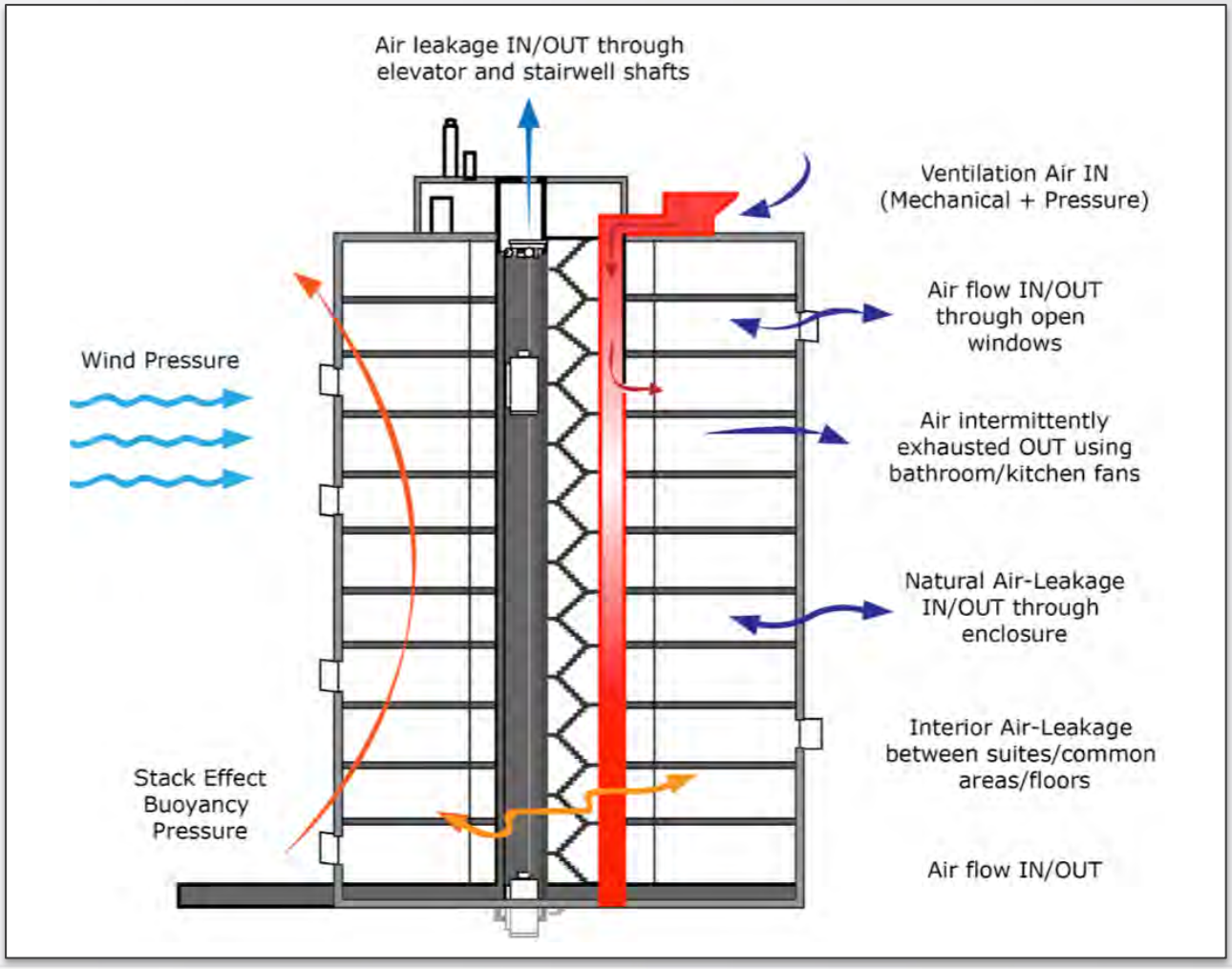
Energy Impacts of Ventilation Strategies in Multifamily Projects

