

**BIGGEST
BANG
FOR
YOUR
BUCK-
Part Deux**

Sponsored by:

Housing Development Consortium of Seattle – King County
(HDC)

Presenters:

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**Volunteer effort focused on cost-effective,
quality product decisions for affordable
multifamily development**

2012 Survey Topics

- **Cabinets & Counters**
- **Windows**
- **Apartment Unit – Heating & Ventilation**

Respondent Profiles – Owners & Developers

18 total respondents

- 15% Eastern WA / 85% Western WA
- 55% Urban / 30% Suburban / 15% Rural
- 16% serve <30% AMI & homeless.
- 55% serve 30-50% AMI
- 27% serve >50% AMI
- 50% with < 1000 units, 50% with >1000 units
- 75% of units < 1000 sf

Respondent Profiles – Builders / Designers

29 respondents

- 34% Eastern WA / 66% Western WA
- 39% Urban / 34% Suburban / 27% Rural
- 24% 0-1000 units
- 44% 1001- 5000 units
- 32% > 5000 units
- 75% of the units < 1000 sf

Cabinets



26-yr old plywood cabinets – still in great shape!

Cabinets Survey Results - Owners

- 50/50 preference between particle board and plywood for cabinet box.
- Particle board is more susceptible for resident damage, especially to doors, moisture damage
- Plywood is proven as durable, long-lasting product, but is often VE'd during pricing.

Cabinets Survey Results - Owners

Resident considerations

- Lower-income, High % Kids = hard on cabinets and hardware. Particle board doesn't always stand up to abuse.
- Modifications are needed for different populations
 - Drawers are easier to access for seniors
 - Easy to pull hardware
 - Smooth hinges and gliders.

Cabinets Survey Results - Builders

- 50/50 recommendation for particle board and plywood
- Particle board regaining ground as cost-effective, reliable, sustainable product
- Plywood recommended for bath vanities
- Project team should coordinate with cabinet vendor to discuss options, sizing, and resident considerations.

Cabinets– Plywood Considerations

| PROS | CONS |
|---|-----------------------------------|
| Durable, proven in field | Higher cost |
| Easier to drill through, repair | Cheaper plywood can be irregular* |
| Stronger, able to support heavier loads | Temperature and humidity warping |
| More water resistant | |

**be wary of foreign products*

Cabinets– Particle Board Considerations

| PROS | CONS |
|-------------------------------------|---|
| Up front and replacement cost | Less proven in the field |
| Uniform appearance and density | Can be damaged during drilling, repairs |
| Can be made from recycled materials | More water absorbent |
| | Particle glues can deteriorate with heat, water |

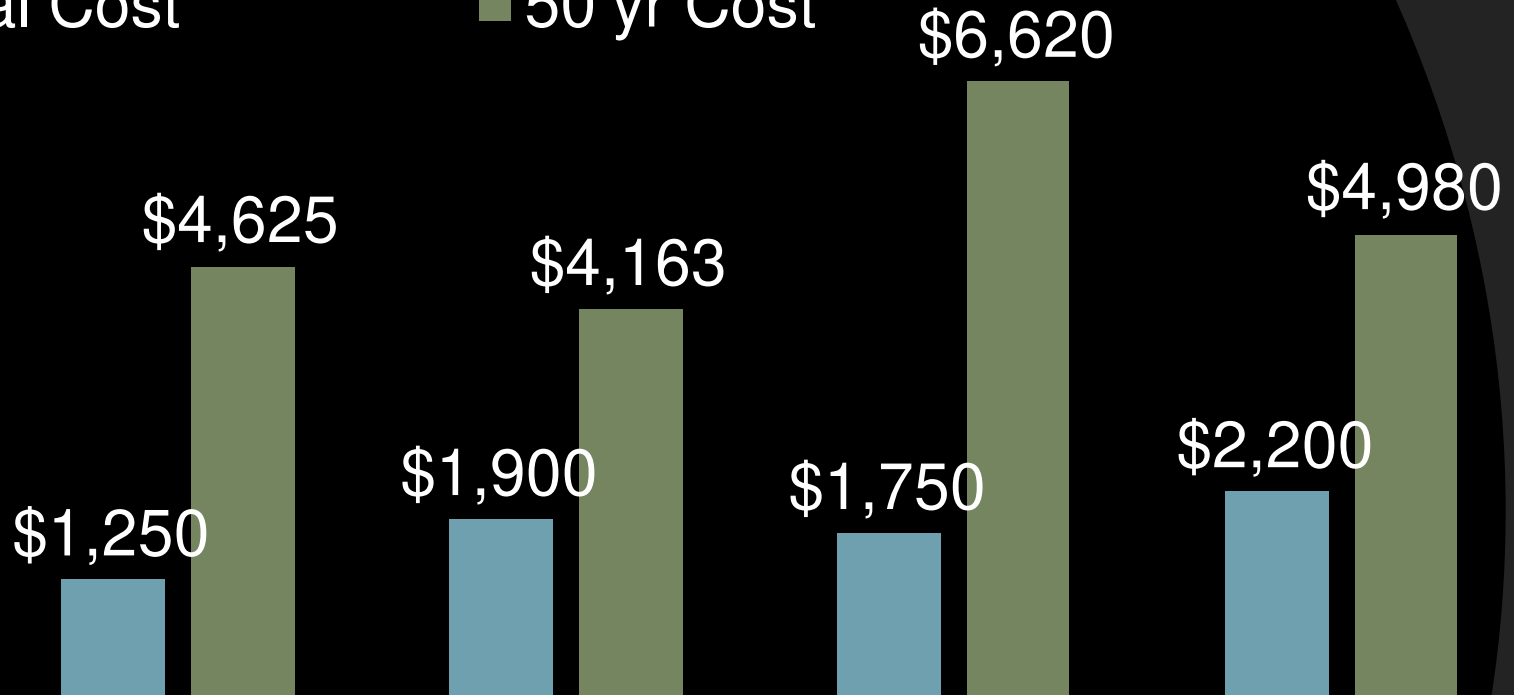
Cabinets– Life Cycle Considerations

| PRODUCT | Initial Cost per Apt. | Replace ment Cost | # of Replac ements | 50 yr Cost | COMMENTS |
|---|------------------------------|--------------------------|---------------------------|-------------------|-----------------|
| Low End Plywood Box/base Cabinet | \$1,250 | \$1,688 | 2 | \$4,625 | 20 yr life |
| Plywood box, face frame oak or alder | \$1,900 | \$2,263 | 1 | \$4,163 | 35 yr life |
| Mid-Quality particle board box. | \$1,750 | \$2,435 | 2 | \$6,620 | 25 yr life |
| Higher End Recycled Content particle board box | \$2,200 | \$2,780 | 1 | \$4,980 | 30 yr life |

