Today’s Agenda

Introductions

Thermal comfort

Whole house approach
   Major components of the home

Clean heating options
   Electrification with Heat Pumps
Upgrading – Which Direction?

• Furnace is old > 20 years
• My heating system is less than 15 years old
• I have a radiant system
• I want to add cooling
• Understanding your home comfort issues

• Envelope improvements

• What type of system do I chose?

• Sizing a system to your home
Thermal Comfort

- Thermal comfort is affected by four main factors
  - Air temperature
  - Mean Radiant Temperature
  - Air movement / Velocity
  - Relative Humidity
Whole-House Approach

• Your home is a system

• Home comfort is made up of connected parts working together

• Only as strong as the weakest link
Building Shell – Air Leaks

- Air seal
  - Sealing the home can help improve indoor air quality
  - Attic and crawlspace are important to address
  - Reduces moisture, particulates, and radon
  - Dense pack wall insulation can help
  - Lowers heating and cooling costs
Building shell - Insulation
Ventilation – Managing Air Quality
Ducts

- Surface area of central heating ducts is nearly 25% of your house’s wall area
  - Like at 5th wall of your home
    - Low insulation
    - Leaky – Average 30% leakage
Existing heating

- Central furnace
- Radiant heating with boiler
- Electric baseboard
Electrification Path

For more information on electrification:
https://www.cityofpaloalto.org/electrification
What is a Heat Pump

• You already have one in your home
  • Your refrigerator

• Moves heat from inside to outside or outside to inside
  • The air conditioner is a one-way heat pump

• Very efficient use of energy
Clean Heating Options
Central Heat Pump

- Replace existing central furnace
- Can use existing ducts, better to redesign
Mini-splits

- Ductless
  - Open floor plans
  - Zoned room
- Ducted
  - Useful for smaller rooms
  - Less intrusive
How these systems work

• Heat pump more gradual heating
• Long continuous heating cycles (more efficient)
• Set-backs are smaller or not needed
Central Heating

• Fast heating of air
• Can add cooling

• Problems
  • Cycles on and off frequently
  • Noisy
  • Unbalanced
  • Leaky ducts
  • Over dries the air
  • Generates discomfort with hot air
  • Carbon monoxide risk
Radiant and Electric Resistance Baseboard

• Radiant
  • Comfortable
  • Gradual heating
  • Low noise, less cycling
  • Continuous heating
  • Can be zoned
  • No cooling

• Baseboard
  • Zoned heating
  • Expensive
  • Slow to heat
  • No cooling
Radiant and Electric Resistance

- Can add cooling with mini-split
- Uses less energy than electric baseboard
- Alternative heating to slower radiant
Upgrade paths to explore

• Ducted and non-ducted systems
  • No duct leaks – better air quality
  • Zoned system
Sizing systems

• Heating and cooling load calculation for sizing
  • More involved than old methods

• Modeling calculations
  • Manual J – calculate heating and cooling needs whole house
  • Manual D – Duct sizing for delivering conditioned air
    • Room by room load calculation
Understanding Efficiency ratings

- **SEER - Seasonal Energy Efficiency Ratio**
  - Amount of Energy (and money) used over the year
  - Compare SEER to SEER between systems
    - EER is a different measuring metric
    - Higher number more efficient $\geq 16$ SEER
      - Minisplit have higher SEER

- **HSPF - Heating Seasonal Performance Factor**
  - Higher number better

- **AFUE - Annual Fuel Utilization Efficiency**
  - Higher number better
  - 90-98%
• Main factors affect comfort
• View your home as a system
• Assess envelope of your house
• Size your system to your house

• Contact the Home Efficiency Genie advisor with any questions or for advice
Thank you for attending!

• Questions, comments?

• Virtual Assessment

• Home Efficiency Genie free phone advising
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