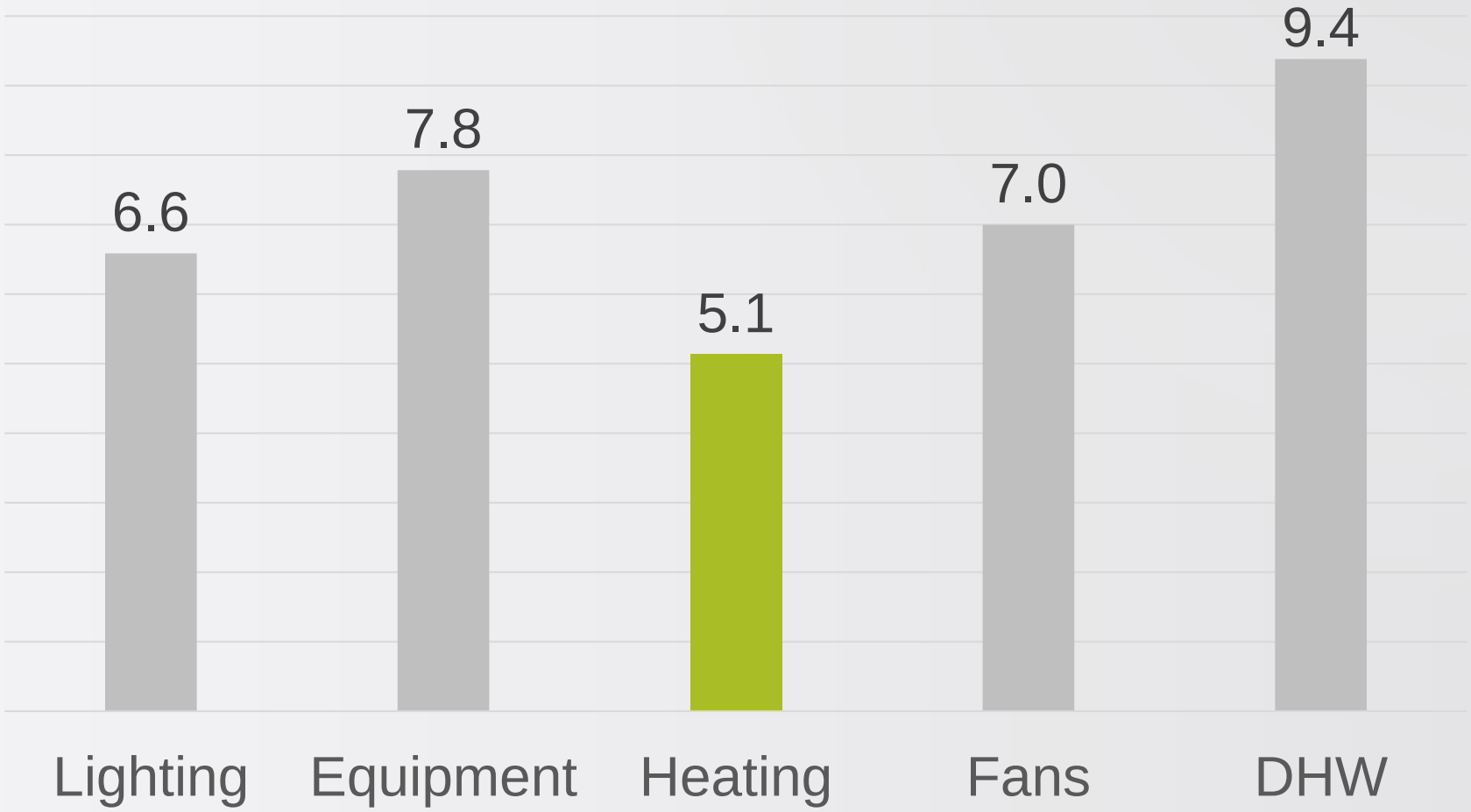
Katherine Anderson, EIT
Glumac Energy Analyst

