Draft Latest Revision Date: 6/27/21

Belmont Energy Committee Comment Letter on the Application for Special Permit for the Residences at Bel Mont (McLean Hospital zone 3)

The Energy Committee (EC) is pleased that the applicant Northland Realty ("Applicant") came before the committee on May 19, 2021 to review plans for a potentially "all electric" development of 38 townhome units (together the "THs") and 3 apartment rental buildings (together the "APTs") at McLean Zone 3. By "all-electric" we understood the Applicant to mean they would install: (i) electric heat pumps (EHPs) and electric induction cooking appliances for all THs and APTs, (ii) electric vehicle charging infrastructure throughout the development, and (iii) with some further exploration needed, potentially also electric water heating systems. The embrace of electrification demonstrated in the plans is aligned with the Energy Committee's Climate Action Roadmap and we hope will serve as a blueprint for new construction in Belmont.

To help achieve these goals, the EC is pleased to share the following recommendations, and several requests for clarification, with the Board as it reviews the Applicant's Special Permit application:

Heat Pumps: Consistent with Applicant's embrace of heat pumps during the May 19th EC meeting:

1. The Board should make the installation of EHP HVAC units a condition of its Special Permit and final certificate of occupancy for the entire development.

Solar Provisions: The Board should require the Applicant to maximize PV solar installations on both THs and APT buildings. To achieve this recommendation, Applicant should be called upon to:

2. Integrate solar footprint into the design of all buildings, such that solar is included as among the primary rooftop objectives. (See Appendix A for details)
3. Install solar on both the south- and west-facing roofs on all rental buildings to the extent that is feasible. We note that west-facing solar arrays are very effective in producing carbon-free energy during the late afternoon/early evening peak demand period in Massachusetts. (See Appendix B: on West-Facing PV).
4. Adopt a condo association bylaw affirmatively permitting solar on all THs, as a condition of building permit occupancy.
5. Install rooftop solar on as many THs as reasonably possible, while the rest of the THs be made "solar ready."
6. Although we believe the foregoing solar provisions should be given priority, we note that the Board has asked that all THs and APTs be "solar ready." We could not find a definition of "solar ready" in Belmont's zoning by-law. We offer a definition for the Board to consider in Appendix A.

LEED and HERS certifications: Independent review of these scores is critical.

7. The Board should require third-party HERS rating by a HERS rater independent from Applicant's project consultants.
    a. Independent reviewers should be involved before, during, and after construction to ensure that when fully constructed the project meets the agreed-to standards.
8. For LEEDS status, the Applicant should be asked to either obtain full LEEDS silver certification or undergo peer review of certifiability status by a third party certifier selected by the Town and paid for by the Applicant.

Appliances

During the May 19th meeting with the EC, the consultant for the Applicant indicated that all units in the development (THs and APTs) would have induction electric stoves.

9. The Board should make induction stoves a condition of occupancy for all units in the project.

Water Heating

The Applicant expressed interest in but also feasibility concerns about electric water heating systems, particularly for the APT buildings.

10. Applicant should be asked to actively consider two alternative electric water heating systems identified by the EC: (i) central tankless electric water heaters (which have been used in other apartment buildings in Massachusetts (see Appendix C)) and (ii) a central heat pump water heater that is newly available from Mitsubishi, as was mentioned by the Applicant's consultants during their presentation to the EC (see Appendix D).
11. If the Applicant does not proceed with an electric water heating system for either the APT buildings or TH units, they should be asked to provide the Board with an economic life-cycle cost/benefit analysis of the foregoing systems versus proposed alternatives.

EV Provisions

The Applicant appeared to agree with the EC that it is most cost-efficient to wire all the indoor garage spaces during construction, as compared to retrofitting wiring later when the garage is constructed.

12. Accordingly, the EC recommends that the Special Permit list as a condition of occupancy that:
    - *all* APT *indoor* garage spaces be wired to be capable of hosting level 2 EV chargers, and
    - 10% of all APT indoor spaces be fitted with actual EV chargers (note: Belmont Light incentives exist for these purchases).
    - We note and appreciate that Applicant will construct all THs with one wired EV-ready parking space per garage.

Requests for Clarification

- The EC notes that lighting and appliances do not meet the LEEDS energy use reference standard. The Board should ask the Applicant to explain what design decisions led to the higher level of energy consumption in this category, and whether they would consider using more energy efficient alternatives to improve the building's performance.

- With respect to "Materials used in Construction," the LEED Checklists provided for Subdistrict A and B indicate that they are receiving only 1.5 out of a possible 6 points for "Environmentally Preferable Products." This category is intended to promote practices that minimize material consumption and help reduce the carbon dioxide (CO_2) emissions associated with materials and construction processes throughout the whole lifecycle of a building. Such emissions will be responsible for almost half of total new construction emissions between now and 2050.
    - The Board should ask the Applicant (i) whether the project team has calculated a lifecycle assessment (embodied carbon) of the materials being used for the project, (ii) what actions were taken to earn the 1.5 points in this category, and (iii) what other opportunities exist for the project to earn additional points and reduce the embodied carbon of the construction.

