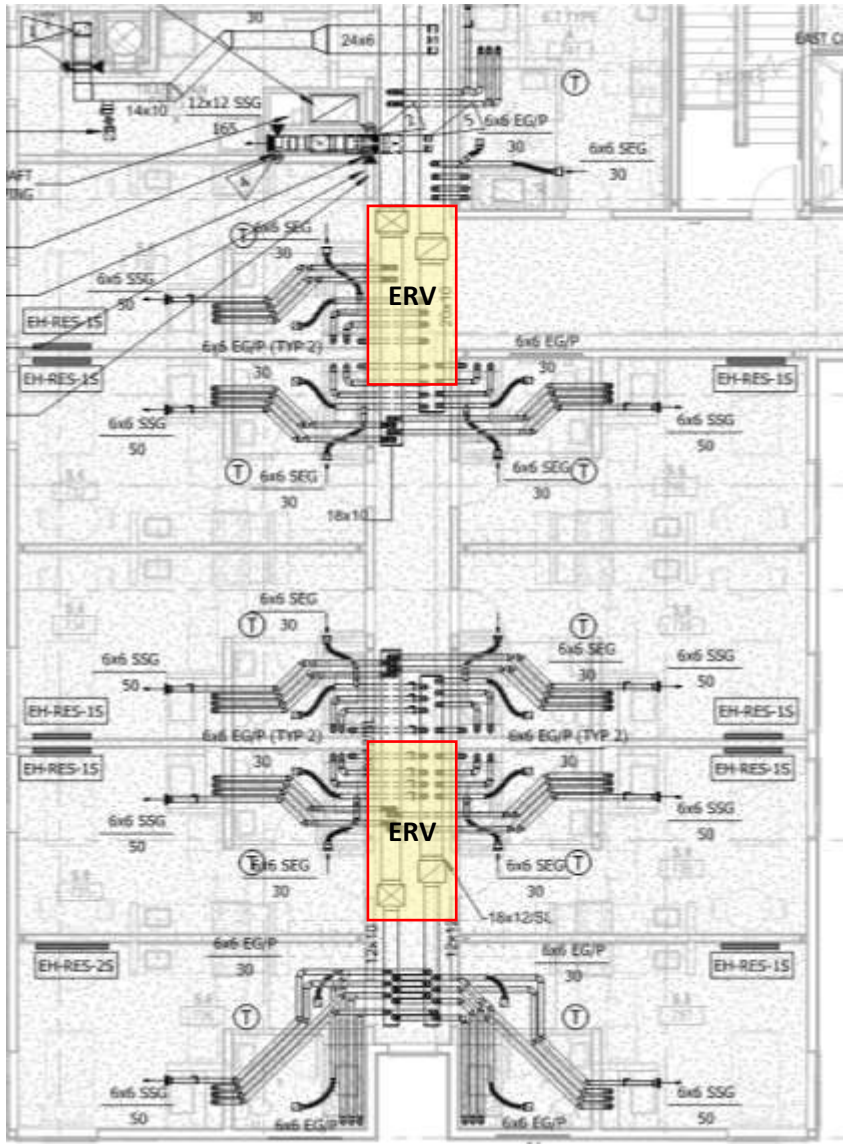
MINUSES (-)

- GENERALLY REQUIRES EXTRA BUILDING HEIGHT ON TOP FLOOR (12-18")
- MORE COSTLY DUCTWORK THAN OTHER OPTIONS
- SERVING 5+ FLOORS OF UNITS ADDS MORE COSTLY REQUIREMENTS
- AIR FLOW RATE IS VARIABLE ONLY ON A SYSTEM BASIS
- TYPICALLY HIGHER FAN POWER