Generic Multifamily Ventilation



Multifamily Energy Use

Electric Baseline, New Construction in PDX



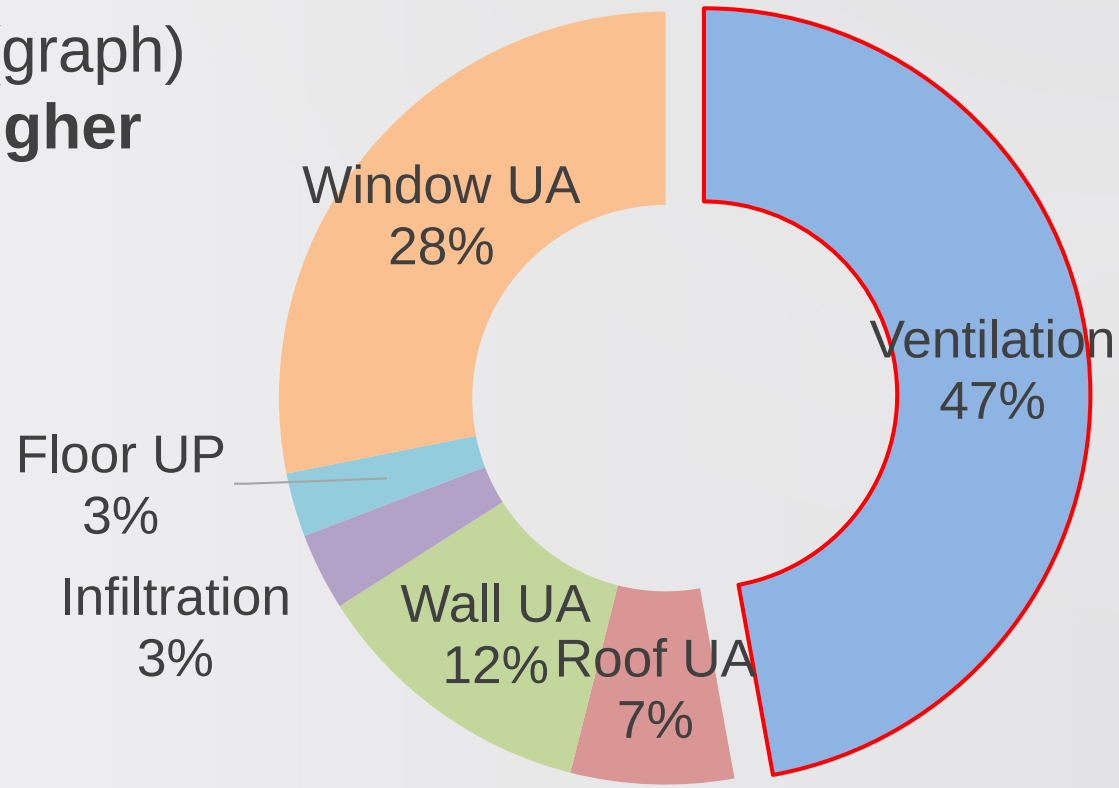
Energy Impact of Ventilation Tempering

0.06 CFM/SF vent in PDX

- **Load** = 10.8 kBtu/sf (graph)
- Min. case, **usually higher**

0.10 CFM/SF…

- **Load** = 18.0 kBtu/sf



Graph info

- No heat recovery
- ~30% WWR
- U-0.35 windows
- Code walls, roof
- 50-60% of load offset by internal gains

Smallest baseline end use, why do we care?

- **More design team control** over HVAC
- Huge **variation** in loads
  - Continuous vs intermittent exhaust?
  - IAQ (staleness, odors, humidity/mold)
  - Pressurization issues
- ~70% of consumption is at night (7pm-7am)
  - Fuel mix implications

Determining Minimum Unit Ventilation

- Ventilation min. for occupants/staleness
  - ASHRAE 62.2 req's **~0.06 CFM/sf**
  - OR Mech Code req's 0.35 ACH (~0.06 CFM/sf)
- Bathroom exhaust
  - 20 CFM continuous
  - 80 CFM intermittent (4 hour equiv.)
- Kitchen hood
  - 25 CFM continuous
  - 150 CFM intermittent (4 hour equiv.)
  - Often see **300-500 CFM** for intermittent hoods
- **Intermittent** may result in fewer CF of exhaust, but also **oversizing of make-up systems**

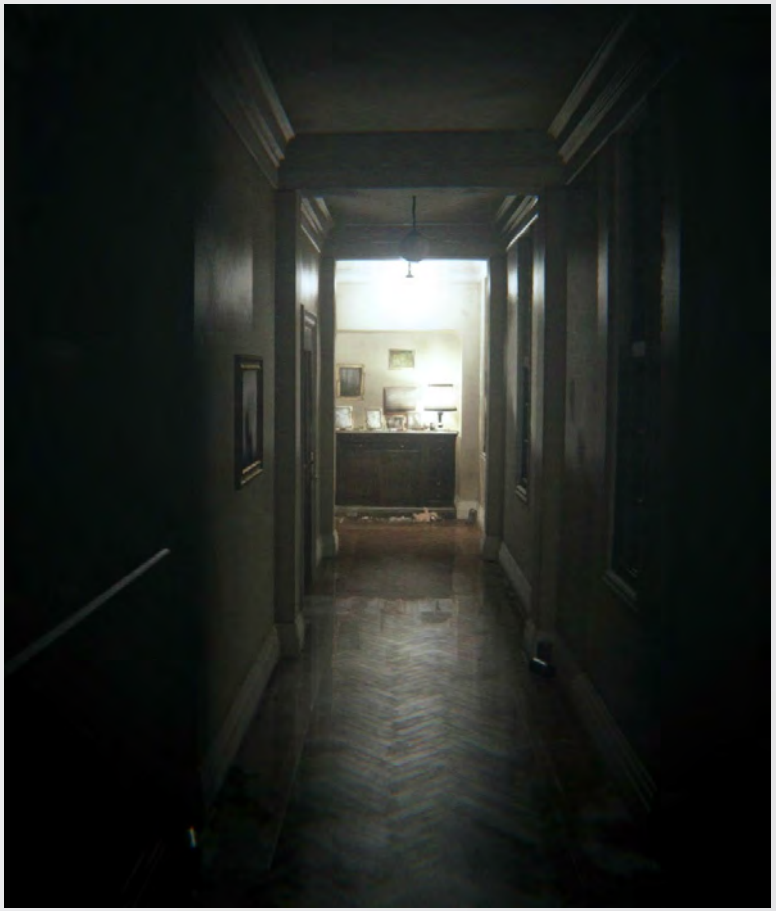
Reduction first!