The Belmont Energy Committee is pleased to present this comment letter to the Belmont Planning Board and is ready to assist the Board in reviewing responses to the foregoing or other energy related issues pertaining to the development.

Sincerely,

Belmont Energy Committee

Appendix A: Suggestions for definition of "solar-ready"

Solar-Ready Roofs: Proposed for Planning Board consideration McLean Zone 3 Townhouses (TH) and apartment buildings (APT).

Consult with Belmont Light to identify any inter-connection restrictions for the location of the building site that apply to grid-tied PV systems and any other issues that might restrict installation of solar panels on the roofs of townhouses and apartment buildings. Mitigate any restrictions.

Identify electrical panel location for convenient PV system connections and keep space available in the electrical panel for a PV circuit breaker.

Specify panel capacity sufficient to accommodate the total power coming into the building (proposed PV system size power generation plus size of breaker protecting main panel). Allow for the sum of these two sources of power to be 20% greater than the panel rating.

Lay out the locations for the inverter and the balance of system components.

Run electrical conduit from the solar collector location to the electrical panel and other electrical components.

For TH leave at least enough unobstructed space (obstructions include skylights, chimneys, roof vents and roof mounted equipment), to allow for a 5kw solar array with an orientation of 110-270 degrees from true north.

For APT: Leave unobstructed space on the south and west facing roofs.

Avoid shading of roofs as much as possible.

Avoid placing equipment on roofs that will interfere with solar installation.

Report the weight bearing load of all TH and APT roofs and certify they are sufficient to accommodate solar arrays.

Appendix B: West-Facing Solar Panels Nearly of Equal Value as South-Facing Panels

Email from Claus Becker to Belmont Tariff email group:

Dear all,

below a copy of the monthly production from my solar panels. I have three arrays. One is pointing East, one is pointing South and one is pointing West. For technical reasons, I can no longer separate the South and the Eastern production. 16 out of 28 SE panels are facing South. To all compass directions should be added 20 degrees (i.e. clockwise) as shown in picture below.

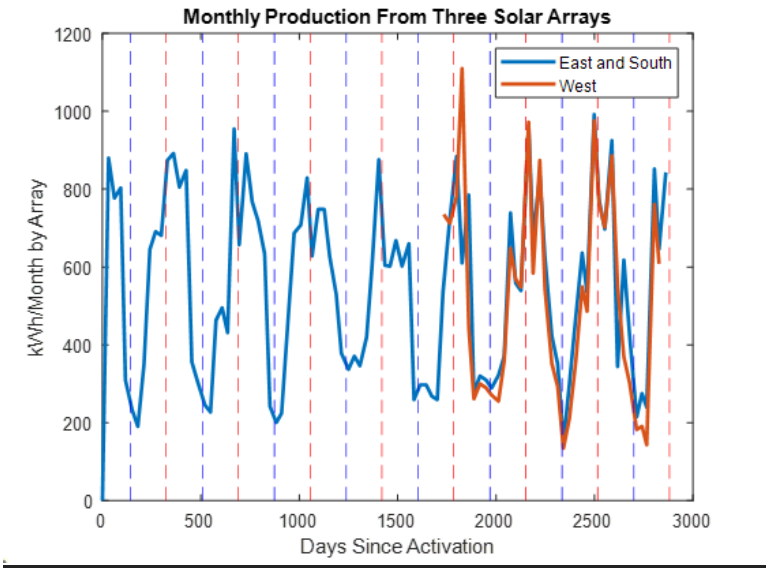
The SE system has 28 Sunpower X19s with micro inverters and was installed August 2013.The W system has 20 Sunpower X21s with a central inverter and was installed in May of 2018. Both are rated at 6.0 kW AC.

The reason why I thought this was worth taking your time with is because I am surprised at how small the hit is to my production from the Western orientation. The graph has production data with winter and summer solstice marked for each year in blue and red, respectively. It is almost identical. Average monthly production over the time I have had the current installation is 540 vs 495, and ~8% difference.

With ToU charging coming, the value of the Western array should be superior to the SE arrays. Pertaining to advising prospective solar customers, I am tempted to conclude that West is as good as South. East is probably not as good for economic reasons, but if you have an Eastern option you probably have a Western one as well on the other side of the roof.

I hope you are doing well.