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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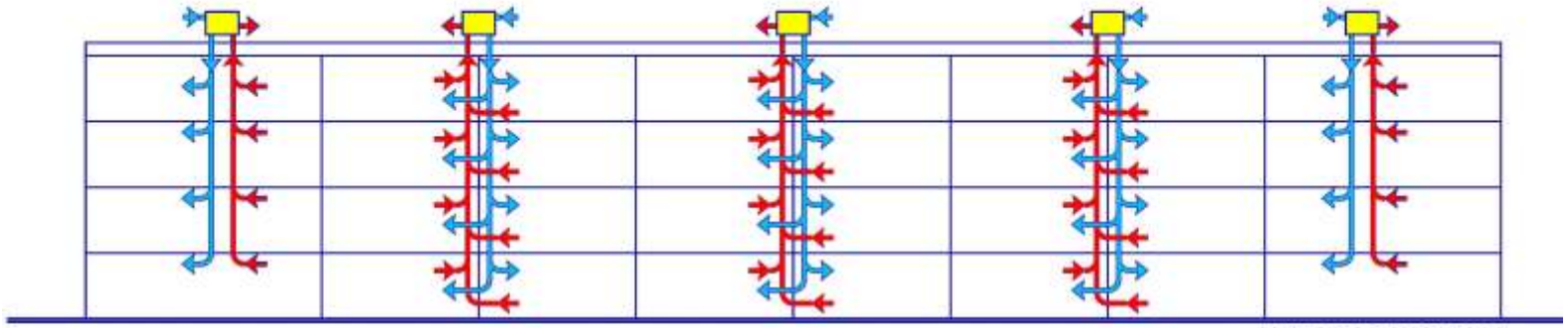
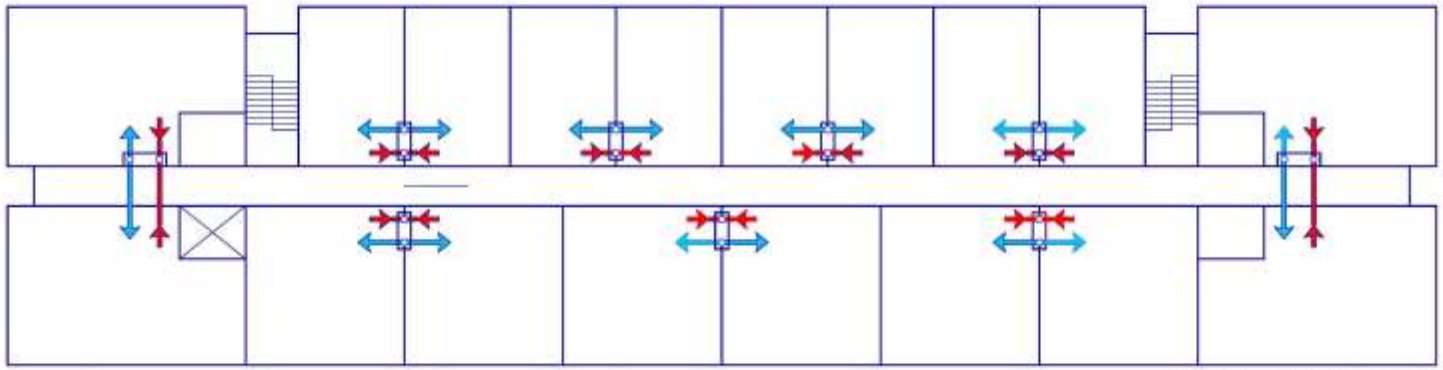
B) Centralized Layout #2



BUILDING SECTION



TYPICAL FLOOR PLAN

*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.