- Why do we design >0.06-0.1 CFM/SF?
  - Balancing **intermittent** + **decentralized** exhaust streams (bathroom, kitchen)
  - **Odor mitigation**
- Solutions
  - **Localized** designs
  - **Centralized** exhaust risers

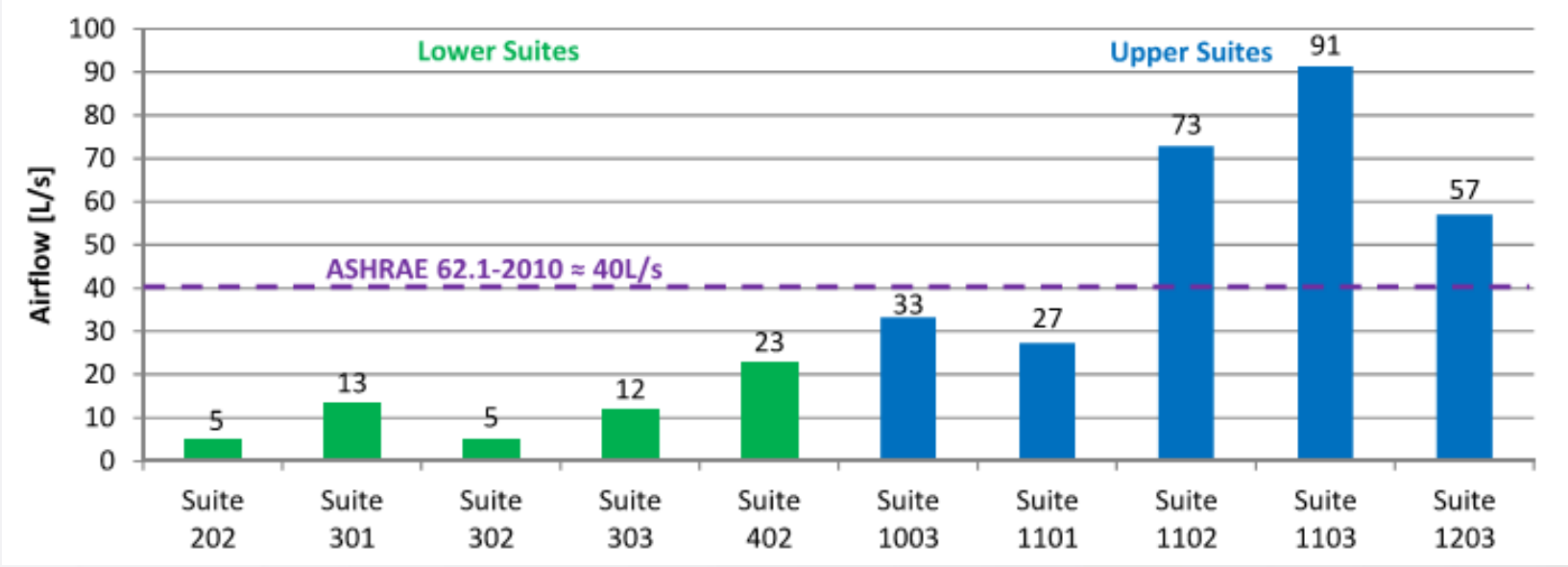
“Classic” 1: 100% OA Corridor RTU

- Intended to prevent negative pressure, odor transfer
- No return shaft to save $$
- **~0.2-0.5 CFM/SF** in corridors (0.06-0.075 req’d)
- **35-75 kBtu/SF** w/ 80% gas furnace

An overventilated corridor is a scary corridor!



