Modeling Heat Recovery Plants: DHRC in Condenser Water Loop

Introduction

This eHelp explains how to model a heat recovery plant using a Dedicated Heat Recovery Chiller (DHRC) in the Condenser Water Loop. This modeling feature is offered in HAP v4.9 and later versions. In the "System Overview" section below the configuration and operation of equipment in this plant is described. In the second section, a tutorial explains how to model this type of plant in HAP.

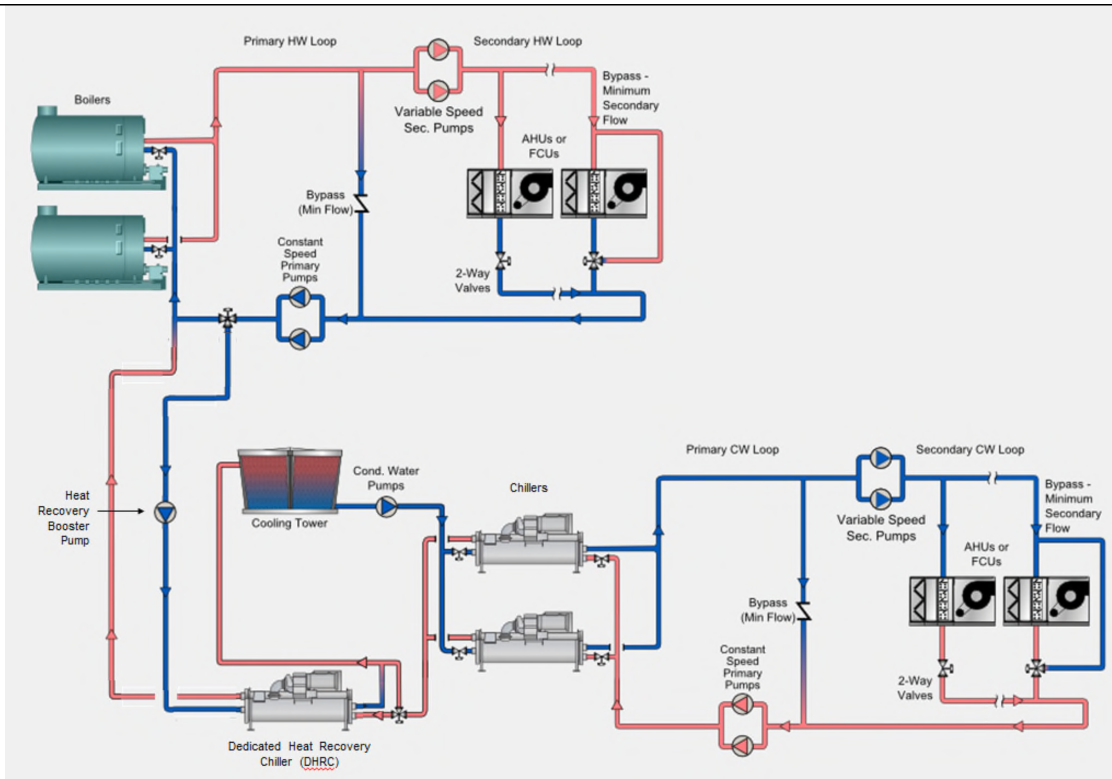

Figure 1. Diagram of Heat Recovery Plant with DHRC in Condenser Loop

(*Note: This is a simplified diagram only intended to show the basic arrangement of components*)

System Overview

Basics of Equipment Configuration and Operation

Figure 1 contains a simple diagram of a heat recovery plant using a dedicated heat recovery chiller (DHRC) in the condenser loop:

- The upper half of the diagram shows a hot water system with two hot water boilers in parallel and a primary/secondary water loop providing hot water to heating coils in air handlers or fan coil units Note that there can be different types of of heat recovery systems. Some will supply heat to a service hot water (SHW) system instead of or in addition to serving space heating loads.

