Manhattan Tenement Adds Solar Heater

CHARLES C. COPELAND, Associate and HVAC Head
Goldman & Sokolow, Consulting Engineers, New York

Turn-of-the-century apartment cooperative is New York's first to apply solar panels for service water heating.

TWO NATIONAL NEEDS, for low income urban housing and alternate energy sources, are met in a unique "sweat equity" rehabilitation of a Lower East Side Manhattan tenement building. The 11-apartment, five-story, 10,410 sq ft walk-up at 519 East 11th Street is one of many similar structures in the city that have been abandoned by their landlords as unprofitable. An estimated 30,000 apartment units are being abandoned each year. Soaring fuel costs are pushing many marginal properties into the red.

Once abandoned, with services discontinued, tenants flee and the empty buildings are vandalized. No. 519 survived no less than fifteen fires before rehabilitation efforts were begun. Rehabilitation is proceeding under a $177,000 municipal mortgage loan as part of a program in which responsible prospective tenants were organized. They work on the building, under supervision, rebuilding interior floors, walls, mechanical systems, etc., for which they are paid $3 an hour for four days. An additional day without pay is the "sweat" which generates an equity in the building. The tenant-cooperators expect to handle maintenance and repairs themselves, once they move in.

The project interested a young architect, Travis Price, who has several solar heated homes in the Southwest to his credit. He, in turn, involved the writer, through Goldman & Sokolow, to assist in the engineering. The result was the first federally funded solar energy system in an apartment house in New York, a $43,000 Community Services Administered grant being used to purchase and install solar hot water heating hardware, insulation (the original mortgage provided only $500 for thermal insulation!), storm windows and professional fees. Also included in the grant proposal are productions of films and manuals to be distributed by CSA to others who wish to emulate the systems specified.

Water Heating Optimizes Collector

Technically, the systems are quite simple. However, the multistory building has significantly less roof area per square foot of interior area than one- and two-story buildings which have been the usual models for solar treatment. Because the roofs of existing buildings are the only practical place to locate solar panels, the potential for utilizing solar energy is limited. Therefore, a choice has to be made between heating domestic water and space heating. The former is the best application for this project because:

(1) Domestic water heating is required year-round, while space heating would utilize collection equipment for only six months.

(2) Solar heat can be transferred to domestic water more efficiently. Flat plate collectors operate at 70% efficiency with fluids at 100F and only 50% efficiency at 180F, the temperature required for the natural convection heating terminals used in apartment buildings. Domestic water heating can utilize 60-140F very effectively; hence, at higher collector efficiencies.