Claus


Monthly Production From Three Solar Arrays
East and South
West
kWh/Month by Array
Days Since Activation
0
200
400
600
800
1000
1200
0
500
1000
1500
2000
2500
3000

Tankless water heaters: 12 things to know about these energy savers for multifamily housing

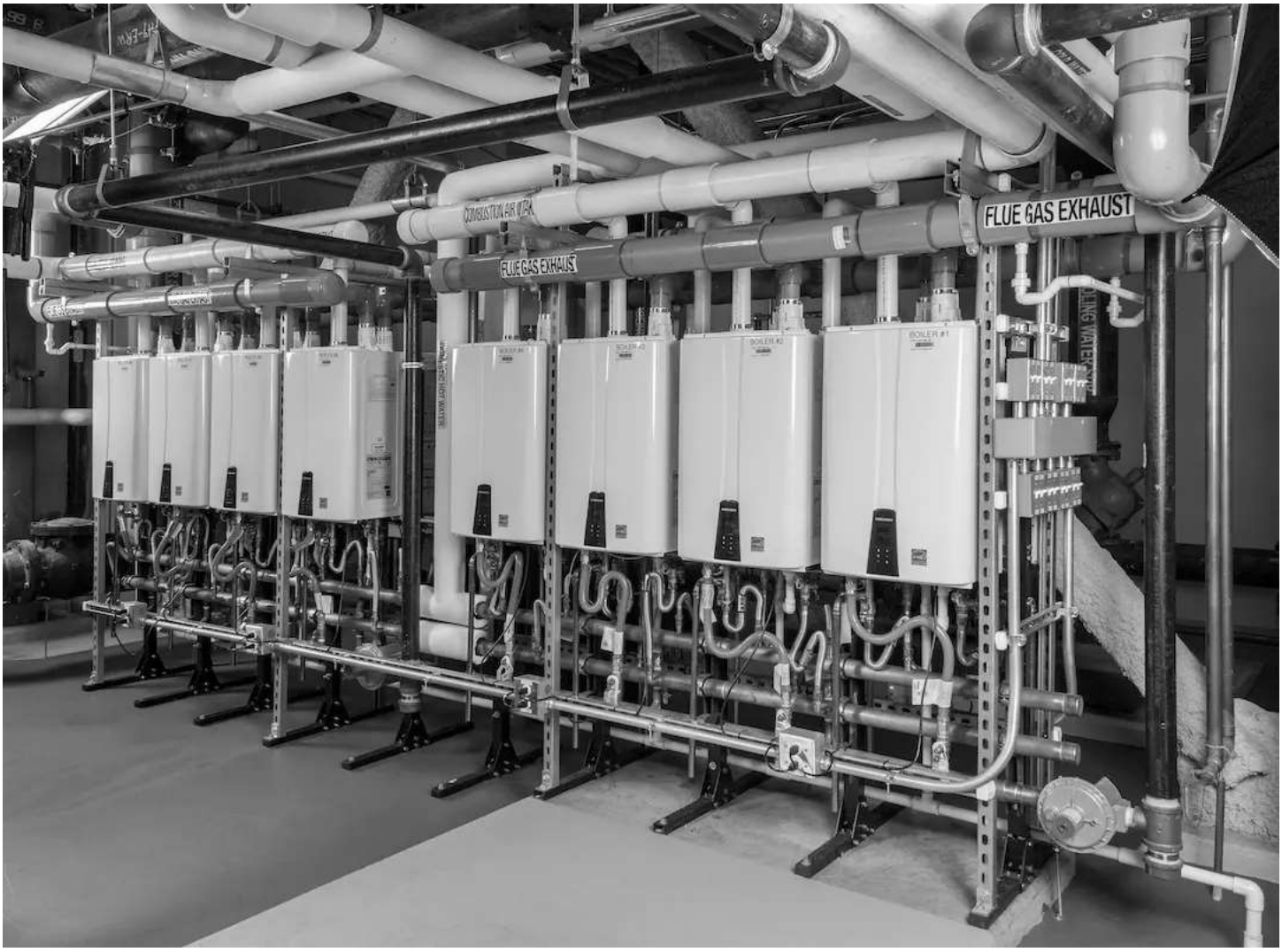
These high-efficiency systems are gaining momentum in multifamily housing, particularly in new urban luxury high-rise properties.

MULTIFAMILY HOUSING (/BUILDING-TYPES/MULTIFAMILY-HOUSING) | APRIL 23, 2020 | PETER FABRIS, CONTRIBUTING EDITOR

Navien NPE tankless water heaters being monitored at a senior living facility in Pennsylvania. Photo: Navien Inc.

Tankless water heaters have come a long way in the last 10 years or so. One-third of respondents (33.2%) to our exclusive 2019 *Multifamily Design+Construction* **Amenities Survey (https://bit.ly/3d7lB4y)** said they had installed tankless water heaters in an apartment or condominium community in the previous 12-18 months.

Sales of tankless water heaters in the overall residential market—multifamily plus single-family—have jumped from 7-9% in recent memory to "14 or 15% this year," according to Brian Fenske, Director of Commercial Sales for Navien, a tankless water heater and boiler manufacturer.



Navien NPE tankless water heaters "ganged" at West End Asteria Apartments, Boston. Photo: Navien Inc.

