179 Henry Street

A Case Study in Converting from Two-Pipe Steam to Hydronic Heating

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179 Henry Street, New York, New York.

by Dan Rieber

New York City is filled with multifamily apartment buildings built before World War II; we often refer to them as prewar buildings. Of course, many wars have been waged since 1945, so I won't use "prewar" as a description. A common trait of these buildings, however, is that they are heated with steam boilers. Builders didn't stop building multifamily housing with steam heat after the war—steam heat has been as common as hot-water heat in these large buildings for some time. The multifamily building at 179 Henry Street was built in 1965 with HUD financing for senior living. The heating system was designed to provide two-pipe steam heat to the building from two large firebox boilers burning #6 fuel oil. This is how it was in 1965 and through the summer of 2010. (For a snapshot of the building before the retrofit in 2010, see "Preweatherization Stats.")

In 2009, APN Energy services came to Northern Manhattan Improvement Corporation (NMIC), where I serve as the director of the NMIC Weatherization program, with a project. A 50-unit, senior-citizen HUD building needed weatherization. The windows had been replaced in 2000, but the lighting was ancient, and the ventilation system had never been cleaned and was overventilating, sucking heat out of the apartments and the two-pipe steam-heating system. APN had conducted an energy audit and decided to replace the aging firebox boilers; one was inoperable and the other leaked severely. APN arranged a meeting between my company and T.U.C. Management Company, the manager of the building, to see if the building qualified for enrollment in the weatherization program. APN had already enrolled the building in the New York State Energy Research and Development Authority (NYSERDA) Multifamily Performance program, which provides incentive dollars to buildings for performing energy efficiency measures. Our discussion revolved around the efficiency measures that could be done, but the heating system was a bit of a dead end. Replace the boilers and do nothing to address the innumerable steam leaks, many of which were behind walls? This was not a good option.

Over the years, many of us in the New York City multifamily energy efficiency world have talked about how cool it would be to convert steam-heated buildings to hydronic heating. The problem is not one of will but one of money. Changing the boiler is not the big deal—it's the heating distribution system that is the challenge. Now don't get me wrong; plenty of these conversions have been done in the last 20 years in buildings that were gut rehabs. These jobs did not always get the best boilers, or insulation in the walls, but they did get a more efficient heating distribution. The real challenge was to convert a building with steam heat, with tenants in place.


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The old boiler looks like something from a Stephen King novel *(left)*. Radiator with thermostatic radiator valve *(upper right)*. AC sleeve cover *(lower middle)*. Pipe from riser to radiator *(lower right)*.

The big idea! Why not convert the system at 179 Henry Street to hydronic heating? We couldn't use the existing piping in the walls and the existing heating elements, because there were too many leaks in the existing steam pipes, PEX piping was out of the question, and the elements would have to be replaced as well. What we could do was run a brand-new distribution system from the new condensing boilers. The energy audit was run this time with a brand-new distribution system as part of the new heating system, and the retrofit came in with a savings-investment ratio over 1!

New Heating System

T.U.C. management, in cooperation with APN Energy and the owners, engaged an engineer to draw up specifications for new natural-gas-fired boilers and a new heating distribution system using properly sized copper pipe, modified in the field with a special crimping technique that allows installation without soldering. We were quite aware of the fact that soldering pipe in the apartments would be very risky with tenants in place. None of us involved had any experience with the crimped-pipe method of connecting pipes, but we were all confident that it would work. There was no way for us to avoid inconveniencing the residents, but we would do our best to minimize the intrusion.

The new equipment consisted of

- two Laars Rheos boilers, 1.6 million Btu input each; and
- two Turbomax T109 indirect domestic water heaters, 119 gallons capacity each, 1,666 gallons per hour (gph) first-hour continuous draw, and 1,546 gph thereafter.

This project required core drilling the concrete deck floors (12 in all), running the new piping, installing the heating elements, and enclosing the new piping. In the late winter and early spring of 2010, NMIC went out to bid for a new gas-fired heating system and a new hydronic heating distribution system with thermostatic radiator valves (TRVs). The winning bidder would be responsible for coordinating temporary service to the residents and dealing with our local gas utility, Con Edison. Ideally, all the work would be complete for the beginning of heating season in October 2010.

One of the fortunate things going for this project was that the one operating boiler could be used to provide domestic hot water (DHW) while work began shortly after the heating season was over in June.

Once NMIC had qualified the tenants and TUC had agreed on the terms of the project, an owner agreement was signed and work began to convert this building to hydronic heating.