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- The lower half of the diagram shows a chilled water system with two water-cooled chillers in parallel providing chilled water via a primary/secondary water loop to cooling coils in air handlers or fan coil units.
- In this diagram the air handler icons are shown separately for the cooling and heating loops, but typically these will be single equipment units containing both cooling and heating coils. The air handlers are shown separately to make the diagram more readable.
- When simultaneous cooling and heating loads exist in the building, heat recovery is possible. The valve in the hot water return pipe (middle left in the diagram) diverts some or all of the hot water return flow into the heat recovery pipe. The heat recovery booster pump is activated and circulates the return water to the condenser of dedicated heat recovery chiller (DHRC). The DHRC is energized and acts as a water-to-water (W2W) heat pump to extract heat from chiller leaving condenser water and reject the heat into the heat recovery pipe. The heated water then returns to the hot water loop just upstream of the boilers.
- If the heat added to the return water is sufficient to meet the heating system load, then the hot return water bypasses the boilers (bypass leg not shown in diagram), the boilers remain off, and 100% of the demand is provided by recovered heat. On the other hand, if the recovered heat is not sufficient to meet the full heating plant load, then one or more of the boilers operate to satisfy the remainder of the heating demand, and heat recovery satisfies only part of the demand.

Survey of Advantages and Disadvantages

As with most heat recovery schemes, this scheme causes some costs to increase and other costs to decrease. When applied to a building with good heat recovery potential, the net result can be an overall savings which justifies the system. Key issues for consideration:

- **Heating energy cost may decrease.** In this type of system, heating energy consumption by boilers can be partially replaced with energy use by the DHRC machine. Because the DHRC can operate with a COP in the 2.5 to 4.0 range versus the gas boilers which can have an efficiency from 80% to 95% (COP = 0.80 to 0.95), heating energy use will decrease. However, the relative price of electricity and natural gas play a key role in determining whether the heating energy cost decreases. In many locales the cost of electricity is 3 to 4 times more expensive than natural gas when compared on the basis of common units of measure. That cost differential can mean the heating cost for the DHRC heat recovery plant is comparable to a conventional system in spite of large energy savings.

  Example: In a certain locale the price for electricity is 0.0960 $/kWh and the cost of natural gas is 0.937 $/THM. If we convert the gas price to use units of kWh, we get a gas price of 0.0320 $/kWh. Therefore a kWh of electricity is three times as expensive as a kWh of natural gas. If the average annual COP of the DHRC is more than three times that of the gas boiler, then heating cost will be reduced by using the DHRC. If the annual COP of the DHRC is less than three times that of the boiler, heating cost will increase. Note: This is a single example for illustration. Energy prices vary widely by location and over time. You should use your own local utility prices to assess heat recovery viability for your projects.

- **Cooling energy cost could increase or stay the same.** In this type of heat recovery system different design approaches can be used to operate chillers as in a conventional plant, or to operate the chillers at elevated condenser water temperatures to allow more efficient operation of the DHRC machine. Which approach is used will determine whether cooling energy cost stays the same or increases.

  Design Approach #1 – In a conventional chiller plant the operating strategy for water-cooled chillers is often to minimize entering condenser water temperature (ECWT) to optimize chiller efficiency. For example, the full load ECWT might be 85 F (29.4 C) and the minimum ECWT is 60 F (15.6 C). The cooling towers (or dry coolers) run with fans at full speed to minimize ECWT until the minimum setpoint is reached. When this operating strategy is used, it results in lower condenser water temperatures entering the DHRC evaporator. The chillers will use the same energy

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as in a conventional chiller plant, but the DHRC has to produce higher lift to produce hot water for the heating loop, and therefore operates less efficiently.

Design Approach #2 – An alternate approach is to operate the chillers at higher ECWT levels, for example setting the minimum ECWT to 75 F or 85 F instead of 60 F. With these higher entering condenser water temperatures, the chillers will typically operate less efficiently and use more energy, but the higher water temperature entering the DHRC evaporator requires lower lift and allows the DHRC to operate more efficiently. In this scenario cooling cost would increase, but the payoff should be lower heating costs.