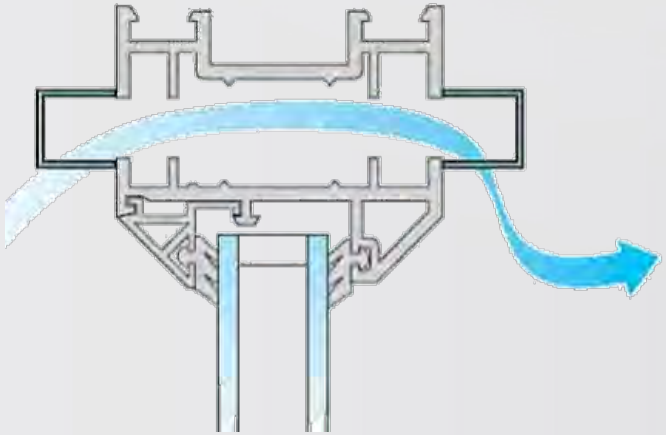
“Classic” 1: 100% OA Corridor RTU



Corridor Pressurization System Performance in Multi-Unit Residential Buildings, Ricketts & Straube, 2014

“Classic” 2: Trickle Vents

- Pressurization issues
  - Trickle vent =/= path of least resistance
- Whistling
- Often drives ME to include “Classic” 1

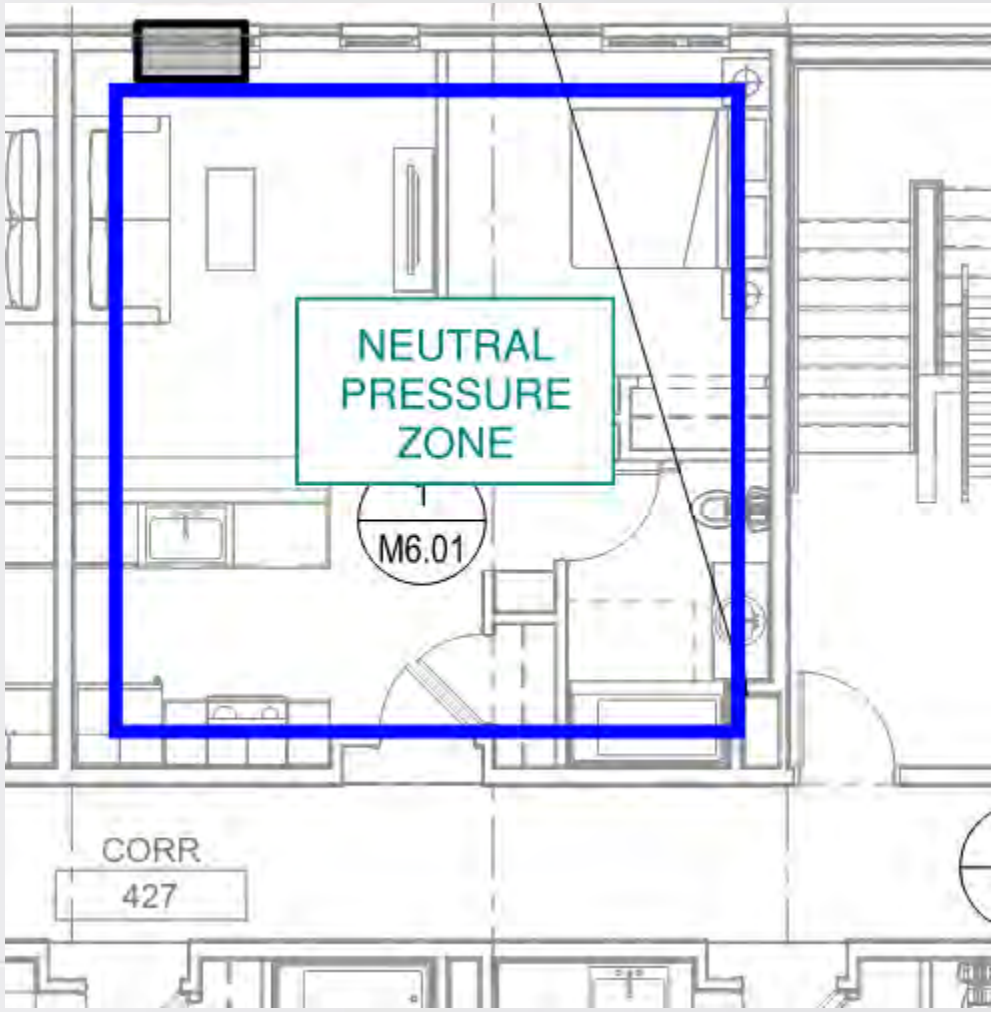


“Classic” 3: PTAC ventilation

- Fans run 24/7 **or** inadequate ventilation
- Large OA damper penetration increases infiltration
- Handling intermittent kitchen exhaust:
  - Vent. rate usually oversized…
  - **Or** ME includes “Classic” 1

Solution 1: Localized Vent. + Exhaust Makeup

- Continuous bathroom and kitchen exhaust
- In-unit makeup
- Balanced, opportunity for HRV
- Minimal ductwork compared to centralized
- NC **and** retrofit



