Fossil Fuel Compliance Path

If needed for EPCA compliance

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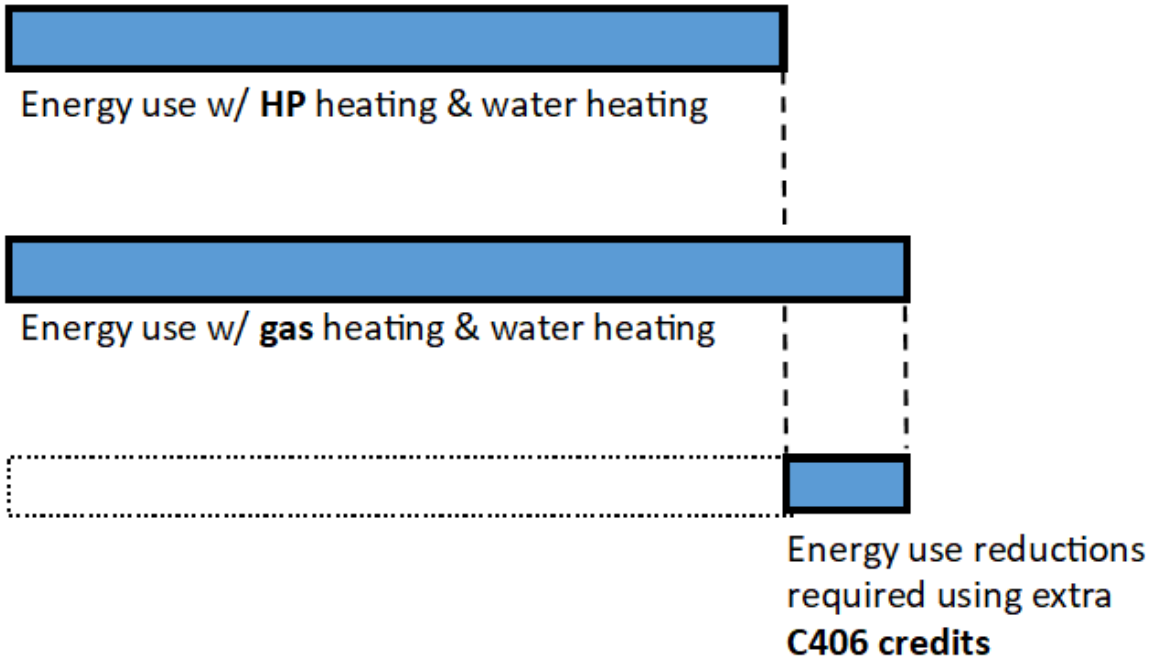
Basic concept

Compliance path explicitly permitting gas heating & water heating, while maintaining same overall energy efficiency as heat pump buildings.

1. Calculate difference in annual energy use between buildings using gas & using heat pumps
2. Require sufficient additional C406 credits from buildings with gas equipment to equalize annual energy use.



The proposed **Fossil Fuel Compliance Pathway** explicitly permits the use of fossil fuel combustion appliances, together with extra energy efficiency credits to compensate for the additional site energy usage of the gas appliances. Propane & heating oil appliances are also permitted.

Convert “emissions” credits to “energy”
Modification of original proposal

- Using the same conversion factors used to develop Jonny Kocher’s residential code proposals
- 13 *energy* credits
  - = 10 *gas* carbon emissions credits
- 12 *energy* credits
  - = 10 *electrical* carbon emissions credits

- “Electrical” proposals (credits x 1.2)
  - All not listed as “gas” proposals

- “Gas” proposals (credits x 1.3)
  - 2. HVAC TSPR
  - 4. Heating efficiency
  - 15 Shower drain heat recovery
  - 16. Service water heat recovery
  - 19. Point of use water heater
  - 20. SHW distribution right-sizing
  - 21 SHW circulation system
  - 23. Low flow res showerheads
  - 24. Enhanced envelope performance
  - 25. Base reduced air leakage
  - 26. Enhanced reduced air leakage

Adjustment for “exempt” heating capacity

Formula: CR = A – (A x B/C)

$$\text{Adjusted Credits} = \text{Credits required by Table C401.3.3.1} - \left(\text{Credits required by Table C401.3.3.1} \times \frac{\text{heating capacity complying with an exception}}{\text{Total building heating capacity}} \right)$$

This removes heating capacity that’s allowed to be electric resistance from the equation.

