

Air Conditioning at Porter House

AC Background:

- AC has been discussed amongst the board since the early 1990s. We met with a local contractor many years ago and was told a high pressure ducted system would cost \$25,000 to \$50,000. We're a volunteer-run organization with little expertise and have an annual budget of \$12,000-\$18,000...not going to happen!
- Until summer 2019 PH used a 12,000 BTU window AC in butterfly room on 2nd floor. The window unit kept the upstairs somewhat manageable. The downstairs remained somewhat less miserable than the second floor but was not adequately cooled.

Why AC:

- **Controlling relative humidity:** Uncontrolled humidity hastens the decline of house and collections.

Mode	Effect
Dimensional Change	warping, dislocation of joints, splitting, breaking of fibers, delamination, loss of surface material, cracking
Chemical Reaction	corrosion of metals, fading of dyes, weeping or crazing glass (clouding), crystallization and movement of salts, disintegration and yellowing of paper
Biodeterioration	mold growth (RH 70% or above), bacteria

- **Visitor Experience:** Lack of climate control makes our offerings less appealing to a wide audience.
- **Staff Experience:** Lack of climate control lessens our ability to recruit and retain volunteer docents. Our docents tend to be older.

Air Conditioning Options: There are two options to provide climate control to the Porter House and each has its benefits and drawbacks.

The first, a high pressure ducted system, would require a significant upfront investment that has dissuaded past action. Such a system can't be installed in phases. This type of system acts much like a conventional forced air AC ducted

system, with the exception that air is forced at a high rate of speed through 2" diameter insulated ducting.

High Pressure Ducted System:

- Air handler in attic with 2" ducting supplied to the ceilings of each room of the second floor. Air handler in the basement with ducting supplied to each room of the first floor through 2" diameter holes cut in the floors.
- Two air returns, each supplying return air to the two air handling units. One return would have to be cut into the ceiling of the upstairs hallway or adjoining room, and the other into the floor of a room downstairs.
- Two outdoor Condensing units

Benefits of High Pressure Ducted System:

- Perhaps less visually intrusive than a ductless heat pump system
- House-wide cooling that would be reliable across the entire building

Drawbacks of High Pressure Ducted System:

- Intrusive: Attic and basement air handlers, cutting 2" diameter holes into plaster ceilings, cutting air returns into ceilings
- Loud
- Little ability to control relative humidity: As air moves across cooled coil moisture is removed in the form of condensation. Beyond that there is no ability to control humidity
- Condensation removal issues- reliant on pumps to remove condensate
- Potential attic moisture issues: Insulated ducting running through incredibly hot attic, resulting in potential mold issues
- Expensive to install and can't be done in phases
- Expensive to operate: Low EER and SEER rating
- System can't heat

Ductless Mini Split Heat Pump Options:

- The second option is a ductless mini split heat pump system. This type of system could be implemented in phases as resources allow.
- Secured three estimates: Our initial thought was to install the system in two phases, each providing about 1/2 the cooling load required to condition the space. In the end we decided to attempt the project as one phase and only do a second phase if necessary. We ended up installing a 45,000 btu multi head condensing unit with two 24,000 btu heads. One head is located in dining room of first floor, other located in the “safari room” of the 2nd floor.
- Calculated BTU cooling load of first floor 32,000 btu and second floor 35,000 btu. Only one of three contractors calculated the btu load requirements of the space, the rest guessed! We ended up going with the one that did.
- System can heat during the shoulder months of May, September and October when we’re open weekends. Under this scenario we can shut off pilot light of boiler (which consumes about 30 therms of gas/month).
- All but one local contractor install Fujitsu splits, the other installs Mitsubishi. Local contractors seem to have limited knowledge of split systems. They’re used to installing ducted whole house systems. At several points it seemed as though I knew more than them?
- System has worked great!!! Several comments that it’s the best thing that’s happened at PH in 25 years. The only space that remains somewhat warm is the far east room of the 2nd floor. This is not likely a capacity issue, but rather that the air isn’t sufficiently pushed into that space. We’re currently working with contractor to come up with a plan to install a 9,000 btu single zone unit.