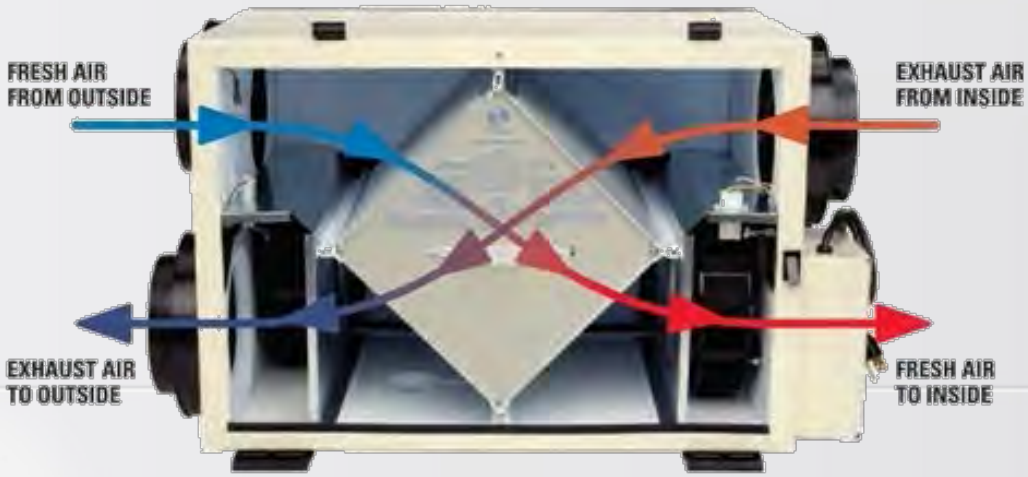
Solution 2: Localized HRVs

- Centralized HR difficult due to myriad exhaust sources
- One solution:
  - Local HRVs for apartment bathroom exhaust, ventilation
  - Central HR for cooking exhaust, or no HR on cooking exhaust
  - Communal laundry with HR option
- $1.5-3/sf adder vs PTHP

Solution 2: Localized HRVs

Caution! Do not oversize the HRV!

- 50 CFM cont. ventilation: **7,900 kBtu** load
- 130 CFM cont. w/ 65% HRV: **7,200 kBtu** load

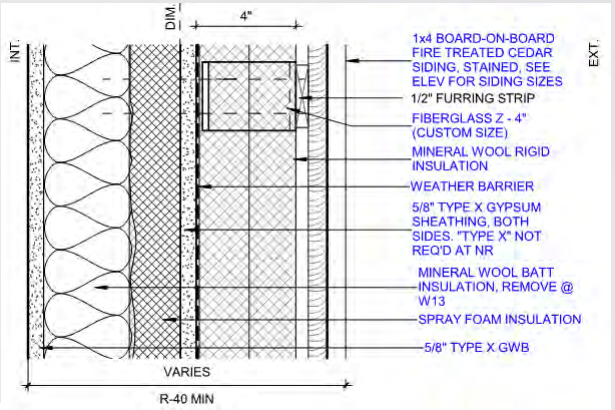


Case Studies: Apartment Project #1

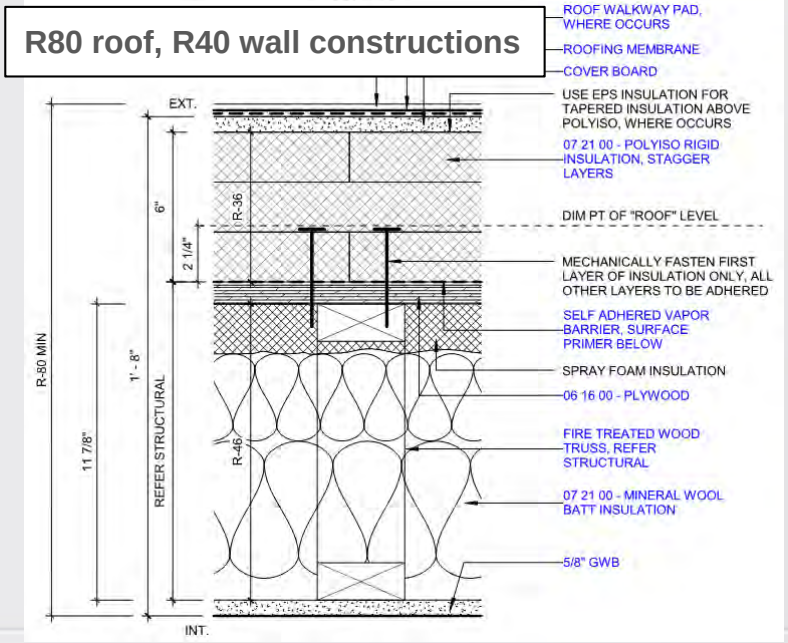
Passive House Envelope, HRVs, electric heat

