

Packages (PTACs & VTACs) or Split Direct Expansion (DX) Air Conditioning System with Electric Heat:

Each residential unit will be served by individual air conditioning unit with electric heating coil. In the case of using split systems, fan coil units will be located inside the units and condensing units (heat pumps) will be located outside, on the balcony, roof or parking deck.



NOTE: Gas heat could be used with split system to improve heating efficient and capacity. The combustion air and flues required for gas heat is more difficult to design into the building.



Chilled Water and Electric Heat System:

The central system will have a chilled water loop system (43-58 F typically) with chiller(s), cooling tower(s), pumps, heat exchanger, and controls.

Chilled water piping will be piped from the chiller to each chilled water fan coil unit (FCU) located in each residential unit.

Cooling Efficiency:	
Heating Efficiency:	
Upfront Cost:	
End User:	
Maintenance:	



Pay Back on Efficiency: 3-6 years

Pros:

- Provides the best end user environment with low noise and best control
- Chilled Water FCU in Residential Unit is quiet (no compressor like WSHP)
- Minimal maintenance in the Residential Unit (no compressor like WSHP)
- Separation of chiller & FCUs has minimal effect on efficiency/performance of system

Cons:

- Initial cost is higher
- Space will need to be allocated for a central plant housing pump(s), heat exchanger and chillers (if water cooled).
- Tenant consumption has to be metered via BTU Meter (chilled water usage) or included in rent/association fees
- Not all mechanical contractors are familiar with this system type or equipped to work on them



Variable Refrigerant Flow (VRF) System with Cooling Tower/Boiler:

The central system will have a tempered (condenser) water loop system (85-95 F typically) with cooling tower(s), boiler(s), pumps, heat exchanger, and controls.

Condenser water piping will be piped from the cooling tower/boiler to each floor's water source heat recovery unit. From there, refrigerant is piped to all the FCUs in each unit.

Cooling Efficiency:	****
Heating Efficiency:	****
Upfront Cost:	
End User:	*****
Maintenance:	



Pay Back on Efficiency: 2-3 years

Pros:

- Higher efficiency
- Separation of cooling tower & WSHP has minimal effect on efficiency/performance of system
- Cooling tower has smaller footprint on exterior than a condensing unit farm

Cons:

- Initial cost is higher than split systems
- Tenant energy consumption cannot be metered
- ASHRAE 15 refrigeration requirements can cause more systems to reduce the amount of refrigerant in system. This is to prevent any harm to occupants if the refrigerant charge is emptied into a room.
- Maintenance of cooling tower/water quality
- Not all mechanical contractors are familiar with this system type or equipped to work on them

NOTE: a geothermal ground system could replace the cooling tower / boiler to improve efficiency and lower maintenance.

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Variable Refrigerant Flow (VRF) System with Air Cooled Heat Recovery Outdoor Units:

Each residential unit will be served by individual fan coil unit. The fan coil units have multiple options and can be installed above ceilings, vertical, or wall mounted to name a few. Refrigerant lines are routed to heat recovery units that are located outside, on the roof or parking deck. The outdoor units can serve multiple indoor units (up to about 60 indoor units possible on single outdoor unit) which reduces outside footprint needed.

Cooling Efficiency:	
Heating Efficiency:	
Upfront Cost:	
End User:	
Maintenance:	



Pay Back on Efficiency: 2-3 years

Pros:

- Higher efficiency (multiple units on system allows them to heat and cool simultaneous and transfer heat without running compressors)
- No central plant / cooling tower to maintain

Cons:

- Initial cost is higher than split systems
- Tenant energy consumption cannot be metered
- ASHRAE 15 refrigeration requirements can cause more systems to reduce the amount of refrigerant in system. This is to prevent any harm to occupants if the refrigerant charge is emptied into a room.
- Not all mechanical contractors are familiar with this system type or equipped to work on them
- Leaks in refrigerant piping if installed poorly



Water Source Heat Pump (WSHP) System with Cooling Tower/Boiler:

The central system will have a tempered (condenser) water loop system (85-95 F typically) with cooling tower(s), boiler(s), pumps, heat exchanger, and controls.

Condenser water piping will be piped from the cooling tower/boiler to each WSHP (typically constant volume water to air heat pump units) located in each residential unit.

Cooling Efficiency:	
Heating Efficiency:	
Upfront Cost:	
End User:	
Maintenance:	



Pay Back on Efficiency: 3-5 years

Pros:

- Higher efficiency
- Separation of cooling tower & WSHP has minimal effect on efficiency/performance of system
- Cooling tower has much smaller footprint on exterior than a condensing unit farm
- Allows HVAC power consumption to be metered per tenant although the condenser water loop power consumption will need to be on house meter

Cons:

- Initial cost is higher than split systems
- Maintenance of cooling tower/water quality
- With the compressor integral to the indoor WSHP, there will be more noise
- A larger mechanical closet will be required in each residential unit
- Not all mechanical contractors are familiar with this system type or equipped to work on them

NOTE: a geothermal ground system could replace the cooling tower / boiler to improve efficiency and lower maintenance.

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