Example: The electric resistance heating allowed for dwelling units.

Baseline credits for three building types

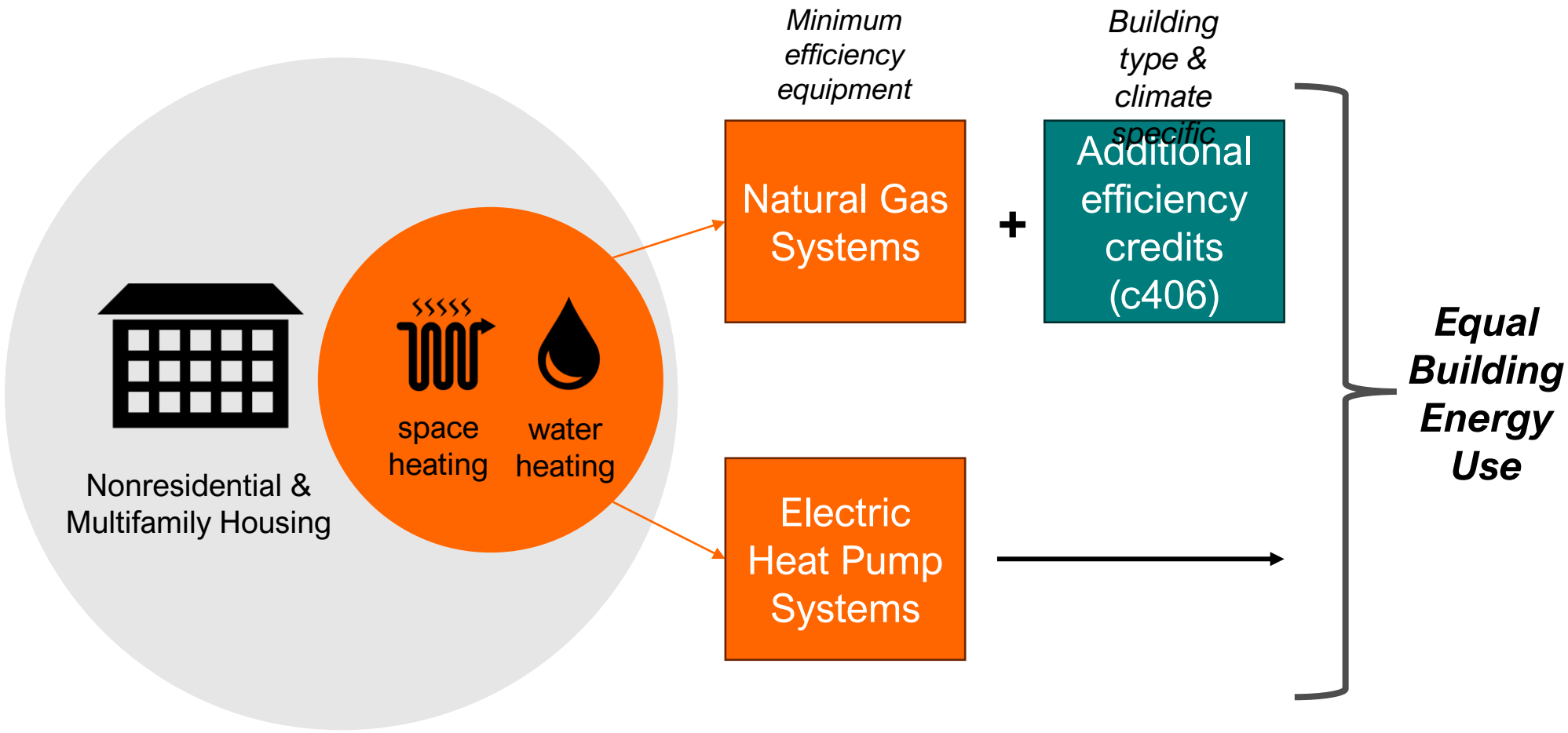
Table C401.3.3.1 HVAC Heating Equipment Credits		
Building Area Type	Baseline Credits Required	
	Climate Zone 4C	Climate Zone 5B
Multifamily	195	187
Health care/hospital		
Hotel/motel		
Office	112	165
Restaurant		
Grocery		
Other retail		
School	52	60
Warehouse		
All others		