One particularly robust component of the multifamily market—new urban luxury high-rise properties—may already have swung over to tankless systems, according to Steve Straus, President of engineering firm Glumac. Five years ago, the tank-to-tankless ratio on Glumac-engineered luxury high-rises was about 80/20; today, it's 50/50, Straus said. The pace of adoption in this sector could portend greater acceptance in the broader multifamily market.

Despite these positive signs, many developers hold fast to the belief that tankless units can't produce enough hot water to meet the needs of hundreds of apartment or condo dwellers. Having used tank models for years, they see no reason to switch to tankless. "Investors can be risk-adverse," said Straus.

According to Navien's Fenske, however, "those days are over." Today's tankless units can supply a steady stream of hot water indefinitely. Manufacturers have markedly improved tankless units, overcoming the perceived drawbacks and improving performance to the point where developers, operators, builders, and engineers should consider using them in multifamily projects.


NAVIEN
NAVIEN

Navien tankless water heater being installed by Smith Plumbing & Heating, Nashua, N.H. Photo: Navien Inc.

TANKLESS WATER HEATERS 101: START WITH A CAREFUL ANALYSIS OF ALL THE OPTIONS

The choice of water heaters should be preceded by a comprehensive analysis of all the options: tank vs. tankless, gas vs. electric, brand vs. brand, model vs. model. Let's look at 12 factors your team should consider in evaluating tankless water heaters for your next multifamily project.

1. Tankless water heaters solve the capacity problem. The most important advantage of tankless systems, said Fenske, is that they provide an endless supply of hot water to your tenants and condominium owners. That's because tankless systems instantaneously heat the water based on immediate demand, whereas tank systems can temporarily run out of hot water after a period of heavy use. One thing you don't need is angry building occupants complaining about cold showers.

2. Tankless water heaters save space. Tankless units typically occupy 40–60% less space than comparable tank units, according to Fenske, who also conducts training, design, and product development for Navien. This is especially important since the latest energy code standards require beefier insulation jackets for new tank units, adding several inches to their girth.

Reducing the space needed for water heaters by a half or so is a significant benefit for multifamily developers, especially in large high-rise projects, said Glumac's Straus. Ganging tankless water heaters in the basement could create more space for, say, a bigger dog washing room.

3. Tankless water heaters are easy to install and provide reliable hot water service. Tankless units can be ordered in pre-assembled rack systems that simplify installation. Centralized or zoned systems provide redundancy and reliability, and are often preferred for large multifamily buildings. "Our clients almost always want centralized systems," said Straus. "When arranged in parallel, if one unit fails, others can take its place."

Straus said his clients avoid using "dispersed systems." "They don't want the maintenance associated with servicing individual tankless heaters in every living unit," he said.

Rinnai tankless water heater in rack formation. Photo: Rinnai America Corp.

TANKLESS WATER HEATERS SAVE ENERGY

4. Tankless water heaters score high on energy efficiency. The U.S. Energy Department standard for measuring energy efficiency in similar types of water heaters is the uniform energy factor, or UEF. The higher the UEF, the more energy efficient the water heater.

According to Energy Star, gas tankless water heaters have a UEF of at least 0.87 to as high 0.97 for the most efficient gas units, known as condensing gas models, which use a second heat exchanger to heat water with the exhaust gas. Electric tankless water heaters have a UEF of 0.96 to 0.99, while the UEF of commercial tank water heaters can range from 0.80 to 0.90 according to Energy Star. (Note: The UEF rating does not take into account the cost of producing and delivering natural gas or electricity.)

5. Tankless heaters have a reasonable payback period. Tankless water heaters cost anywhere from 30-40% more up front vs. tank systems, although this premium comes down significantly—and can even disappear—when multiple ("ganged") tankless installations are compared to multiple commercial tank and boiler combinations.

Tankless systems can save 15-25% on energy costs compared to tank systems, depending on the type, the brand, and specific product and model features. If your project is located in a service area with high utility rates, the payback period will be quicker. Your estimator, preconstruction

expert, or MEP engineer needs to weigh all these variables to determine the anticipated payback periods for the various systems you may be considering.

"If you're going to hold the property and you're looking at cost of ownership over a longer payback period, tankless is going to be a better value for you in almost every situation," said Ansley Houston, Senior Director of Commercial Business for Rinnai America Corp., manufacturer of gas tankless water heaters.

6. Tankless water heaters can contribute to your "green" marketing campaign. If you're seeking a green certification, such as LEED, or promoting your use of Energy Star appliances, you'll want to mention your tankless water heaters in your sales and marketing initiative.

"Developers in parts of the country where conservation is either mandated or valued by consumers can show what they're doing to save energy and water," said Julius Goodman, Marketing Head with Stiebel Eltron, a manufacturer of electric tankless models.