- **Cooling tower fan energy cost may decrease.** Because the DHRC is extracting heat from the condenser loop, there is less heat for the cooling towers or dry coolers to reject. As a result, there will typically be more hours of operation at the minimum ECWT setpoint where the tower or cooler fans are cycling, in 2-speed or variable speed operation and therefore using less energy. If Design Approach #2 above is used, this further reduces fan energy use because a higher minimum ECWT setpoint results in more hours of cycled, 2-speed or variable speed fan operation.
- **Overall energy cost savings** will depend on the sizes of the changes in heating costs, cooling costs and tower fan energy costs. In a building with good heat recovery potential and with a well designed heat recovery system, a net energy cost savings can result.
- **First cost will typically increase.** High performance HVAC systems often involve a trade off between increased first cost for additional components and controls in exchange for lower energy costs. The lower energy costs ultimately pays back the increased first cost and deliver net savings over the life of the system. This heat recovery system is no exception. This type of heat recovery system requires additional pumps, piping, and controls. Most importantly, it also requires an additional machine - the dedicated heat recovery chiller. Therefore, the purchase and installation cost for this heat recovery plant will generally be larger than the first cost for conventional cooling and heating plants.
- **Lifecycle cost may decrease.** While first cost will be higher for heat recovery, in a building with good heat recovery potential and a well designed system, energy costs can be lower. This can yield net savings over the life of the system.

Keys to Successful Application

Successful application of a heat recovery plant first requires a building with simultaneous cooling and heating loads for a significant number of hours per year. Examples of buildings that may have good heat recovery potential include hotels, dormitories and hospitals. Each of these building types tend to have large persistent service hot water (SHW) loads all year long. Therefore heating demands exist during the cooling season when recoverable heat is available from cooling equipment. In moderate to warm climates cooling demands may exist most of the year, further increasing the number of hours with simultaneous demands. Figure 2 shows the full-year hour-by-hour cooling and heating load profiles for a sample hotel in a warm climate in the northern hemisphere. This example demonstrates good heat recovery potential.

On the other hand, the building whose cooling and heating profiles are shown in Figure 3 might not be a good candidate for heat recovery. This is an office building in a cool climate in the northern hemisphere. Cooling is dominant in the summer while heating is dominant in the winter, and SHW demands are relatively small. Some hours with simultaneous cooling and heating demands exist in the shoulder seasons and when SHW demands exist in the summer, but the size of the demands and the number of potential heat recovery hours tend to be small. There could be small net energy cost savings, but it becomes more difficult for this savings to offset the additional first costs of the heat recovery system to achieve project payback objectives.

Note: Figure 3 is not meant to imply that all office buildings in cool climates are poor heat recovery candidates. It is only meant to demonstrate that any building lacking hours with simultaneous cooling and heating demands is a poor candidate for heat recovery. Each building application is different and should be evaluated for heat recovery potential. See "Avoiding Simulation Pitfalls" at the end of this article for further details.

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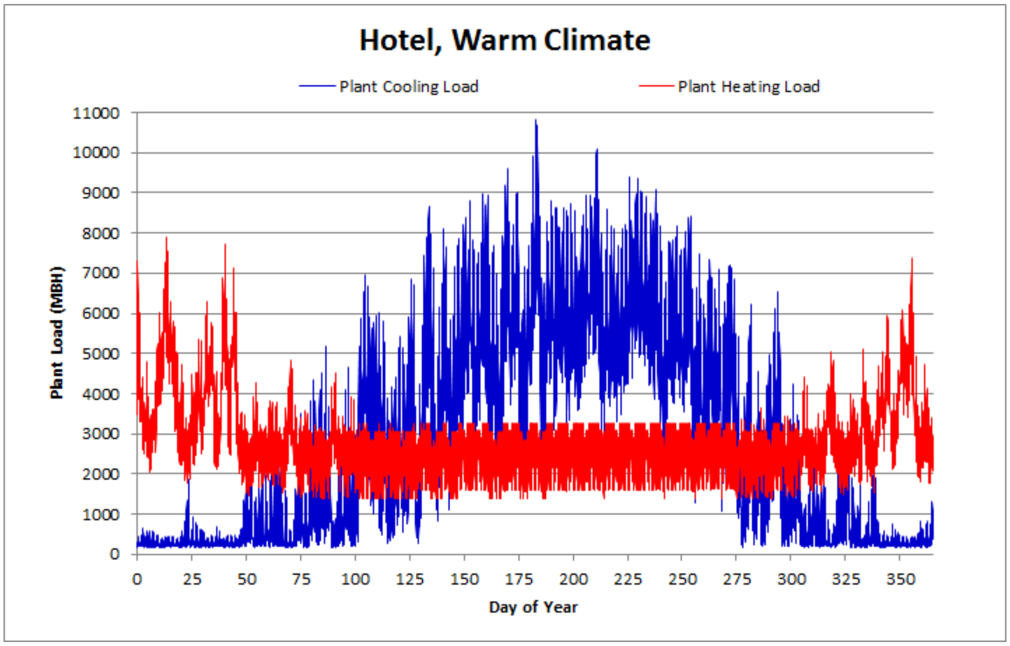