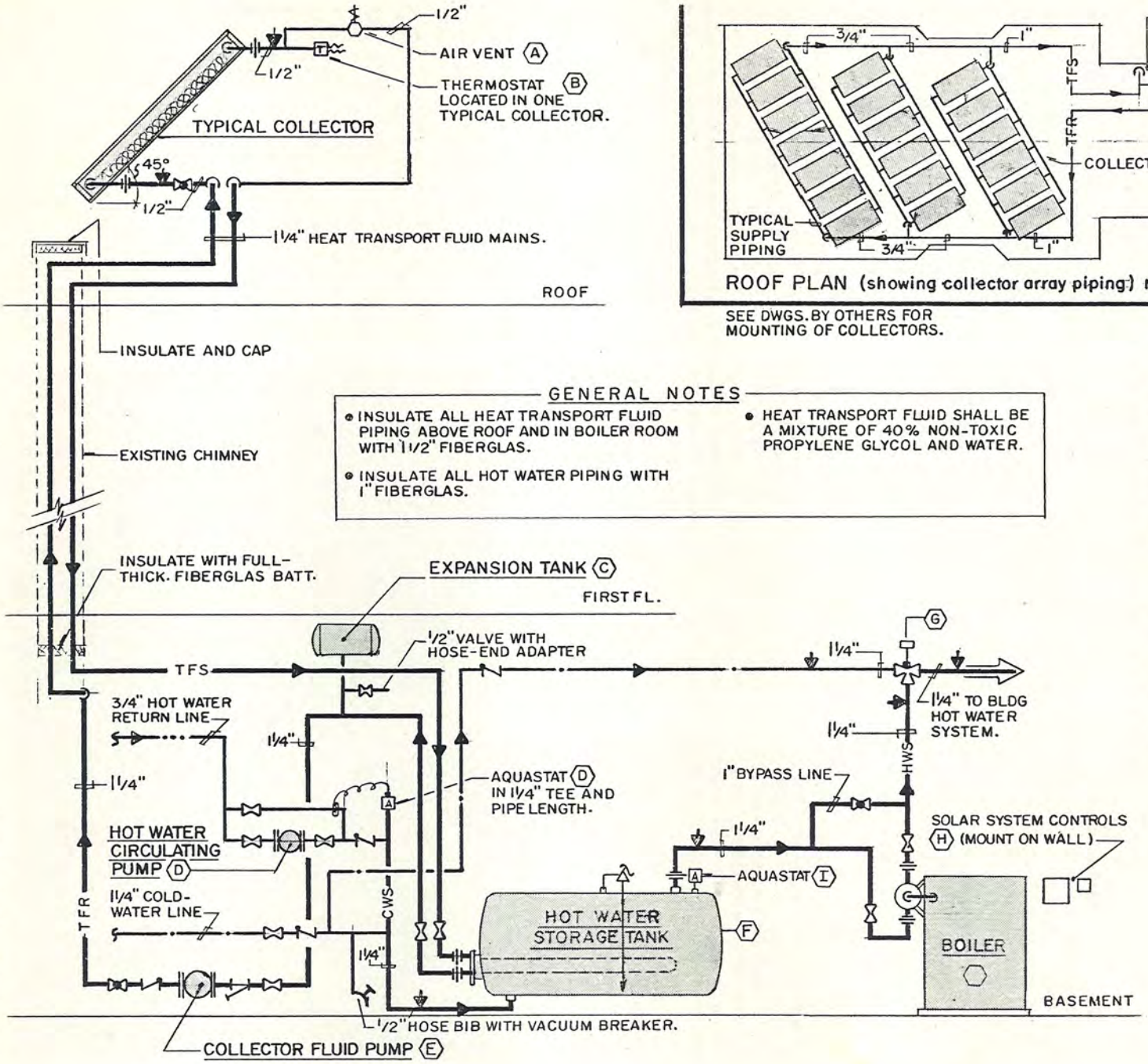
System Details

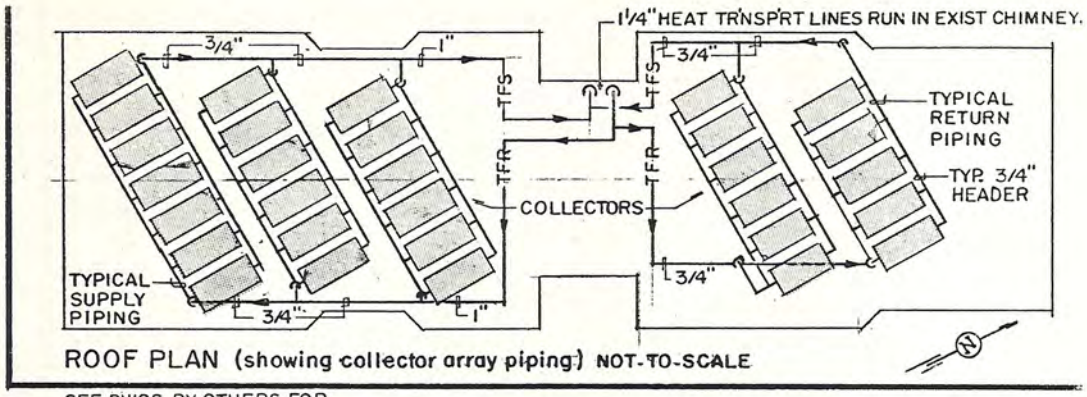
In Fig. 1, the heat transport fluid is shown piped between collector and 500-gal cement-lined hot water storage tank, where incoming cold water is heated. If water leaving the tank is too cool, the auxiliary heater or instantaneous coil will boost the temperature. If too hot, a mixing valve blends in cold water to achieve the desired 130F.