Rheem tankless water heater installed in individual unit. Photo: Rheem

TANKLESS WATER HEATERS LAST MORE THAN 20 YEARS

7. Tankless water heaters have a long lifespan. According to the DOE (**https://bit.ly/3b0jqO6 (https://bit.ly/3b0jqO6)**), most tankless water heaters will last more than 20 years; comparable tank units average 10-15 years. That's because tankless units don't have the most common point of failure in tank units—the tank itself. Check the warranty for coverage of labor, parts, and the heat exchanger.

8. Tankless water heaters may soon be required by code. Tankless units may become a necessity, not a choice, as energy-efficiency codes become tougher. Glumac's Straus noted that tank units with a low UEF (0.80 or less) may fail to meet more restrictive state or local energy codes in the near future.

9. Tankless systems are relatively easy to maintain. The maintenance needs of tankless water heaters depend largely on the quality of the water being fed into them. Hard water can leave mineral deposits on heat exchange elements. When hard water is the only alternative, install a water softening system. Tank water heaters, which store large volumes of water, are more susceptible to mineral buildup than tankless models.

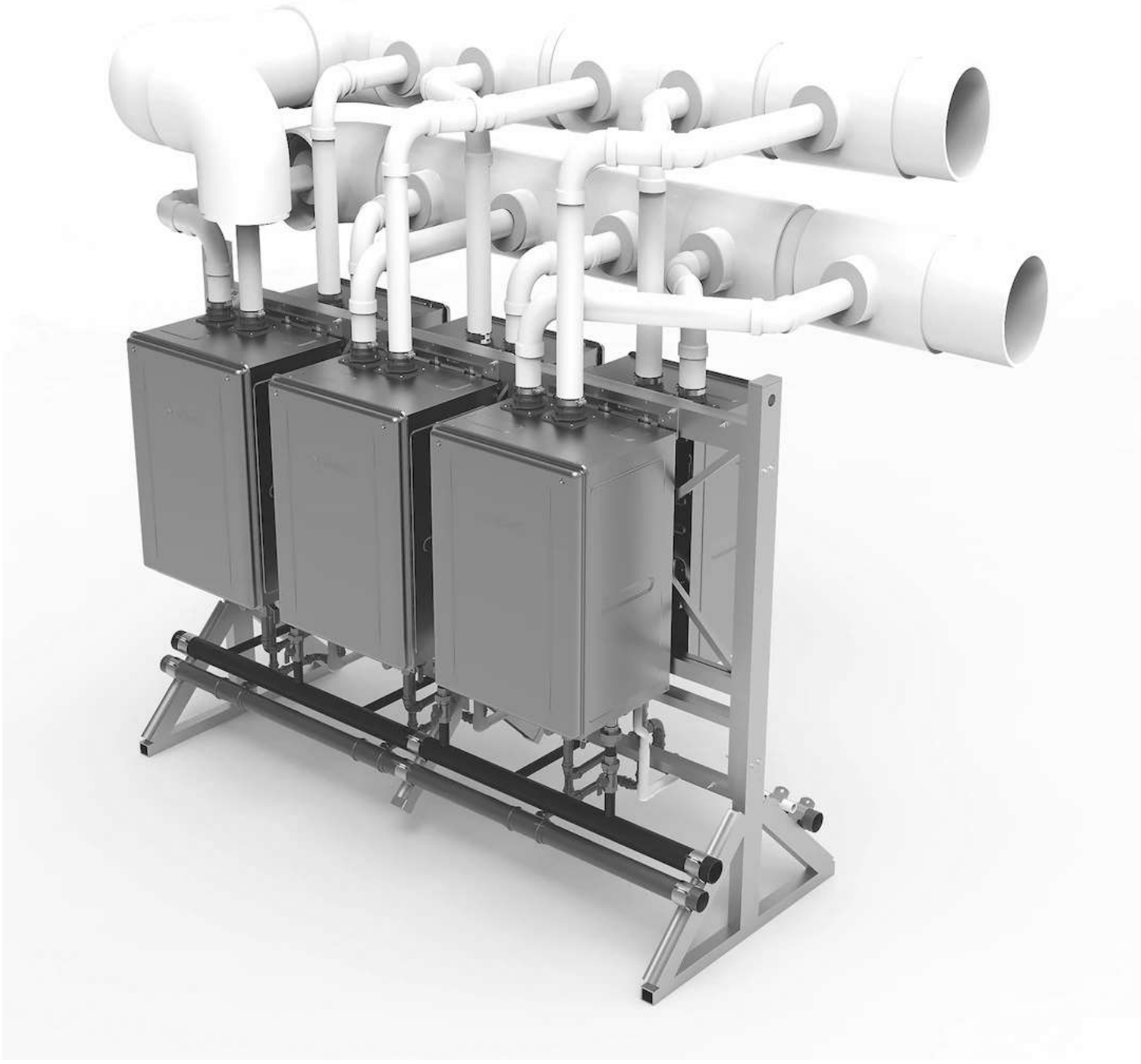
One manufacturer, Navien, uses stainless steel heat exchangers that are more resistant to corrosion from minerals in the water than the more commonly used copper tubing.