Figure 2. Building with Good Heat Recovery Potential

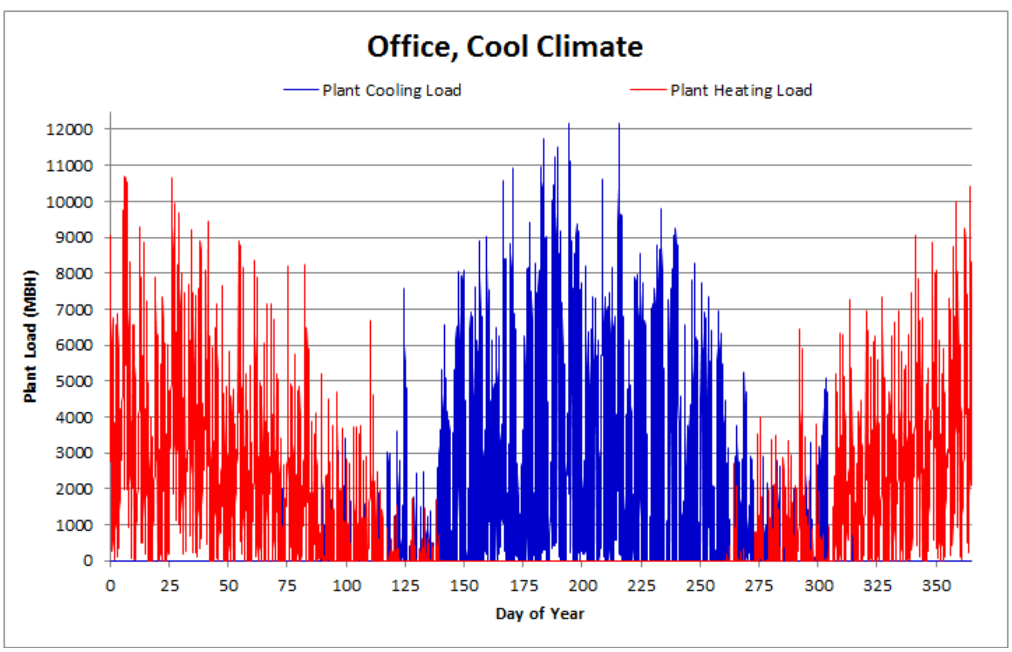

Figure 3. Building with Poor Het Recovery Potential

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In addition to building cooling and heating load profiles, viability of a heat recovery system solution will also depend on equipment efficiencies at full and part-load, heating energy sources (electric vs gas for example), relative electric and gas energy prices, and equipment costs. Because many factors are involved, it is often not obvious whether heat recovery makes sense for a given application. Modeling heat recovery versus a conventional plant in an energy modeling tool such as Carrier HAP is a good place to start making the case for heat recovery. The following section provides a tutorial on using HAP to compare energy performance of conventional versus air-cooled chiller with heat recovery condenser plants.

HAP Tutorial

A typical application with HAP is to compare the energy costs of conventional cooling and heating plants versus a heat recovery plant. The following tutorial summarizes the steps for conducting this analysis with a heat recovery plant using a dedicated heat recovery chiller in the condenser water loop.

Step 1 – Model the Common Elements

Use standard HAP procedures to model the common elements of the building: weather, wall, roof, and window assemblies, schedules, spaces, air systems, and electric and fuel rates.

Step 2 – Model the Conventional Plants

To represent the baseline case – conventional cooling and heating plants – create one chiller plant and one hot water plant using standard HAP procedures.

Step 3 – Input Chiller, Boiler and DHRC Equipment Data for Heat Recovery Plant

Create one or more water-cooled chillers, one or more hot water boilers and the DHRC machine to use in the heat recovery plant. These inputs could be created “on-the-fly” while inputting the plant, but are described here as a separate set-up task for simplicity and greater clarity.