Cabinets—50 Yr Life Cycle Cost

■ Initial Cost

■ 50 yr Cost



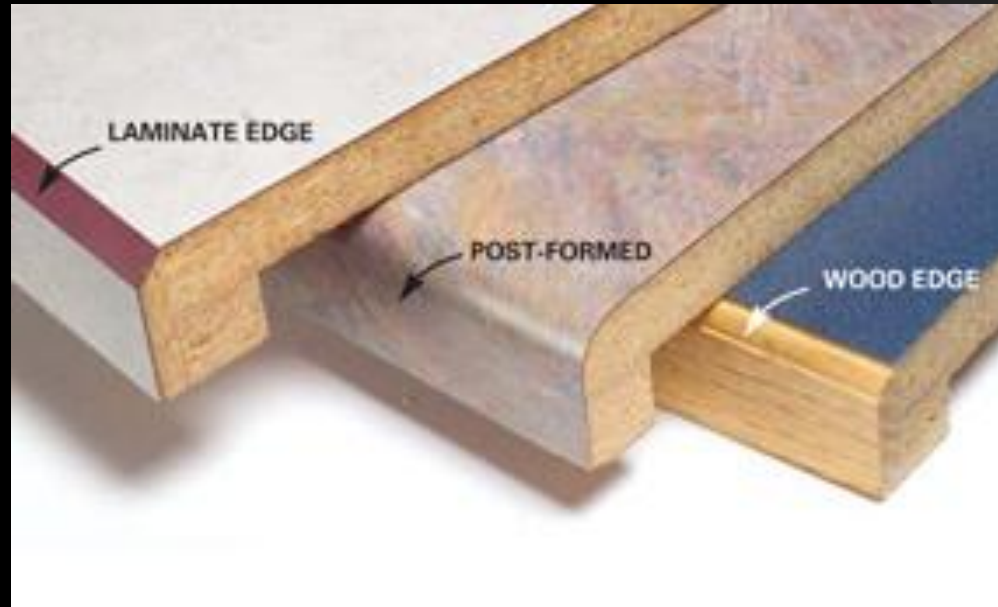
Low End
Plywood
Box/base

Mid-grade
plywood
core, face
frame alder

Mid-grade
particle
board box.

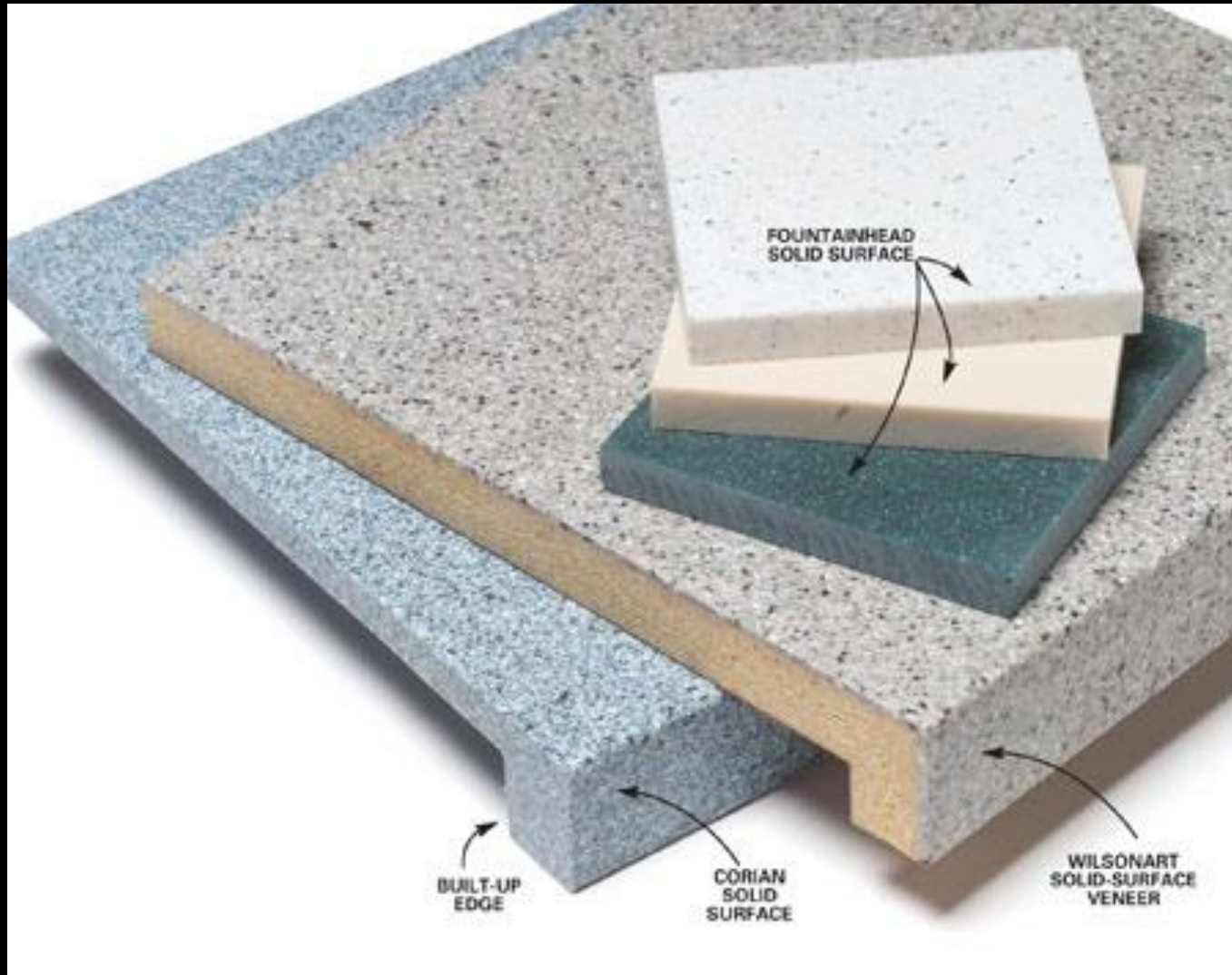
Higher End
Recycled
Content
particle
board box

Counters



- Laminate remains the market favorite for cost-effectiveness and selection.
- Backsplash and molded front edge prevent moisture and food damage
- No sealing required, completely non-porous
- Con: easier to burn/scratch

Counters – Non-laminate options – SOLID SURFACE (aka Corian)



Counters – Non-laminate options – ENGINEERED STONE



Counters – Non-laminate options

Solid surface and engineered stone

- more durable, resistant to damage
- can be more sustainable, made from recycled materials
- easier to repair through sanding
- Engineered stone tested in recent projects (Madrona, Renew Max)
- More marketable for higher AMI projects

Counters – Life Cycle Cost (per apt.)

| PRODUCT | Initial Cost per Apt. | Replace ment Cost | # of Replace ments | 50 yr Cost | COST COMMENTS |
|---|-----------------------|-------------------|--------------------|----------------|---|
| Laminate Counters with Integrated Backsplash | \$468 | \$688 | 3 | \$2,533 | assume 15 yr life |
| Renew-Max: | \$1,006 | \$126 | 3 | \$1,384 | assume 50 +yr with 12- 15 yr buff/refinishing at \$2/sf |
| Caesarstone | \$1,669 | \$126 | 3 | \$2,047 | assume 50 +yr with 12- 15 yr buff/refinishing at \$2/sf |

Windows!