Benefits of ductless system:

- Less physically intrusive and easy to install
- Can be installed in stages. Overall system cost cheaper.
- Much cheaper to operate: Higher SEER and EER ratings. DC driven compressor allows for low modulation at a high efficiency, unlike single stage conventional units that operate at 100% or 0%.
- Ability to cool during the summer and provide supplemental heating May, September and October
- Great humidity control

- Cool (and heat) zones as needed, unlike a ducted system that's all on or all off. Potentially cheaper to operate given occupancy needs of given spaces.
- Nearly silent interior evaporator head. Exterior condenser *significantly* more quiet than conventional outdoor AC condenser.
- Gravity-fed condensate removal- not dependent on electric pump, less chance of moisture issues

Drawbacks of a ductless system:

- Multi-zone split systems have a higher minimum output than do single zone systems. The Fujitsu 45RLXFZ has a minimum output of 12,000 btu. When the cooling load is less than 12,000 (days when it's not hot outside) the unit will cycle on and off rather than modulate down to a low output. During these conditions the system is less efficient and less capable of removing humidity from the air. Splits are more efficient than conventional single or two stage ducted units because they are driven by DC compressors that are capable of modulating down to a low output. Since the Porter House is really large and the designed cooling load is 67,000 btu, the amount of time this happens is hopefully minimal. In our deliberations, having one outdoor condensing unit was much preferred over having two single zone condensers. Look at courthouse as an example of several single zone units.
- Visually intrusive interior floor and/or wall mounts
- Visually intrusive line set covers running up exterior of building

Total Project Cost:

Fujitsu 45RLXFZ with 2 24,000 btu heads:	\$8,635
220v electric hookup	\$400

Solar at Porter House

History:

Bill Date (Month/Day/Year)	Electricity (kWh)	Dollars
01/28/19	264.000000	\$51.16
12/26/18	264.000000	\$49.58
11/26/18	254.000000	\$49.65
10/29/18	379.000000	\$68.62
09/26/18	505.000000	\$66.00
08/20/18	885.000000	\$66.00
07/27/18	929.000000	\$66.00
06/26/18	697.000000	\$78.00
05/25/18	348.000000	\$78.00
04/25/18	235.000000	\$78.00
03/27/18	289.000000	\$78.00
02/23/18	218.000000	\$78.00
01/26/18	198.000000	\$78.00
12/26/17	224.000000	\$64.00
11/27/17	276.000000	\$64.00
10/27/17	312.000000	\$64.00
09/27/17	412.000000	\$64.00
08/28/17	741.000000	\$64.00

- 2018 Total consumption of 5,200kwh
- Hypothetical consumption of new AC system: 2,000-3000kwh?
- We secured two estimates and ended up going with the cheaper of the two. One estimate was \$2.21/watt and the other \$2.77/watt.
- Our system is 4.41kw (14 panels) and cost \$9,800. The yearly electric production of the system is about \$700.
- AC and solar are too new to provide accurate consumption information. July 2018 consumption 929kwh, July 2019 consumption 200kwh.
- Sensitivity to visual impact of solar was a huge consideration! We didn't want to create any ill will. We did a lot of research about solar and historic buildings. The general takeaway is this: It seems like solar on historic buildings was contentious about 20 years ago, but the issue has largely faded. We found a few examples of solar being installed on historic house museums in the Northeast, but none in the Midwest. Still, Decorah is a change-adverse community and we were nervous of creating any bad feelings.