ALSO SEE: Tankless water heaters improve water heating efficiency in an Indiana condo community (https://www.bdcnetwork.com/tankless-water-heaters-improve-water-heating-efficiency-%C2%A0indiana-condo-community)

Polluted air and contaminated combustion also can be a problem in gas units, as air drawn in for combustion can leave deposits in the heat exchange chambers. Proper installation steps should be taken to assure clean combustion air for gas-fired appliances. Here, too, gas models with stainless steel heat exchangers will resist corrosion more effectively. For optimal operation the combustion elements should be cleaned during scheduled annual maintenance.

10. Gas tankless water heaters may earn utility rebates. Some gas utilities offer rebates for gas tankless units. Utility rebates for electric tankless water heaters are generally less available. Check with your local utility for current rebates.

11. Today's tankless units are getting smarter and smarter. The latest tankless models have sensors that detect when demand fluctuates and send a signal to smart electronic controls that automatically "cascade" the number of units in operation, so that hot water supply keeps pace with demand. Manufacturers are adding Wi-Fi capability to many models that allow your operations staff to monitor and adjust the units remotely. Check with your supplier, as the technology is getting more sophisticated almost by the minute.



Noritz tankless water heater assembly. Photo: Noritz

TANKLESS WATER HEATER SUPPLIERS CAN PROVIDE EXPERTISE

12. Work with your tankless water heater supplier. If you're new to tankless systems—or just have a question—consult with the manufacturer or dealer, especially in the early stages of design, when important decisions are being made. They are eager to provide technical advice to make your project successful.

Stiebel Eltron electric tankless water heater. Photo: Stiebel Eltron

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QAHV Hot Water Heat Pump

For Large Capacity Hot Water Applications

QAHV-N560YA-HPB

QAHV Hot Water Heat Pump Series

As a leading manufacturer of air-to-water heat pumps, Mitsubishi Electric have developed QAHV; the latest innovation in their comprehensive lineup of Hot Water Heat Pump products. QAHV has been specifically designed to produce high volume hot water and is suitable for commercial and industrial applications where hot water demand is high. By adopting Mitsubishi Electric's unique technology, QAHV ensures highly reliable performance as well as high heating capacity even at low outdoor temperatures.

Ideal Applications

- ✔ Gyms
- ✔ Hotels
- ✔ Motels
- ✔ Aged Care Facilities
- ✔ Schools
- ✔ Universities

Main Features of QAHV

- Utilises natural refrigerant (CO_2)
- High efficiency (Achieved COP 3.88*)
- Supplies high temperature hot water of up to 90°C
- Operable even at low outdoor temperature of -25°C

Increased Energy Savings

Unique to Mitsubishi Electric, QAHV utilises a twisted and spiral gas cooler. Using twisted pipes as water pipes and running the refrigerant pipes along their grooves helps to increase the heat-conductive area; allowing for better heat transfer and an impressive COP of 3.88*. The continuous spiral groove design accelerates the turbulence effect of water and helps to reduce pressure loss within the heat exchanger, enhancing efficiency. Equipped with the latest inverter scroll compressor, QAHV offers unparalleled efficiency when compared to fixed speed systems.

Superior Heating Performance in Low Temperatures

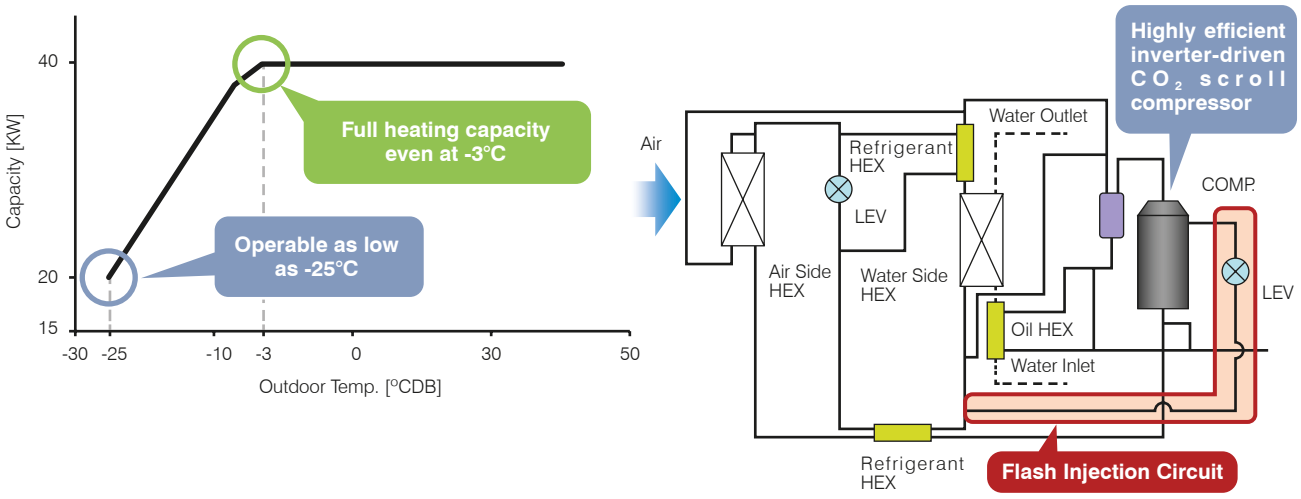
QAHV is able to provide its full heating capacity of 40kW even at ambient temperatures as low as -3°C. Furthermore, the unit operates to supply 90°C hot water in ambient temperatures as low as -25°C. This superior level of performance is achieved using Mitsubishi Electric's industry-first Flash Injection Circuit which provides the optimum amount of refrigerant to the system via a compressor through a specially designed injection port, ensuring highly stable operation.