Windows Survey Results - Owners

- Priority on long-term durability and energy efficiency rather than lowest cost.
- Building code and Evergreen Standard drives product selection
- Vinyl is predominant material
- Sliders are least expensive and easiest to use and maintain.
- Concern re: adequate light and airflow for home-bound residents.

Windows Best Practices - MATERIAL

| VINYL | |
|-------------------------------------|---------------------------------|
| PROS | CONS |
| Cost | Limited colors |
| Energy performance | Expansion, contraction, warping |
| Long term maintenance (no painting) | Potential seal failure |

Windows Best Practices - MATERIAL

| FIBERGLASS | |
|-------------------------|-----------------------------------|
| PROS | CONS |
| Strength and durability | Cost |
| Low Expansion | Heavier than vinyl |
| Unlimited color choices | Painting needs to be updated |
| | Mechanically fastened (vs welded) |

Windows Best Practices - STYLE

Horizontal and vertical sliders are simplest, least expensive, easiest to maintain, BUT provide least amount of protection from wind-driven rain



Casement and awning windows provide best seal against water and air penetration

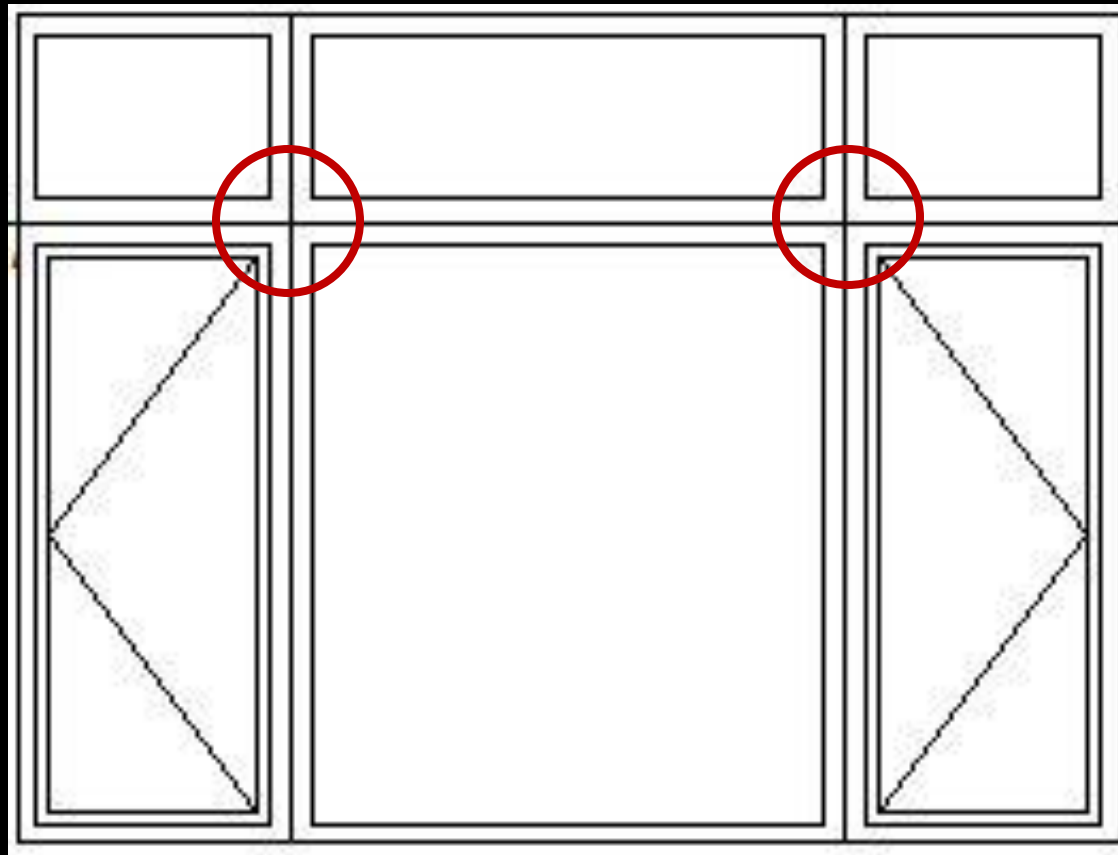


Awning



Casement

Multi-pane = higher chance of air/water penetration at connection points and higher replacement cost



Limited operable sf = improved performance

Windows Best Practices - Orientation

You may want to consider different windows for different sides (N-S-E-W) of the building.

Windows with South and West exposure:

- Lower SHGC rating

- Low-E coating

- Interior shading (heavy blinds) or exterior overhead shades

Windows with North and East exposure:

- Higher visual transmittance (VT)

- Low-E coating

Windows Best Practices

On-site mock-ups and property management feedback is always helpful for testing out window options before installation!

Maintenance tips:

- Lubricate casement / awning hardware
- Clean and lubricate tracks on sliding windows
1 x / year
- Wash windows with mild soapy water and rinse.
- Use vinegar and water solution to neutralize the effects of salt water.