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

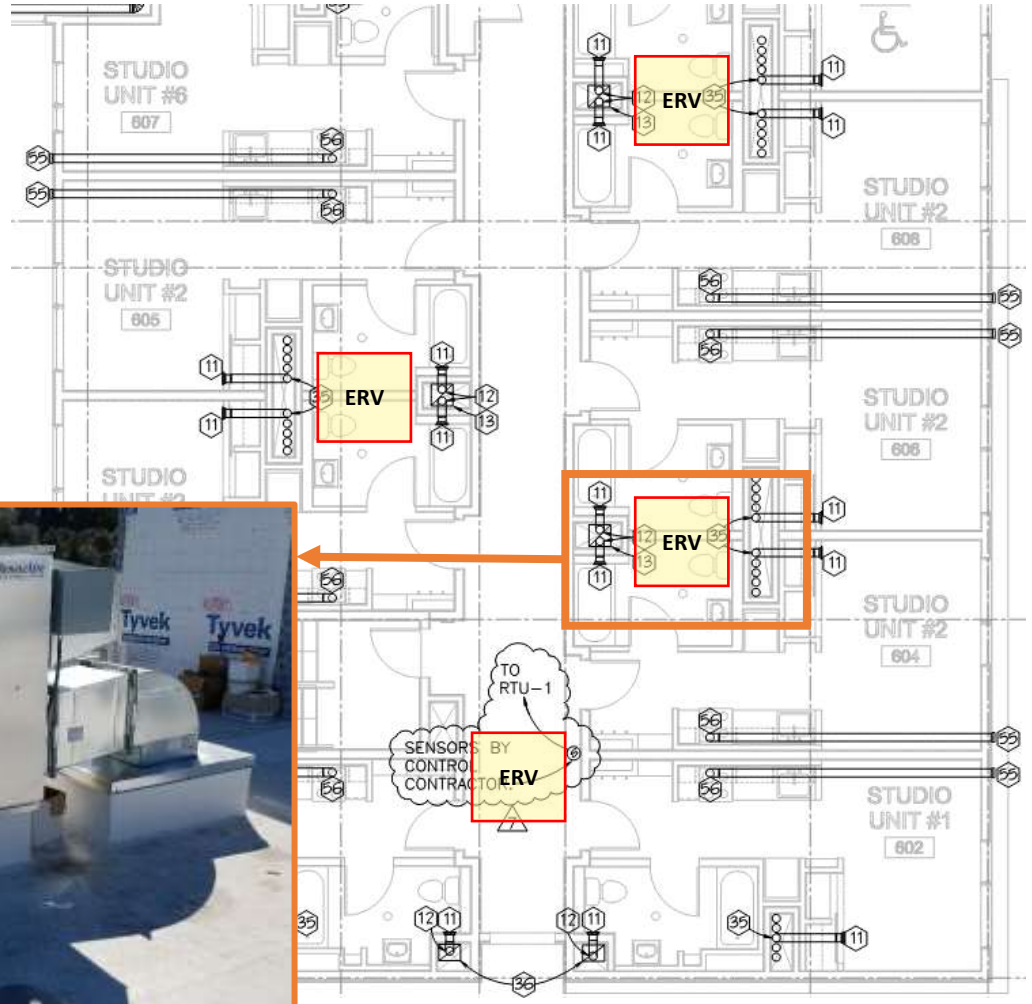
MINUSES (-)

- 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

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



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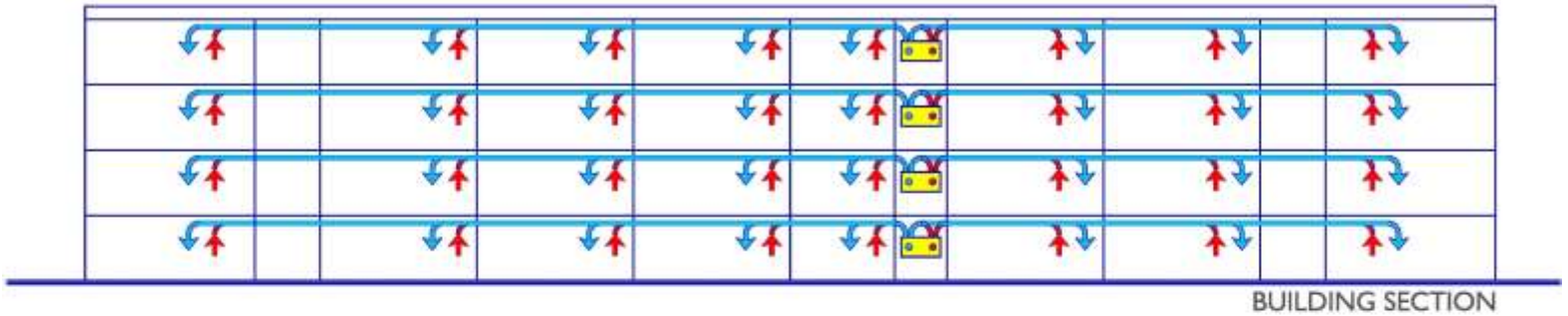
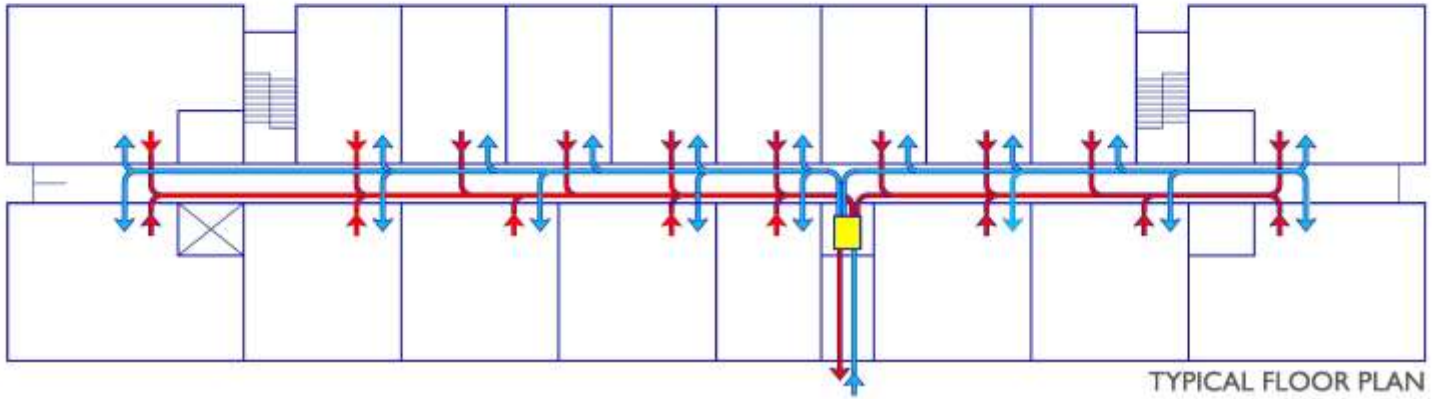
C) Centralized Layout #3