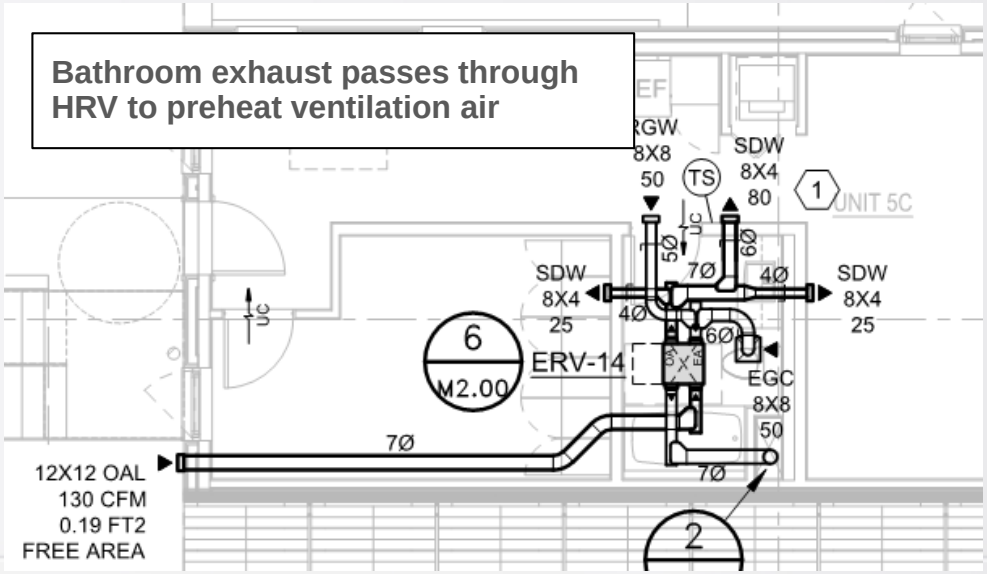
➔Heating load ↓ 70%,

➔Energy/cost ↓ 50%



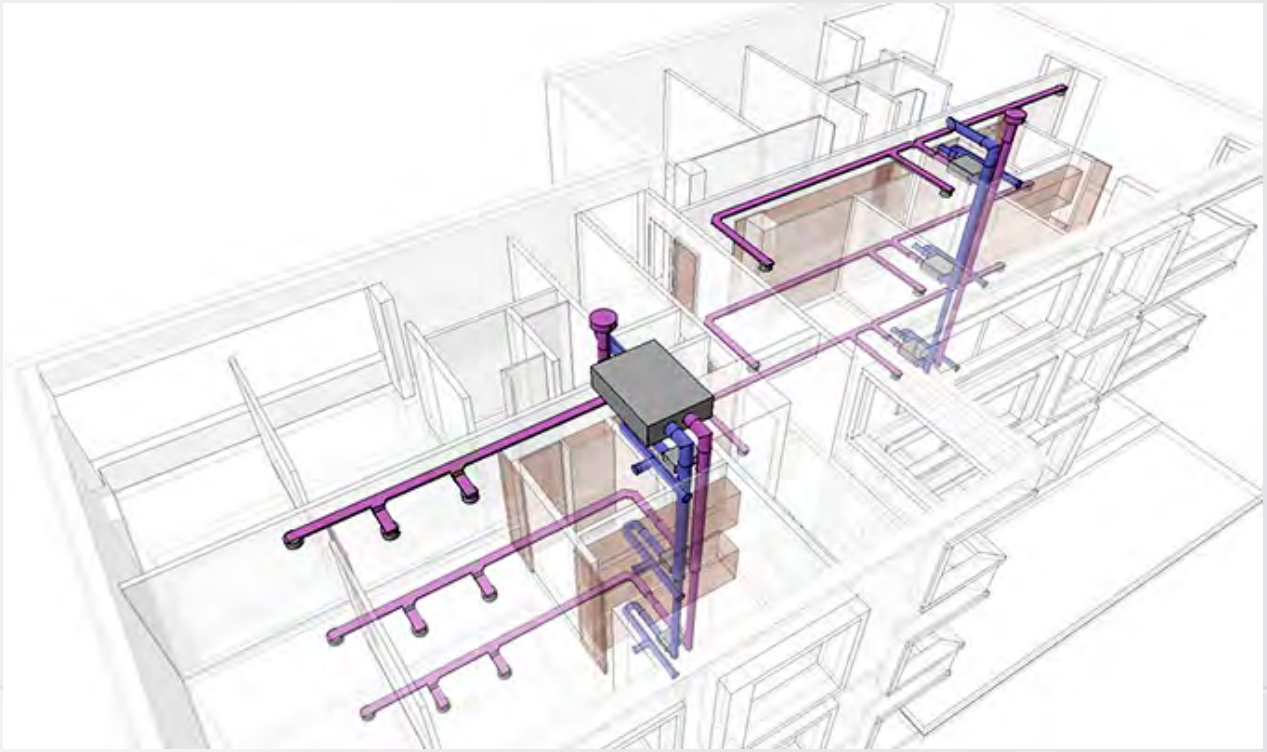
R80 roof, R40 wall constructions





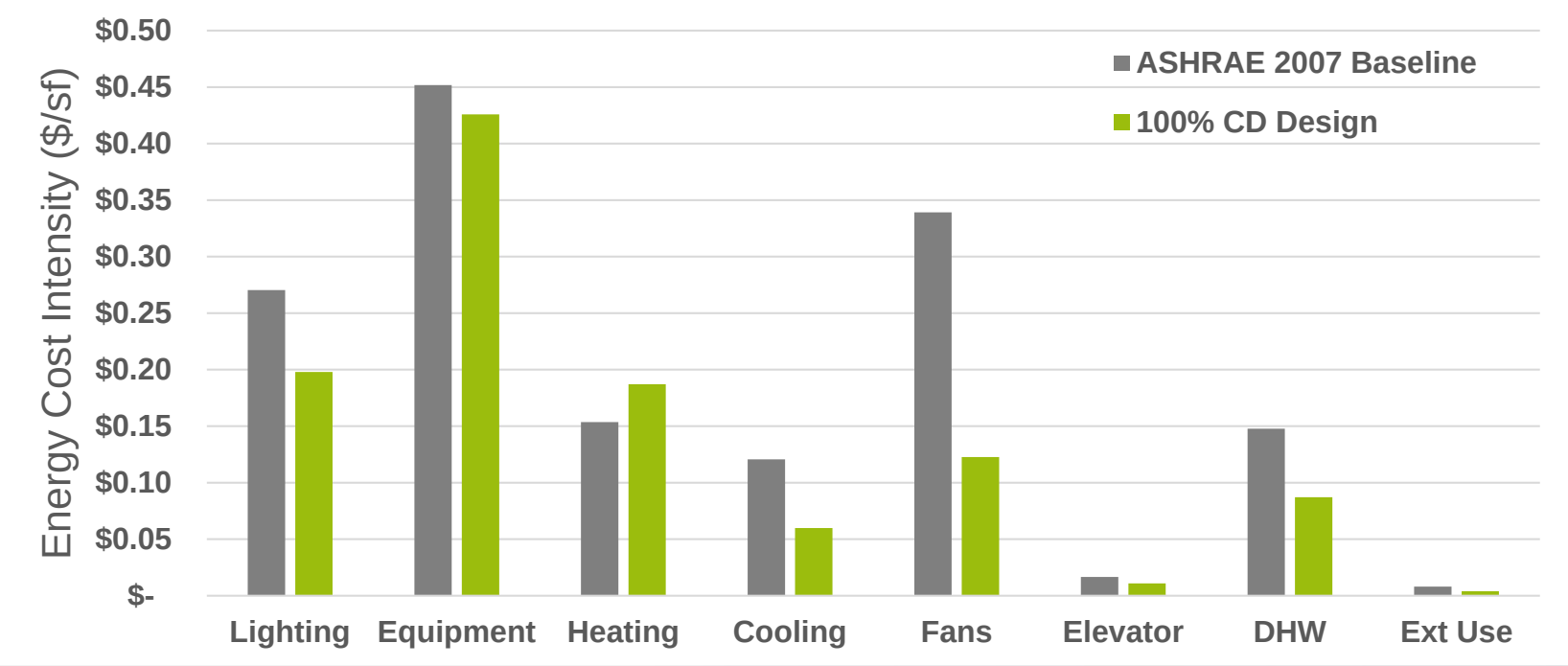
Solution 3: DOAS ducted to units

- Floor-by-floor or whole building
- Continuous exhaust to minimize sizing, controls
- Balanced, opportunity for HRV and economizing



Case Studies: Apartment Project #2

- Ducted ventilation from central unit – fan energy ↓ 40%
- Split systems
  - Heat pumps should operate below 35 F!



2019 Energy Code Updates

- Will the classics be nixed by 2019 Energy Code?
  - NOPE
  - Heat Recovery req. has specific exception for Classic 1
- Process exhaust historically unregulated, will continue
- Push to require local HR or centralized exhaust?

THANK YOU!

Katherine Anderson, EIT
Energy Analyst
kanderson@glumac.com