Best Practices : cranks, latches & hardware

Stainless
Steel

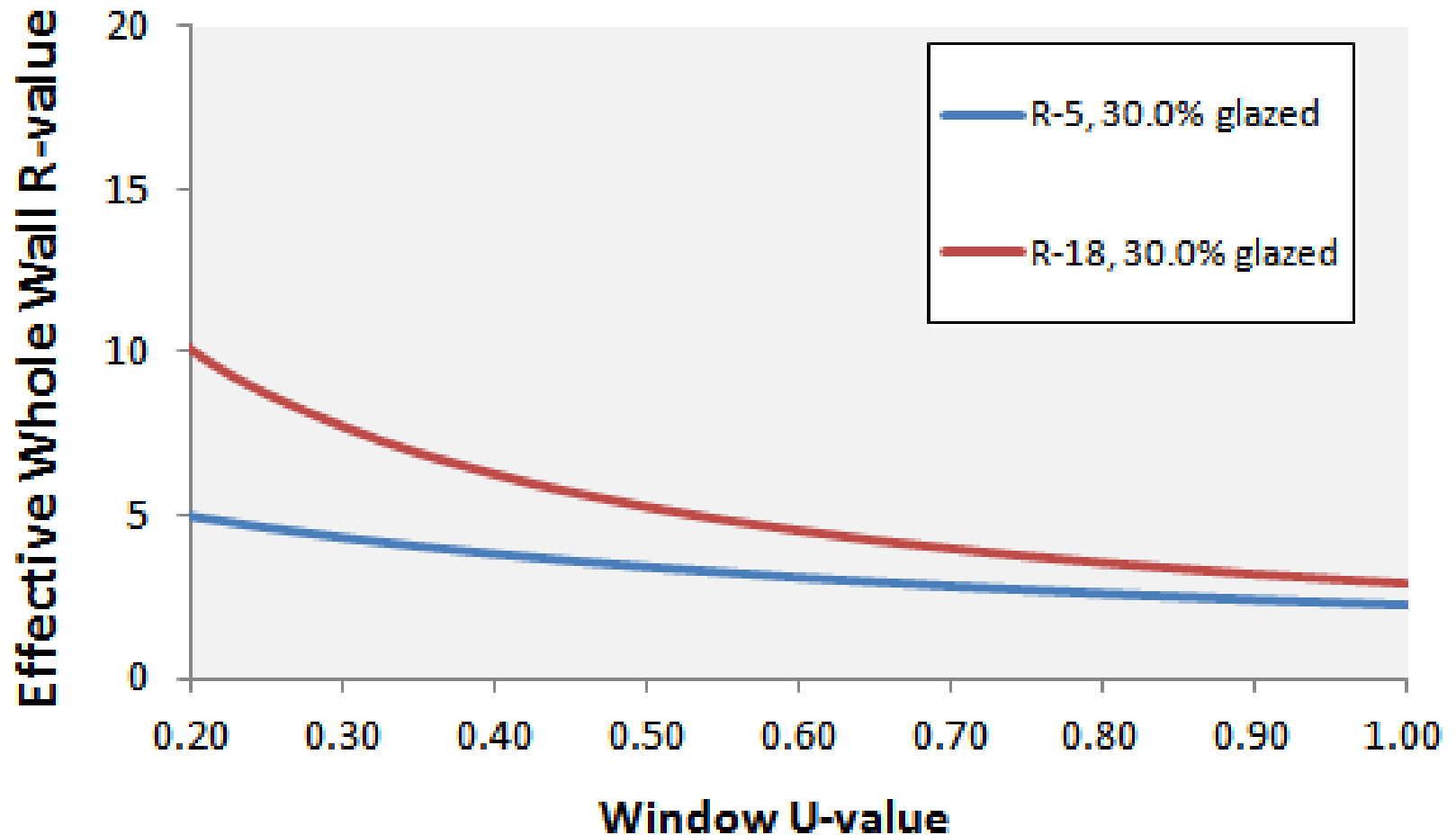


Windows - Energy and Considerations

- Putting windows in perspective: How do windows compare to walls?
- What is ideal Window-to-Wall Ratio (WWR): 25%, 30%, 40%?
- How do the various product types differ in cost?
- What is the cost for better performance, and what is the payback?

Windows - Energy Considerations

Impact of Windows on Whole-Wall R-value






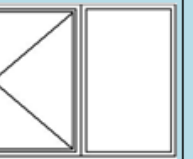
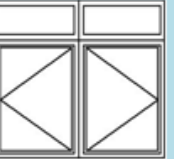


WINDOW AREA - 45%



WINDOW AREA - 25%

Windows – Cost Considerations

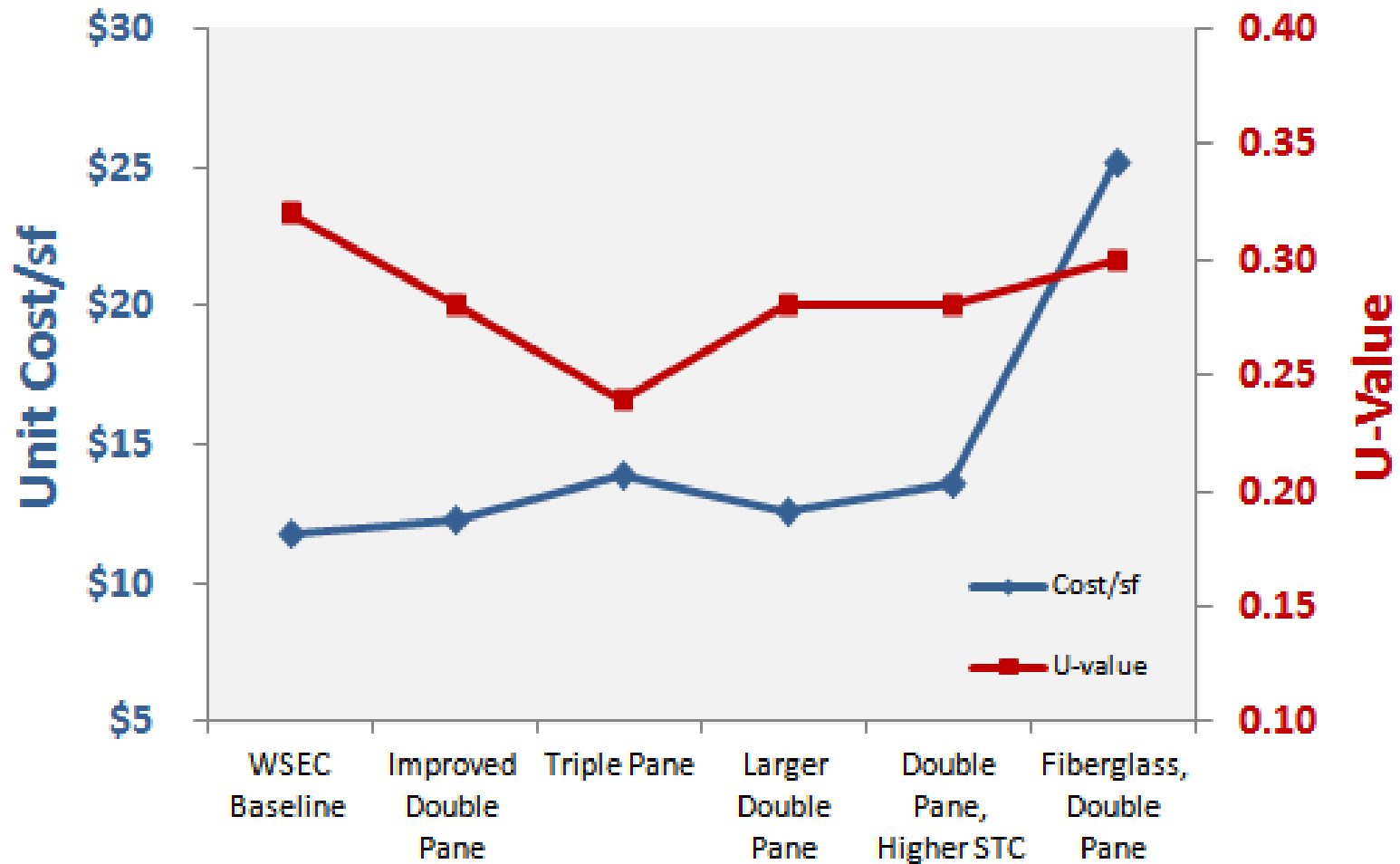
| Window Cost/U-Value Comparison | | |  |  |  |  |  |
|--------------------------------|-------|----------------|--|---|---|---|---|
| Description | U-val | U-val Increase | Fixed | Slider | Awning | Casement | Multi-Pane |
| WSEC Baseline (30sf) | 0.32 | - | \$ 228 | \$ 224 | \$ 372 | \$ 398 | \$ 545 |
| Improved Double pane | 0.28 | 13% | \$ 244 | \$ 241 | \$ 389 | \$ 414 | \$ 561 |
| Triple pane | 0.24 | 25% | \$ 311 | \$ 279 | \$ 426 | \$ 472 | \$ 599 |
| Double pane, larger (50sf) | 0.28 | 13% | \$ 596 | \$ 390 | \$ 605 | \$ 733 | \$ 830 |
| Double pane, higher STC | 0.28 | 13% | \$ 336 | \$ 266 | \$ 414 | \$ 440 | \$ 587 |
| Fiberglass, double pane | 0.30 | 6% | \$ 545 | \$ 567 | \$ 782 | \$ 809 | \$ 1,075 |