Why is CO_2 Refrigerant Used?

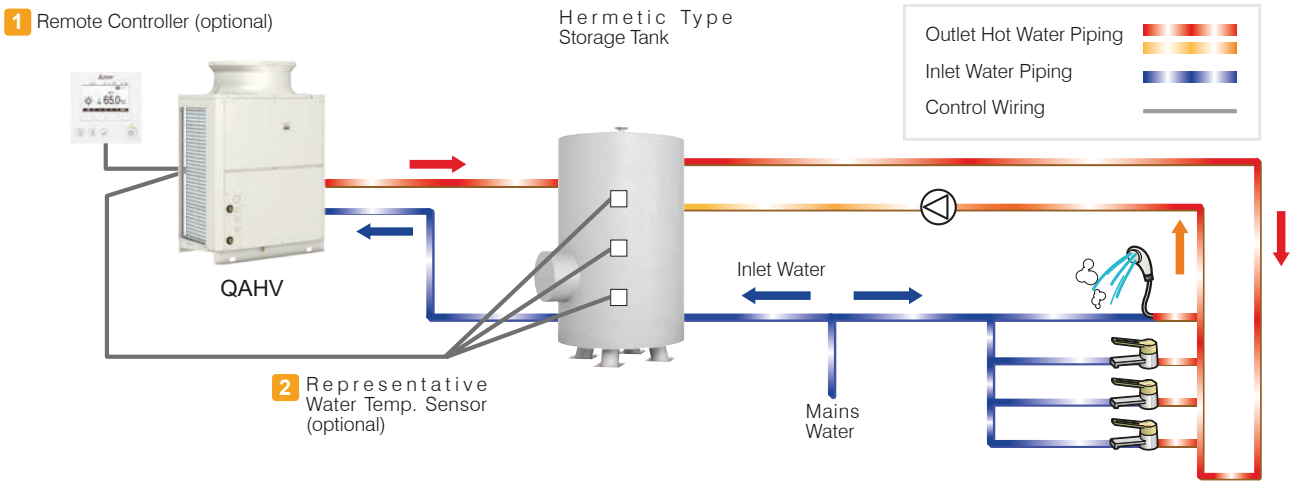
QAHV adopts CO_2 (R744) as it is an environmentally-friendly, natural refrigerant which has zero Ozone Depletion Potential (ODP) and has a Global Warming Potential (GWP) of 1.

*Under normal heating conditions at outdoor temp:16°CDB/12°CWB, inlet water temp 17°C, outlet water temp 65°C

Stable Heating Capacity Even at Low Temperatures

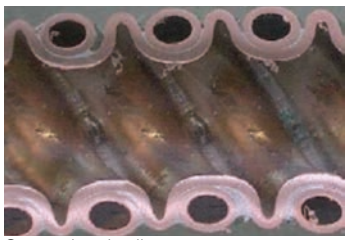


QAHV System Schematic Image



Mitsubishi Electric Patented Twisted and Spiral Gas Cooler

Twisted water pipe with the refrigerant pipe spiralled around it



Cut section detail

Using twist pipes as water pipes and running the refrigerant pipes along their grooves helps to increase the heat-conductive area, allowing for better heat transfer.