1. Create Boilers – Often the same boiler equipment will be used in both the conventional and heat recovery plants since the boilers are sized to meet the peak heating load in the heat recovery plant. If so, then the boilers defined for the conventional system can be reused and no new inputs are needed. If the boiler equipment will be different for the heat recovery plant, define this equipment using standard HAP procedures.
2. Create Water-Cooled Chillers – Define one or more water-cooled chillers for the plant. This is done using standard HAP procedures.
3. Create the DHRC Machine
    - From the main window choose the “Chillers” category and double-click the “<new default chiller>” item.
    - On the General Tab (Figure 4) specify the Equipment Function as “Heat Pump”. Because the DHRC machine is operated in heating priority it qualifies as a water-to-water (W2W) heat pump rather than a chiller. After selecting the Equipment Function, choose the equipment type. Figure 4 shows an example where a water source screw compressor machine is used.

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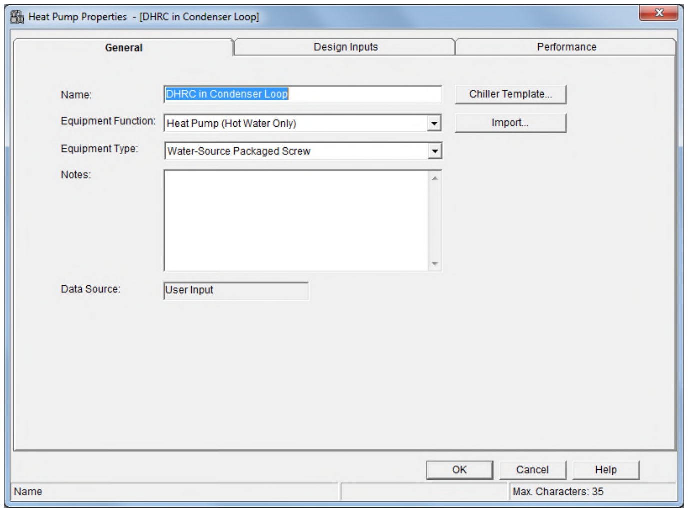

Figure 4.

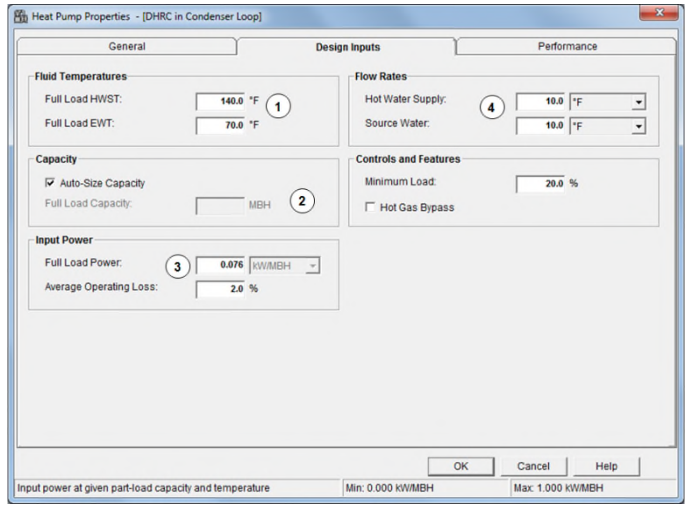

Figure 5.

- On the Design Inputs tab go to the Fluid Temperatures section (see “1” in Figure 5) and specify the design hot water supply temperature (HWST) for the heat pump. This is the leaving water temperature from the condenser. Figure 5 shows an example where the HWST is 140 F (60 C). Also specify the source entering water temperature (EWT). This is the temperature of condenser water entering the DHRC at design. Figure 5 shows an example where this temperature is 70 F (21.1 C). This example value is based on a 60 F minimum ECWT and 10 F delta-T for the condenser water loop.
- In the Capacity section (2) specify autosized capacity or directly specify the full load heating capacity of the heat pump.
- In the Input Power section (3) specify the full load input power in terms of kW input per MBH of heating output (ikW input per kW heating output in Metric).
- In the Flow Rates section (4) specify the hot water supply flow. This is the hot water flow through the condenser. Also specify the source flow. This is the cold water flow through the evaporator. A required water delta-T can be defined as shown in Figure 5 and HAP will calculate the flow, or the flow rates can be directly specified in gpm or L/s.
- On the Performance tab (Figure 6), make sure performance data is provided for the range of operating conditions expected. For a W2W heat pump the rows in the performance map represent performance for different evaporator entering water temperatures. Data needs to be provided for the range of entering water temperatures anticipated.