One of the first things to be done was testing the floor tile that would be disturbed for asbestos. We got lucky; no asbes-


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A scene of the street being dug up for the new gas line to the building *(above)*. The new boilers *(below)*.

tos present. The next hurdle would be getting ConEdison to provide the new gas service to the building for the boilers. Gas service existed for cooking, but it was insufficient to accommodate the new boilers. This would turn out to be the most difficult part of the project. Once the gas main was identified in the street as being of sufficient capacity, ConEdison had to determine a new point of entry (POE); once this was done, the heating contractor could plan the layout of the gas piping from the boiler room to the POE.

While all this was going on, the NMIC crew was providing CFLs and doing air sealing in each apartment in the form of AC sleeve covers. In addition, a lighting contractor provided new energy-efficient light fixtures in the kitchens and bathrooms. All through the job, the residents were very cooperative and took the work in stride. To say there were no hiccups or problems would be to say we don't live in the real world, but they were few, and were dealt with professionally and in a timely manner by all concerned.

All through the summer the core drilling, and the installation of new heating pipe and heating elements, TRV, and enclosures for the pipes, went on without much of a problem. The boilers were installed, and so were their indirect DHW makers. All the while, the old boiler was chugging along, providing temporary service. That is, until the New York City Department of Buildings said the boiler was not safe to operate. The heating contractor, SNS, had to hire a temporary boiler (in a trailer parked outside the building) to provide heating and DHW while the job finished up and we waited for gas service.

The process of physically bringing the new gas piping from the street took about 21 days (November 1–21, 2010).

A Challenge

One big challenge was the venting of the new boilers. Our plan would have been thwarted if we had been required to run the chimney the full height of the building. The new boilers wouldn't allow for that scenario. Once again, luck was on our side. The building has a setback after the second floor, and there was just enough room on this second-floor roof to put the new chimney, in just the right place to conform to New York City venting code.

Gas service was provided, and the new boilers and heating distribution system were fully functional by the middle of January 2011. Measurements were taken in the apartments to make sure that proper heat was being provided, and that hot water at an appropriate temperature was coming from the taps. Settings were adjusted on the heating side, and soon we were right where we wanted to be.

The cost of the heating work was $610,774; the Weatherization program and the building owner shared this cost.

Postweatherization Fuel Use

As we look at the postweatherization fuel consumption we are happy to report that the savings are significant. For the 18 months prior to weatherization, the building used 9,580 MMBtu of #6 fuel oil per year at a cost of $137,450. Now, a year and half later, the building has used 3,294 MMBtu of natural gas at a cost of $45,776, a 33% savings. This is 9 Btu/ft^2/HDD, compared to 20.4 Btu/ft^2/HDD preweatherization. As we move through 2012, New York City has banned the use of #6 oil in apartment buildings and is pushing energy efficiency in buildings greater than 50,000 square feet with New York City's Local Law 84. When we got started in 2009, there was much talk of this change, but none us of thought it would happen. Well, I'm glad to say that it has, and that 179 Henry Street will not be scrambling to meet new regulations.

Lessons Learned for the Next Project

Starting the process early is key. Set aside enough time for planning, discovering roadblocks, and clearing them. Make sure there is good communication among all those involved, especially the gas utility if you are converting from oil to natural gas, since coordinating trades and contractors can make for quite a headache. Good planning and commitment from all involved make for a successful job. So if you're considering a conversion from steam to hydronic heating, don't be discouraged. All you

Preweatherization Stats

- Owned by Alliance Holdings, Incorporated
- Built in 1965
- Btu/ft²/HDD = 20.4 (this is high!)
- Twelve floors
- Heated space = 60,420 ft²
- Fifty apartments
- HUD regulated, all senior-citizen residents
- Mixed-use property; first two floors have educational facilities and after-school programs space, offices and social services for residents, and a community room
- Gibraltar model GHF 193-23 horizontal return tube low-pressure steam boilers, rated at approximately 192 hp each
- Boiler #1 fitted with Preferred Utilities burner, model unknown
- Boiler #2 fitted with Industrial Combustion burner model MEG 63P with maximum firing rate of 45 gph of heavy oil
- Building burns #6 fuel oil; stored in 8,500-gallon tank
- Double-pane, double-hung windows installed in 2000

need is the will, commitment, a good engineer, a good auditor, a good contractor, good construction management, and of course, the money. This project could not have happened without the weatherization program. These grant funds were essential to the success of the project. Partnering with the NYSERDA program helped as well. In the end, we have 50 units of senior housing that are more sustainable, and the building pollutes less and uses less energy to provide heat and DHW. It's a home run on any scorecard.

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