- **Given our mission, should we really be concerned with the visual impact of AC and solar, or do they instead increase our relevance within the local community?**

Fundraising Both Projects

- Total Project cost: \$18,835 (Keep in mind our annual budget is less than \$20,000!)
- We decided to couple both projects: They go hand in hand and our ability to fundraise for both as a package would be easier than fundraising them sequentially.
- Since AC has been a priority of the museum for decades, the board decided the museum would contribute \$3,000 toward the project.
- Solar has not been on the radar of the museum. As a way of thinking of it, I proposed to the board we think of the project as though we were a private individual eligible for 30% federal and 15% state tax credit. Our “tax credit” would come in the form of donations from the local community and the remainder (55%) could potentially come from museum reserves. Anything above or below the 55% would shorten or lengthen the payback period of the system.
- Our decision to move ahead with both projects simultaneously was hastened by proposed changes in net metering at the state legislature. We felt as though we had a gun to our heads. The board agreed to move ahead with both projects without a clear understanding of what amount could be raised from the local community. The overall gut feeling was that the community would pull through. That proved to be true.
- We mailed a fundraising appeal letter to about 250 local individuals and received donations from 51 individuals. The response rate was 20%. In the non-profit world (generally speaking) anything above about 10% is a success.

Funding breakdown:

Private donations: \$11,000

Depot Outlet grant: \$2,000

Museum contribution: A little less than \$6,000.



PORTER HOUSE MUSEUM

PO Box 115, 401 W Broadway
Decorah, IA 52101

www.porterhousemuseum.org

Dear <Name>,

As stewards of the Porter House Museum, we are increasingly aware of the need to address climate control at the museum. 2018 was the second wettest year in Decorah in 125 years of record keeping. If 2018 is any indication of what the future holds, **we know we must act now to safeguard the house and collections, enhance the visitor experience, and protect the health and comfort of our volunteers.**

We're asking for your financial support to **reach our \$19,000 goal to make climate control and rooftop solar at the Porter House a reality.** Tackling climate control while also offsetting our increased electric use benefits the museum in three important ways. First, installing climate control allows us to better safeguard the house and its collections, while also providing a better visitor experience. Second, the total return on investment of solar power is significant and puts the museum on a more secure financial footing. And third, both projects enhance our mission of being an integral part of the Decorah community while also allowing us to act in a manner in keeping with the museum's ethos of environmentalism and love for the natural world. **We're extremely excited to share these projects with you, and we hope you'll consider investing in the future of the museum.**

We're seeking to install an energy efficient air source heat pump for cooling and supplemental heating. We've worked with several local heating and cooling contractors and have developed a plan and secured estimates. The system will allow us to cool the museum during the summer and heat the public spaces in the more temperate months of May, September, and October when we are open to the public on weekends. Transitioning from gas to electric heat during these months will allow us to shut down the gas boiler. This will save the museum money by eliminating heat the boiler produces throughout the spring, summer, and fall when it is not in use.

We take seriously our need to be stewards of the environment and leaders within the local community. We believe air conditioning and offsetting our electric consumption go hand in hand. We have consulted local professionals and the Winneshiek Energy District to develop a plan to install a 4.41kw solar array to

offset our increased electric consumption. In developing this project we have taken into consideration best practices for the placement of the rooftop panels, and believe that our plan will not detract from the historic significance of the

17 March 2019

house or the historic district. We intend to adhere to the Secretary of the Interior's *Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings*.

The Porter House has remained viable for the past fifty years through the generous financial and in-kind support of the Decorah community. We believe these projects are incredibly important to the future viability of this important Decorah institution, and **are seeking your help in raising the \$19,000 needed to make the project come to fruition.**

Enclosed is a return envelope for your tax deductible contribution, as well as a summary of our mission and recently crafted strategic planning priorities. If you would prefer to contribute electronically, please use the "DONATE" button on our website, porterhousemuseum.org. If you have any questions, please don't hesitate to reach out to any member of the board of directors. **We thank you for your ongoing support of this unique Decorah organization, and we look forward to your continued involvement in the future.** On behalf of the board of directors, thank you.

Sincerely,

Cam Forde
President of the Board of Directors

Paul Cutting
Vice President of the Board of Directors

Peggy Beatty
Secretary of the Board of Directors