# Energy Apportionment for Mini-Split Heat Pumps

("sub-metering" heat pumps)

Background: In most NYC buildings, the cost of heating and cooling is split between the owner and the resident because the systems are separate. But heat pumps typically provide both heating and cooling from a single system, presenting new challenges. However, many system types can be designed so that building owners can "sub-meter" the equipment and bill residents for cooling in order to maintain their current heating and cooling billing structure – ensuring that heating costs aren't shifted to residents, which is not usually allowed per HPD's Electric Heating Policy. This document provides information for sub-metering split heat pump systems.

Energy Apportionment Systems (EAS): Many leading heat pump manufacturers provide the functionality needed to "sub-meter" using Energy Apportionment Systems, (EAS). EAS enables the accurate tracking of energy consumption for cooling (and heating) for each apartment and are typically a proprietary product from the manufacturer, although 3rd party products are available (e.g. Intesis).

MINI- AND MULTI-SPLITS ON HOUSE METER WITH EAS
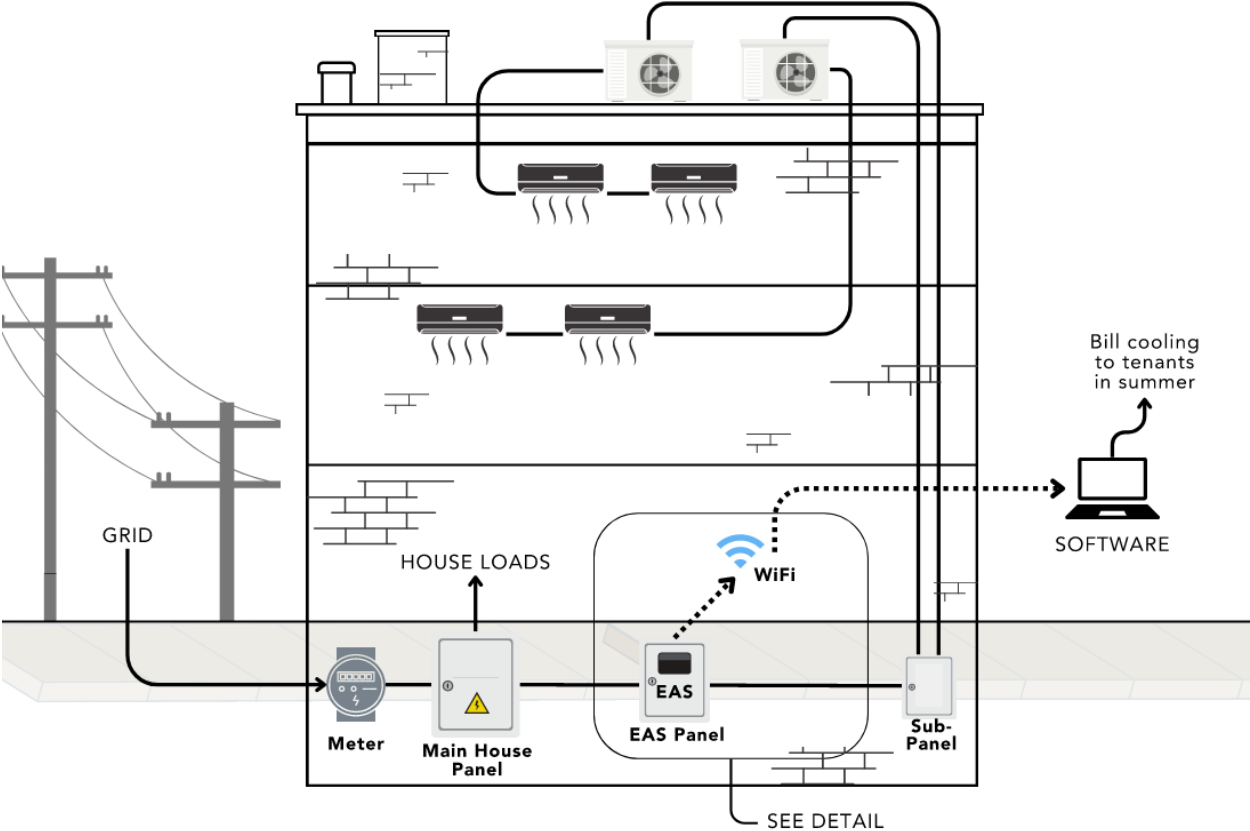
An EAS includes both special physical equipment to monitor and transmit usage information and software for data analysis and billing. The heart of an EAS is provided by the heat pump manufacturer and is a custom pre-designed and factory-assembled energy apportionment panel containing voltage inputs for the outdoor units, utility grade power meters, current transformers, a pulse input controller to monitor usage signals from the indoor and outdoor equipment and a communications module to relay the data:

The energy apportionment panel receives power from the main house electric panel and feeds a dedicated electrical sub-panel which exclusively serves the multi-split outdoor units for the building. (One-to-one mini-split configurations can also be designed.) Current transformers relay pulse signals from each outdoor unit which are recorded by the Watt-hour meters, and the expansion valve position is monitored to calculate the amount of refrigerant used by each indoor unit being served. The apportionment of outdoor unit electricity used is based on the fraction of refrigerant used by each indoor unit compared to the total refrigerant used by all connected indoor units.