*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

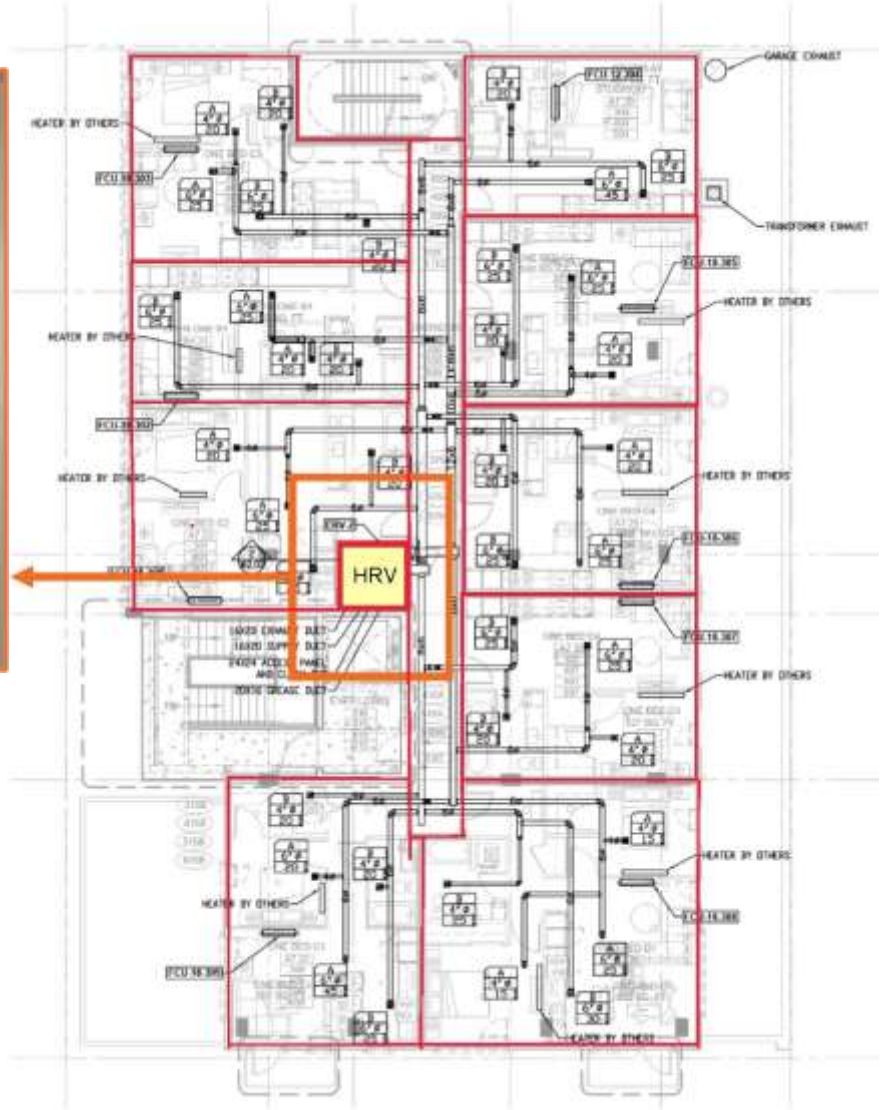
Common variations on the floor-by-floor distribution approach:

- 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

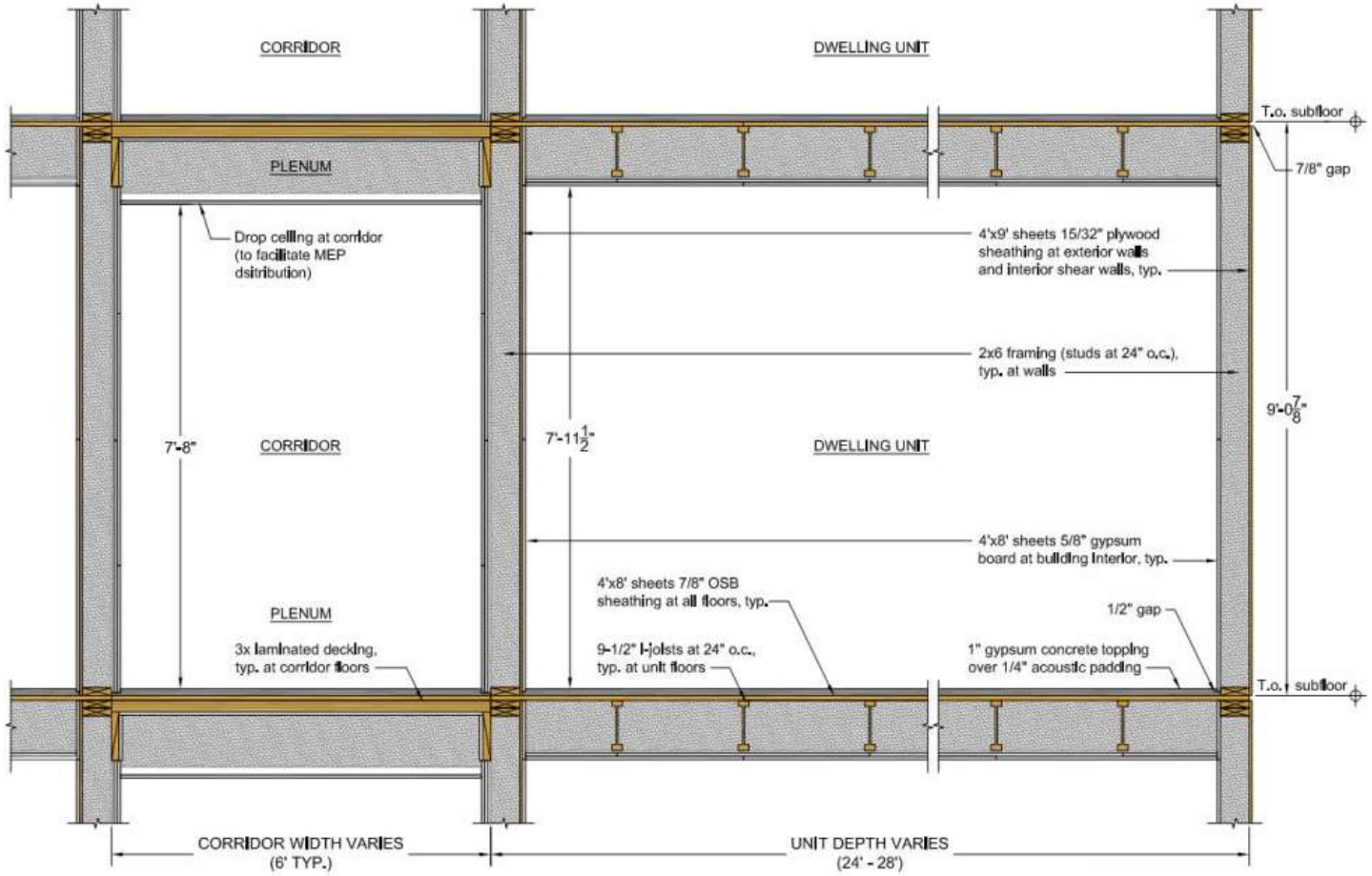


Our Vision

All people live with dignity in safe, healthy and affordable homes within **communities of opportunity**