30 sf/window, except “larger” is 50sf

Non-fixed have ~50% operable area, except multi-pane is ~75%

Windows – Cost Considerations

Cost and U-value by Options



Windows – Example Analysis – 50 x 1BDs

| Description | Total Cost | \$ Cost Increase | % Cost increase | Energy Cost Savings | Utility Incentive* | Simple Payback (yrs) |
|------------------------|------------|------------------|-----------------|---------------------|--------------------|----------------------|
| Sliders, U-0.32 (WSEC) | \$ 26,900 | - | - | - | - | - |
| Sliders, U-0.28 | \$ 28,900 | \$ 2,000 | 7% | \$ 179 | \$ 4,700 | <0 (11) |
| Sliders, U-0.24 | \$ 33,400 | \$ 6,500 | 24% | \$ 358 | \$ 12,600 | <0 (18) |
| Casement, U-0.32 | \$ 47,700 | - | - | - | - | - |
| Casement, U-0.28 | \$ 49,700 | \$ 2,000 | 4% | \$ 179 | \$ 4,700 | <0 (11) |
| Casement, U-0.24 | \$ 56,600 | \$ 8,900 | 19% | \$ 358 | \$ 12,600 | <0 (25) |
| Larger Sliders, U-0.28 | \$ 46,800 | \$ 19,900 | 74% | \$ (320) | \$ 7,100 | - |
| Larger Sliders, U-0.24 | \$ 50,200 | \$ 23,300 | 87% | \$ (52) | \$ 18,900 | - |
| * Seattle City Light | | | | | | |

Notes:

Standard size is, 30 sf/window, total 60sf/apt (~33% WWR)

Larger size is 50% more window area, 90sf/apt (~50% WWR)

Windows – Conclusions

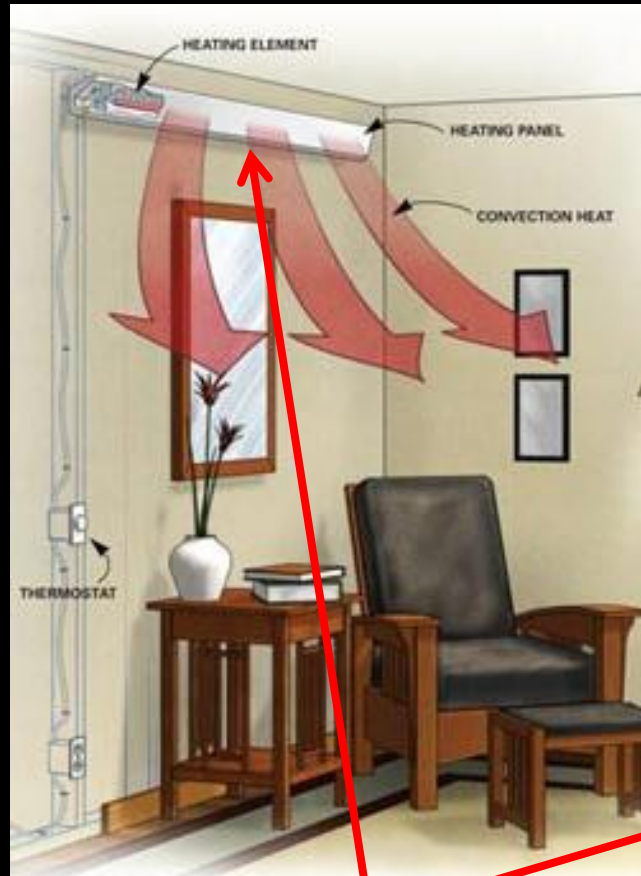
- 1) Upgrading to improved double pane (U-0.28-0.26) is a no-brainer.
- 2) Upgrading to triple pane should be considered, especially if incentives available.
- 3) If you go with double pane, get highest performing and target 25-30% WWR.
- 4) Fiberglass for color choice, but not necessarily performance
- 5) Select stainless hardware and user-friendly latches.