Conveniently, heat transport pipes are run in an unused chimney, eliminating the need for vertical pipe insulation. Because the heat transfer fluid is subject to freezing ambients, an anti-freeze is added to water to achieve a low freezing point. Propylene glycol is preferred to ethylene glycol because it is considered to be nontoxic, although the possibility of contamination is remote since domestic water pressure in the storage tank will exceed the transport fluid pressure.

The solar collector and pumps are controlled by a differential temperature controller, relay and aquastats. Whenever the temperature in the solar collectors, as sensed by an aquastat, is greater by a fixed amount than the storage tank temperature, the transport pump is started. Temperature differential between collector fluid and storage tank is adjustable. Several control manufacturers are making differential controllers specifically for this application.

The flat plate solar collectors, manufactured by Sunworks, Inc., Guilford, Connecticut, are aluminum-encased with copper absorbers and tubes, backed with insulation and single glazed. The selective black surface, chemically etched to maximize absorption of the high frequency sun rays and minimize low frequency reradia-





ROOF PLAN (showing collector array piping) NOT-TO-SCALE

SEE DWGS. BY OTHERS FOR MOUNTING OF COLLECTORS.

GENERAL NOTES

- INSULATE ALL HEAT TRANSPORT FLUID PIPING ABOVE ROOF AND IN BOILER ROOM WITH 1½" FIBERGLAS.
- INSULATE ALL HOT WATER PIPING WITH 1" FIBERGLAS.
- HEAT TRANSPORT FLUID SHALL BE A MIXTURE OF 40% NON-TOXIC PROPYLENE GLYCOL AND WATER.

SYMBOLS

- PIPE UNION
- GATE VALVE, JENKINS-280 U
- GLOBE VALVE, JENKINS-801
- CHECK VALVE, JENKINS-962
- PRESSURE RELIEF VALVE
- STRAINER
- AUTOMATIC MIXING VALVE
- AIR VENT
- TEST WELL

TFS	TRANSPORT FLUID SUPPLY
TFR	" " RETURN
CWS	COLD WATER SUPPLY
HWS	HOT WATER SUPPLY

DIRECTION OF FLOW

tion, is more efficient than standard black painted surfaces and is expected to last longer.

The primary consideration in collector selection, once the question of durability has been weighed, is the collector's maximum Btu absorption per installed dollar. This consideration helps narrow the selection among the fifteen to twenty collectors on the market.

Except for the collector, all components of the system are conventional and lend themselves to installation by the less experienced workers on this project. (This same criterion applies to the one-pipe steam heating system.)

We estimate that 70% of the energy required to heat domestic water will be supplied by the sun, representing a saving of 1500 gal of oil annually. At forty cents per gallon of No. 2 oil, the annual saving is $600. Annual return on the investment of an estimated $11,000 in solar system costs, excluding labor, will depend on future oil prices and interest rates.

Implications for the Future

We believe that solar energy can be used effectively on existing residential and commercial buildings. Its application to domestic water heating to a majority of older buildings could have a tremendous impact on the problem of imported oil. Existing housing stock will be a large proportion of all housing for many years to come. Hence, funds spent on this type of solar energy utilization will provide great benefits to very many people.

The project on eleventh street demonstrates the viability of adaptive re-use of existing structures rather than building anew. This approach is ecologically sound in that it spares the energy required to demolish and rebuild. The approach is especially viable when coupled with self-help programs which involve significant participation of tenant-owners in reconstruction and maintenance of their dwellings.

New York City's desperate financial condition has temporarily stopped other, similar rehabilitation projects, and the financial condition of other urban areas is not much better. Federal money is available for similar solar projects for existing buildings but, without municipal or private seed money for these abandoned buildings, the federal funds cannot be used. It is hoped that, as urban areas become solvent again, this type of housing rehabilitation will receive the highest priority.