Table C401.3.4.1 Service Water Heating Equipment Credits		
Building Area Type	Baseline Credits Required	
	Climate Zone 4C	Climate Zone 5B
Multifamily	65	62
Health care/hospital		
Hotel/motel		
Office	37	55
Restaurant		
Grocery		
Other retail		
School	17	20
Warehouse		
All others		

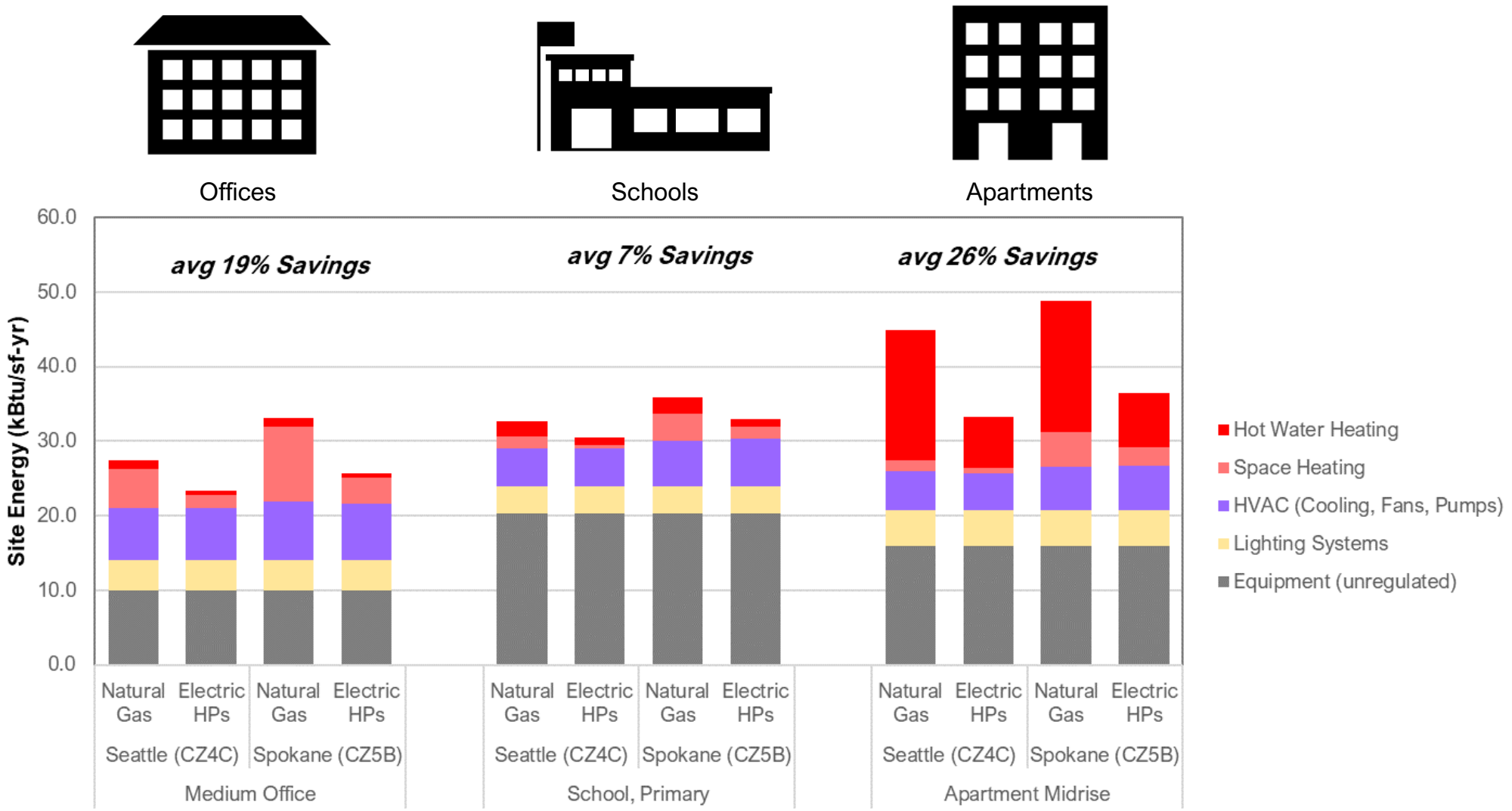
Washington State Nonresidential Prescriptive Compliance Evaluation for Gas and Heat Pump Pathway