Apartment Heating



Apartment Heating – Electric Resistance

Cove



In-wall



Baseboard

If installed on outside wall, important to insulate walls/headers behind

Apartment Heating – Electric Heat Pumps

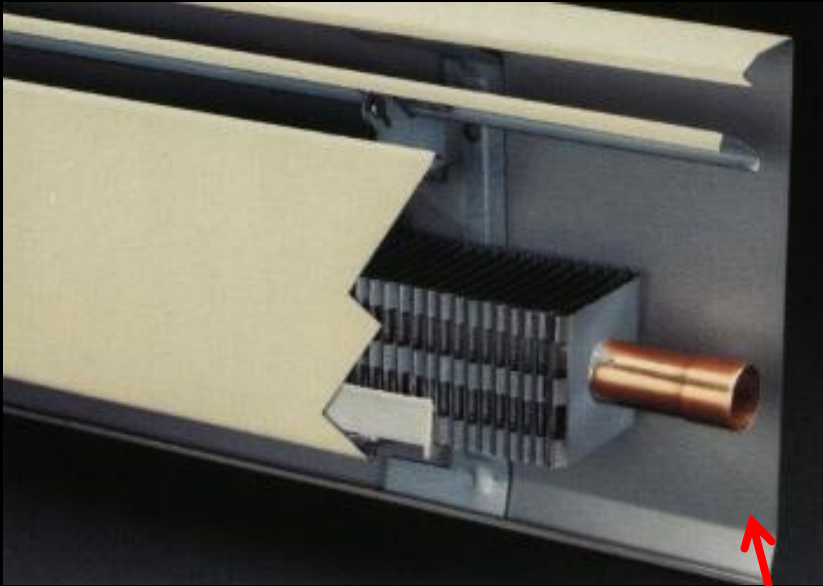


Packaged Terminal Heat Pump
(PTHP)

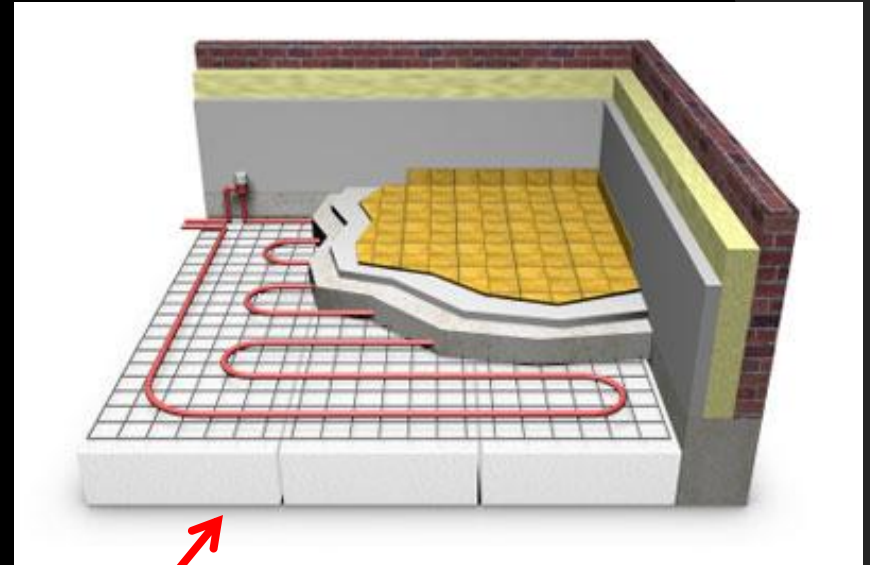


Ductless Heat Pumps
(DHP)

Apartment Heating – Hydronic



Hydronic baseboard



Radiant floor

If installed on outside wall or on-grade,
need to insulate walls/floors

Apartment Heating - Survey Results

Owners

- Electric wall heaters, radiators and cove heaters are proven to be most cost effective to operate
- Hard to realize payback for upgrading to more efficient system
- Radiant hydronic heaters are problematic to maintain

Apartment Heating - Survey Results

Builders

- Electric baseboard heat is most cost effective, but doesn't always work well with unit layouts and venting systems
- Numerous recommendations for Ductless Heat Pumps, especially for
 - larger apartments or townhomes
 - Eastern WA
 - Senior populations.

Apartment Heating – Costs

| Description | First Costs | \$ Cost Increase | % Cost increase | Annual Cost Savings | Utility Incentive* | Simple Payback (yrs) |
|----------------------|-------------|------------------|-----------------|---------------------|--------------------|----------------------|
| Electric In-Wall | \$ 15,000 | \$ - | 0% | \$ - | \$ - | - |
| Electric Cove | \$ 15,000 | \$ - | 0% | \$ - | \$ - | - |
| Electric Baseboard | \$ 15,000 | \$ - | 0% | \$ - | \$ - | - |
| Ductless HP | \$222,500 | \$207,500 | 1383% | \$ 2,600 | \$ 30,000 | 68 |
| PTHP | \$132,500 | \$117,500 | 783% | \$ 3,200 | \$ 25,000 | 29 |
| Hydronic Baseboard | \$200,000 | \$185,000 | 1233% | \$ 1,800 | \$ - | 103 |
| * Seattle City Light | | | | | | |