The data for up to 50 indoor units is relayed from the pulse controller to an expansion controller. This connects to a local area network also hosting a master central controller and a PC workstation (see detail below). On larger projects up to three additional expansion controllers can be added to the network, or additional networks and master central controllers can be incorporated into a larger network prior to final processing of the data at the PC workstation using a proprietary software. The output CSV data file with the apportionment can be saved and shared with a third-party billing company.

An EAS must be integrated into the HVAC design early, as most systems require dedicated power panels for all the outdoor units. A single panel can typically support many outdoor units and serve up to 200 indoor units.

Good planning of the power distribution is important to reduce system costs, and a heat pump manufacturer will typically work directly with the project MEP team to optimize the EAS design and with the HVAC contractor for the install. The EAS can normally be installed by the project HVAC contractor with the heat pumps and other system components. Both commercial and residential-targeted equipment can function with a properly designed and installed EAS, the total heat pump energy use will be accurately allocated to each dwelling unit. The heat pump manufacturer can help design the strategy for separating cooling from heating energy use.

- **Central VRF Systems:** Most VRF systems and larger unitized multi-split systems with three-phase outdoor units have an information protocol that differentiates cooling energy use from the heating energy and can be used with the EAS, making it possible to bill tenants for the energy consumed for cooling.
- **Unitized Systems:** Single-phase mini and multi-split systems can utilize the same hardware to accomplish sub-metering. However, the combination of indoor and outdoor units within a design must be closely reviewed by the manufacturers to ensure functionality.

Third Party Billing: The data generated by the EAS can typically be output to an onsite computer, and access can be provided to third party billing companies at the discretion of the owner. The data from the EAS can be shared with the company that generates the bills and sends them to tenants at a cost of ~$4/ apartment. Many building owners only bill for cooling during the summer months and keep the system in heating mode during all other months. Several companies like Yardi, Quadlogic, and other property management billing companies provide this service.

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DETAIL
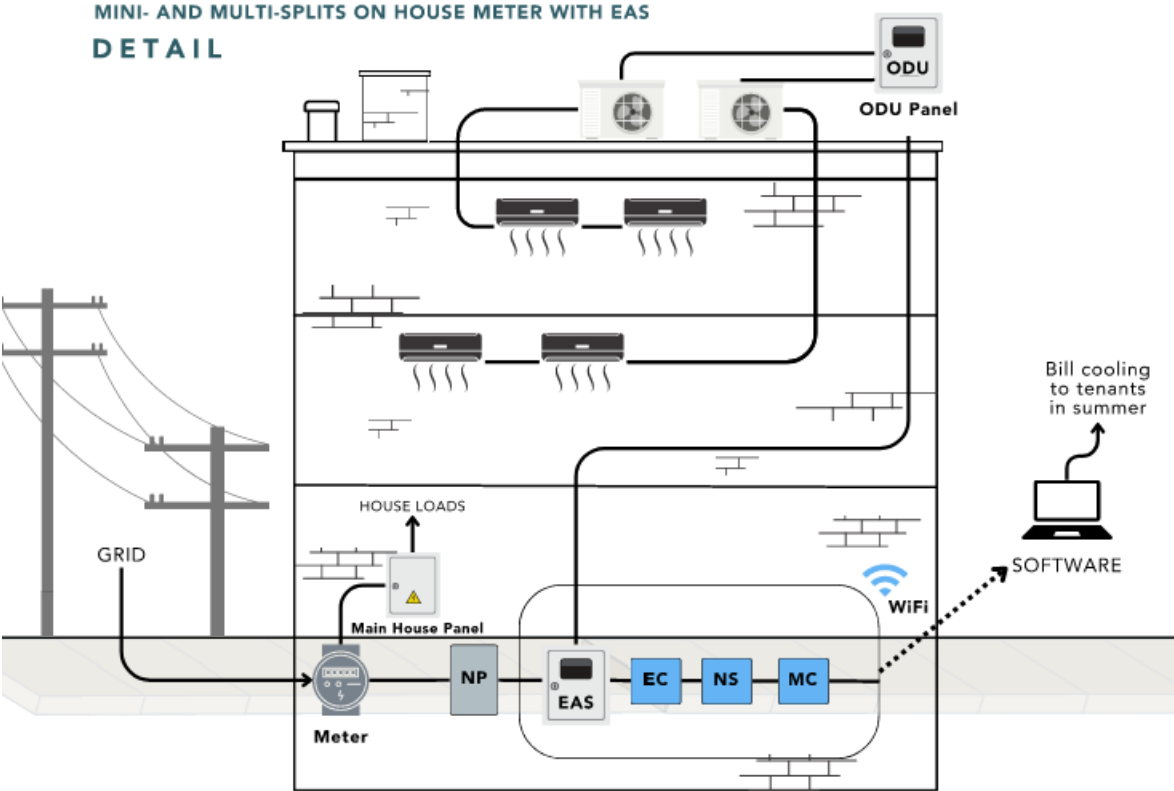
EC = Expansion Controller   NS = Network Switch   MC = Master Controller