7/14/2023

Framework for Heating System Compliance Pathways

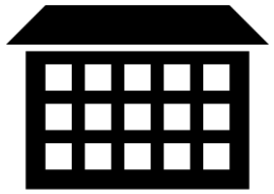


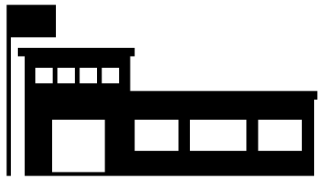
Building Energy Equivalence, Initial Findings



Building Energy Equivalence, Initial Findings

General Assumptions
- *Annual Energy Simulations*
- *EnergyPlus 22.1*
- *DOE based Prototypes*
- *WA Energy Code Minimum Efficiencies, New Construction*





	Medium Office				School, Primary				Apartment Midrise			
	Seattle (CZ4C)		Spokane (CZ5B)		Seattle (CZ4C)		Spokane (CZ5B)		Seattle (CZ4C)		Spokane (CZ5B)	
Site Energy (kBtu/sf)	**Natural Gas**	**Electric HPs**	**Natural Gas**	**Electric HPs**	**Natural Gas**	**Electric HPs**	**Natural Gas**	**Electric HPs**	**Natural Gas**	**Electric HPs**	**Natural Gas**	**Electric HPs**
Equipment (unregulated)	9.9	9.9	9.9	9.9	20.3	20.3	20.3	20.3	15.9	15.9	15.9	15.9
Lighting Systems	4.2	4.2	4.2	4.2	3.6	3.6	3.6	3.6	4.7	4.7	4.7	4.7
HVAC (Cooling, Fans, Pumps)	6.9	6.8	7.8	7.6	5.0	5.1	6.1	6.3	5.3	5.0	5.8	6.0
Space Heating	5.2	1.8	10.0	3.5	1.6	0.5	3.7	1.6	1.4	0.7	4.8	2.5
Hot Water Heating	1.2	0.6	1.2	0.6	2.1	1.0	2.1	1.0	17.5	6.9	17.5	7.3
Total Site Energy	27.4	23.4	33.1	25.7	32.7	30.5	35.8	32.9	44.9	33.3	48.8	36.5
Heating Systems	6.4	2.4	11.2	4.1	3.7	1.5	5.8	2.7	19.0	7.6	22.3	9.9
Heating % of Total	23%	10%	34%	16%	11%	5%	16%	8%	42%	23%	46%	27%
EUI Savings (kBtu/sf)		**4.1**		**7.4**		**2.2**		**2.9**		**11.7**		**12.3**
Relative Energy Savings		**15%**		**22%**		**7%**		**8%**		**26%**		**25%**

- *DOAS with four-pipe-fan coils.*
- ***Natural gas:*** *HW boiler and DHW boiler*
- ***Electric hp:*** *Air to Water HP and Central WSHP*

- *Central DOAS with PTAC/PTHPs*
- ***Natural gas:*** *Furnaces and DHW boiler*
- ***Electric hp:*** *Air Source HPs and Central WSHP*

- *Central DOAS with PTAC/PTHPs* ***Natural gas:*** *Furnaces and In-Unit DHW boiler*
- ***Electric hp:*** *Air Source HPs and Central WSHP*

A2 EFFICIENCY

Analysis Key Assumptions

- All models based on Department of Energy building prototypes
- Modified originally from IECC code models for WA state code
- Simulated in EnergyPlus 22.1
- Weather files based on TMY3 files for Seattle and Spokane
- Medium Office building use assumptions updated in all cases to be more representative on: people usage, lighting usage, equipment usage, infiltration changes, hot water usage

- **Medium Office Systems**
  - DOAS with Four Pipe Fan Coils. Central water heating.
    - Central Heating
      - Boiler: 80%
      - Air to Water HP: COP 2.77
    - Domestic Hot Water:
      - Boiler: 81%
      - HPWH: COP 3.4
- **School Primary**
  - Central DOAS, per apartment Packaged Terminal Heat Pump/AC Unit. Central water heating.
    - Central Heating
      - Boiler: 80%
      - Air to Water HP: COP 2.77
    - Domestic Hot Water:
      - Boiler: 81%
      - HPWH: COP 3.4
- **Apartment Mid-Rise**
  - Central DOAS, per apartment Packaged Terminal Heat Pump/AC Unit. In-Unit Gas /Central Heat Pump Water Heater
    - Heating
      - Furnace: 80%
      - Air to Air HP: 3.81
    - Domestic Hot Water:
      - Boiler: 80%
      - HPWH: COP 3.4