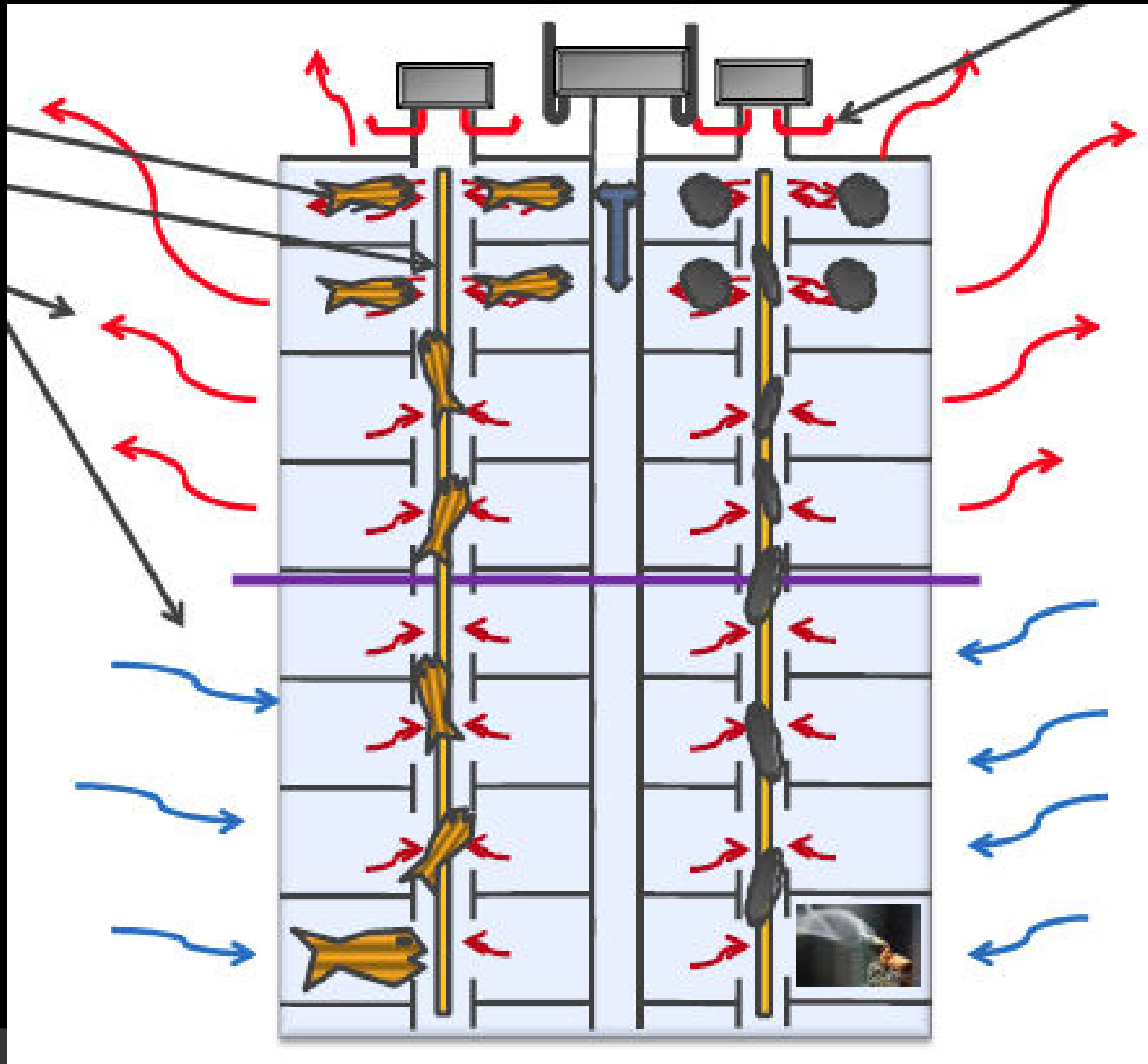
Notes:

Installed costs for building with 50, 600sf (1bd) apts
 R-21 wood walls, U-0.28 windows (60sf/apt, ~33% WWR), 30cfm
 continuous ventilation
 Electric resistance systems last 8yrs, others 15+

Apartment Heating – Conclusions

- Electric resistance is unbeatable in terms of first cost.
- Systems with higher efficiency (DHPS, PTHPs, etc) make more sense when cooling is needed, heating loads can't be reduced, or for larger units (>1500sf).
- For smaller units, recommend prioritizing envelope upgrades and right-sizing ventilation (discussed next...)

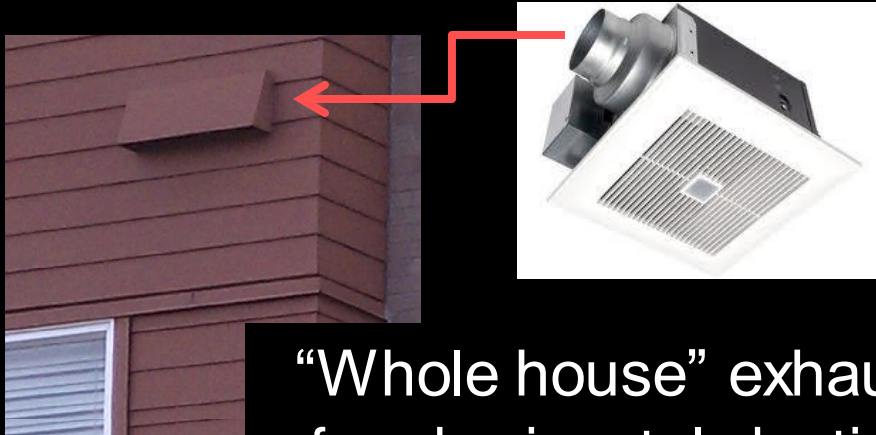
Apartment Ventilation



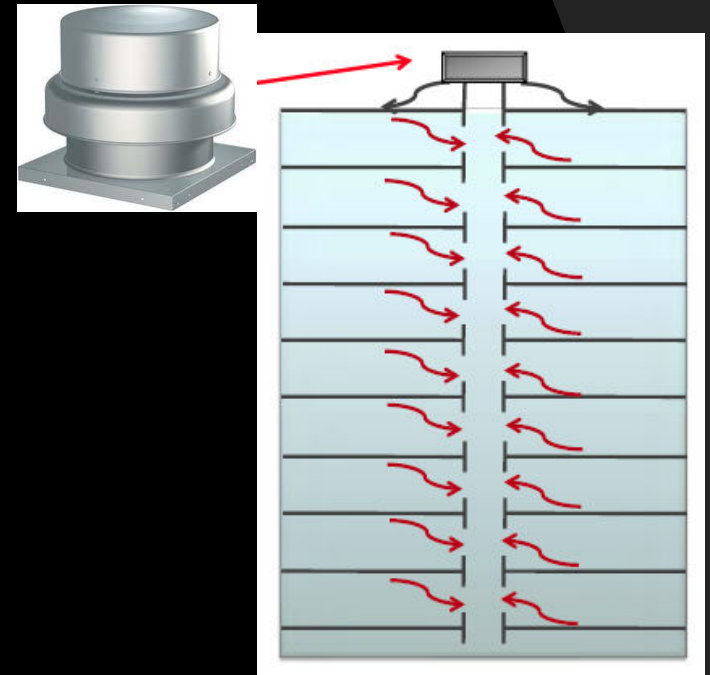
Apartment Ventilation – Survey Results

- Post occupancy audits – some whole house systems have been overdesigned.
- Whole house fans – noise can be bothersome
- Air quality, smells and mold issues in older buildings
- Trickle vents are problematic
- Only one owner has HRV. Noted added maintenance time to change filters.