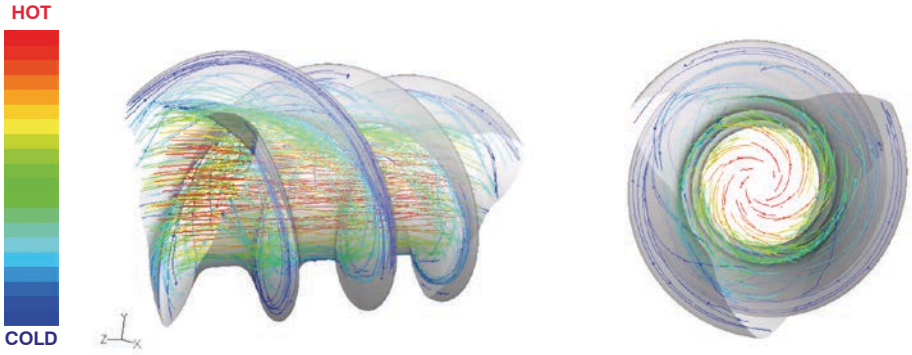
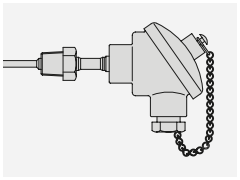


Illustration showing water flow and water temperature distribution

			QAHV-N560YA-HPB
Power Source			3-phase 4-wire 380-400-415V 50Hz
Capacity *1		kW	40
		Btu/h	136480
	Power Input	kW	10.31
	Current Input	A	17.8-16.9-16.3
	COP(kW/kW)		3.88
Capacity *2		kW	40
		Btu/h	136480
	Power Input	kW	10.97
	Current Input	A	20.0-19.0-18.3
	COP(kW/kW)		3.65
Capacity *3		kW	40
		Btu/h	136480
	Power Input	kW	11.6
	Current Input	A	20.4-19.4-18.7
	COP(kW/kW)		3.44
Maximum Current Input *4		A	28.8-27.4-26.4
Allowable External Pump Head			77kPa
Temperature Range	Outlet Water Temp		55–90°C (when the secondary side control is enabled: 55–80°C)
	Outdoor Temp	D.B.	-25~43°C
Sound Pressure Level (measured 1m below the unit in an anechoic room) *1		dB(A)	56
Water Pipe Diameter and Type	Inlet	mm(in.)	19.05(Rc 3/4"), screw pipe
	Outlet	mm(in.)	19.05(Rc 3/4"), screw pipe
External Finish			Acrylic painted steel plate <MUNSELL 5Y 8/1 or similar>
External Dimension H x W x D		mm	1837(1777 not including legs) x 1220 x 760
Net Weight		kg(lbs)	400(882)
Design Pressure	R744	MPa	14
	Water	MPa	1.0
Heat Exchanger	Water-side		Copper tube coil
	Air-side		Plate fin and copper tube
Compressor	Type		Inverter scroll hermetic compressor
	Maker		MITSUBISHI ELECTRIC CORPORATION
	Motor Output	kW	11.0
	Case Heater	kW	0.045
FAN	Air Flow Rate	m3/min	220
		L/s	3666
	Type x Quantity		Propeller fan
	Control, Driving Mechanism		Inverter-control, Direct-driven by motor
	Motor Output	kW	0.92
HIC (HIC: Heat inter-changer) Circuit			Copper pipe
Protection	High Pressure Protection		High pres.Sensor & High pres. Switch at 14MPa(643psi)
	Inverter Circuit		Overheat and overcurrent protection
	Compressor		Overheat protection
	Fan Motor		Thermal switch
Defrosting Method			Auto-defrost mode (Hot gas)
Refrigerant	Type x Original Charge		CO_2 (R744) 6.5kg

Optional Parts

Remote Controller
PAR-W31MAA-J



Representative Water Temperature Sensor
TW-TH16-E

Notes:

*1.Under Normal heating conditions at the outdoor temp, 16°CDB/12°CWB(60.8°FDB/53.6°FWB), the outlet water temperature 65°C(149°F), and the inlet water temperature 17°C(62.6°F)

*2.Under Normal heating conditions at the outdoor temp, 7°CDB/6°CWB(44.6°FDB/42.8°FWB), the outlet water temperature 65°C(149°F), and the inlet water temperature 9°C(48.2°F)

*3.Under Normal heating conditions at the outdoor temp, 7°CDB/6°CWB(44.6°FDB/42.8°FWB), the outlet water temperature 65°C(149°F), and the inlet water temperature 15°C(59.0°F)

*4.Under Normal heating conditions at the outdoor temp, 7°CDB/6°CWB(44.6°FDB/42.8°FWB), when the unit is set to the "Capacity Priority" mode through the dry NC-contact.

*Due to continuing improvements, specifications may be subject to change without notice

*Do not use steel pipes as water pipes.

*Keep the water circulated at all times. Blow the water out of the pipes if the unit will not be used for an extended period time.

*Do not use ground water or well water

*Do not install the unit in an environment where the wet bulb temperature exceeds 32°C

*The water circuit must use the closed circuit

*There is a possibility that the unit may abnormally stop when it operates outside its operating range. Provide backup (ex. boiler start with error display output signal (blue CN511 1-3)) for abnormal stop.

UNIT CONVERTER

BTU/h = kW x 3,412
cfm =m3/min x 35.31
lbs = kg/0.4536

MITSUBISHI ELECTRIC

B D T **Black Diamond Technologies**
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