HOUSING DEVELOPMENT consortium

Ductwork in Corridor

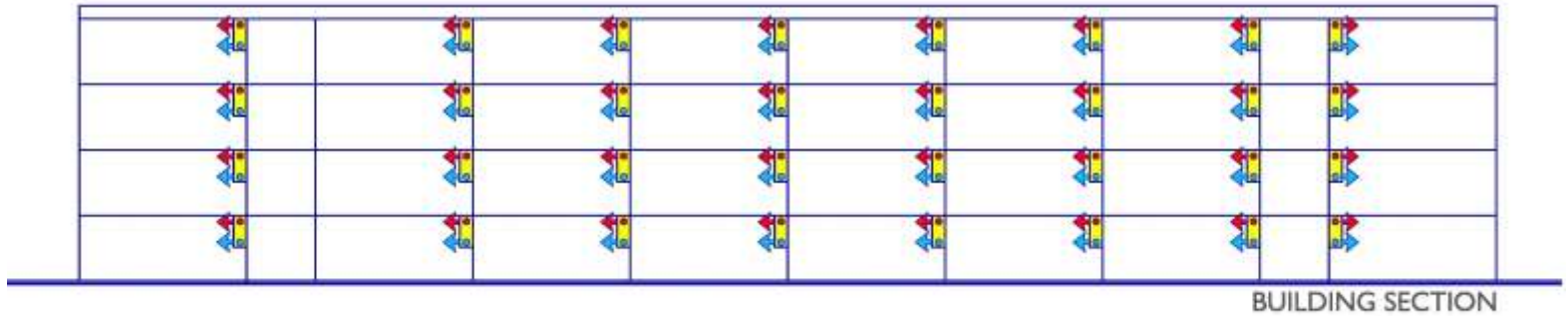


How to get more height in the corridor for ductwork?

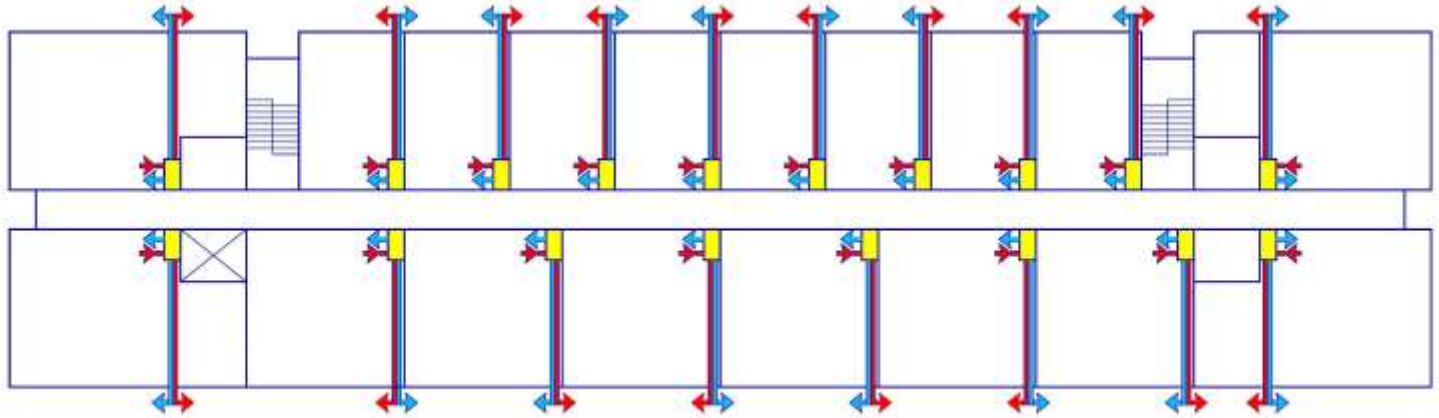
Use car-decking instead of joists!

Image credit: Walsh Construction Co. CEDC Project

D) Unitized Layout



BUILDING SECTION



TYPICAL FLOOR PLAN

*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.

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*

Centralized vs In-Unit

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

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

Ventilation Layout Matrix

System Option	Costs	Building Design	Bldg/Mech Codes	Service/Operations
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)

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

* 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

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

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Thank You!

Check out the Exemplary Buildings Program website

https://exemplarybuilding.housingconsortium.org

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