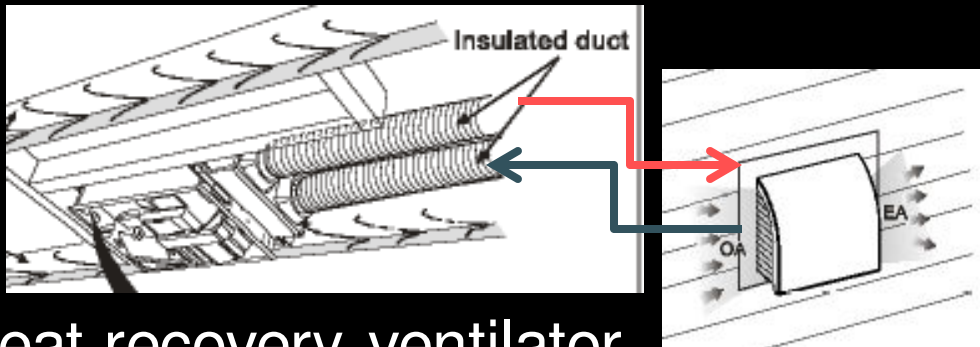
Apartment Ventilation – Ducting



“Whole house” exhaust fan, horizontal ducting



Central exhaust fan, vertical ducting



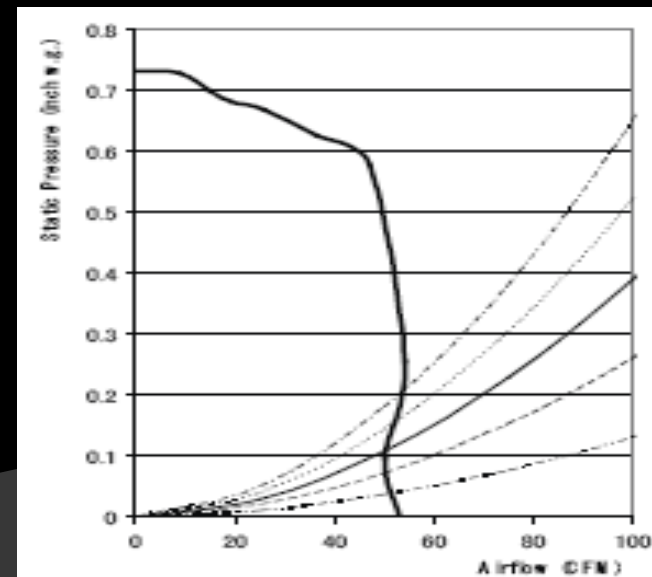
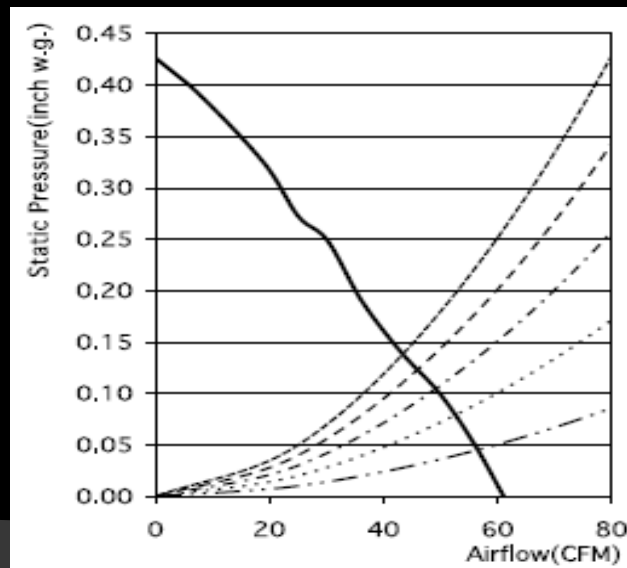
Heat recovery ventilator (HRV, horizontal or through wall ducting

Apartment Ventilation – Ducting

| Horizontal Ducting | Vertical Ducting |
|---|---|
| Can compartmentalize apartments | Units connected between floors, contributes to stack and odor migration |
| Balance one unit at time, easy with DC motors | Need to balance across multiple units |
| Ducts easier to seal, can right-size fans | Ducts harder to seal, leads to over-ventilation, air migration |
| Tenant pays for fan electricity | Owner pays for fan electricity |
| In-unit HRV possible | Central HRV possible, but... |
| Wall penetrations | Roof penetrations (usually) |

Apartment Ventilation – Fan Types

| AC Motor | DC Motor |
|--|---|
| Low cost | Higher cost, but cost-effective |
| Higher sones (>1, noiser) | Lower sones (<0.5, quieter) |
| Low efficiency (1-2 cfm/Watt) | High efficiency, (7-10 cfm/Watt) |
| Constant speed, at mercy of duct static! | Variable speed, automatically adjust to duct static |



Apartment Ventilation – Fresh Air Inlets



Trickle vents



Fresh air ports

| Trickle Vents | Fresh Air Ports |
|---------------------------------------|---------------------------------|
| Open or closed | Optional self-adjusting dampers |
| Less cost | More cost |
| They break or are closed by occupants | No user actuated parts |

Apartment Ventilation – Sizing

- Ventilation is typically largest component of apartment heating bill.
- IMC prescriptive fan sizes too large for smaller apartments (<1500sf).
- Recommend using ASHRAE 62.2 to calculate required ventilation.
- If optimizing ventilation rates, need to:
 - Install quality fan and duct system
 - Test fans and controls after install
 - Educate tenants on purpose
 - Check flow rates periodically



Apartment Ventilation – Costs

- Payback on DC motor fans and controls <2-6 years.
- Fan controls allow whole house fans to also provide bathroom (and maybe laundry) exhaust...Two or three fans for the price of one!
- Payback for HRV >10yrs, but will be less in colder climates or where more ventilation air is needed.



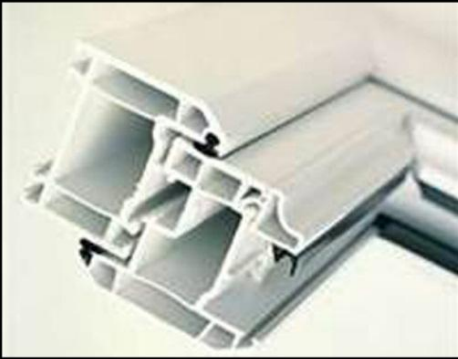
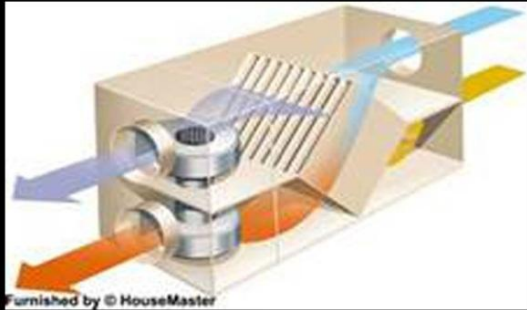
Conclusion

Thank you!

Survey respondents

Dan Cantrell and Harry Hoffman from HDC

Heather Bunn and Ryan Meno from RAFN



QUESTIONS & DISCUSSION

Contact info

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Resources

www.housingconsortium.org

ww.buildinggreen.com

www.efficientwindows.org

www.windowattachments.org

Apartment Ventilation – Sizing