  Example: Suppose the chiller system operates with a design full load ECWT of 85 F (29.4 C), a condenser delta-T of 10 F (5.6 K) and a minimum ECWT of 60 F (15.6 C). At chiller system full load conditions the leaving condenser water temperature will be 95 F (35 C). As the chiller system approaches zero load at low ambient wet-bulb times, the condenser leaving temperature will approach 60 F. Therefore the range of possible entering water temperatures for the DHRC evaporator is 60 F to 95 F. For this example scenario, that range of entering water temperatures must be used in the performance map. It ensures that performance data will exist for all operating condition occurring during the year.

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Readers should note that the current (HAP v4.9) default data for a W2W heat pump is for a dedicated heating plant operating with a ground source loop. Therefore the design point (43 F or 6 C) and the range of temperatures (43 F to 75 F or 6 C to 24 C) is suited for that application rather than a heat recovery application. Therefore performance map data should be replaced with data obtained from the DHRC manufacturer to represent DHRC operation spanning the range of entering water temperatures and part-load ratios.

- Finally, save the DHRC data.

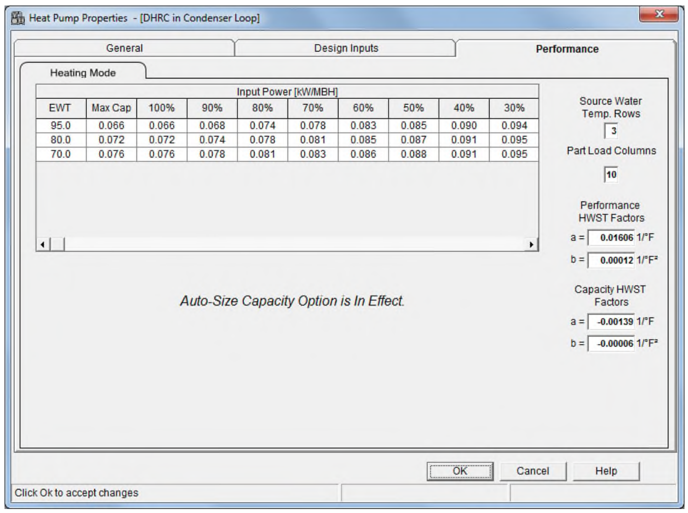

Figure 6.

Step 4 – Define the Heat Recovery Plant

Next create and configure the heat recovery plant. The following subsections describe inputs on each of the seven relevant tabs in the Plant Properties window.

Step 4a – General Tab

On the General Tab select "Heat Recovery Plant" as the plant type (Figure 7). This is a special type of plant which combines the components from one chilled water system, one hot water boiler system and the additional heat recovery equipment, piping and controls. Therefore we will define all of the interconnected cooling and heating equipment as one "plant".

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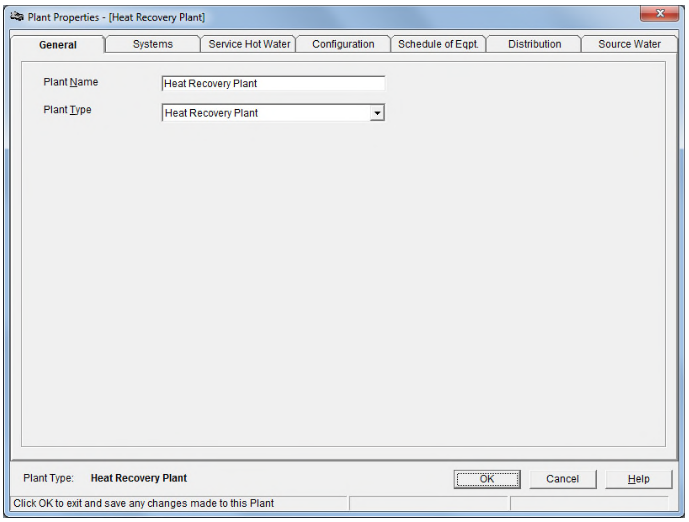

Figure 7.

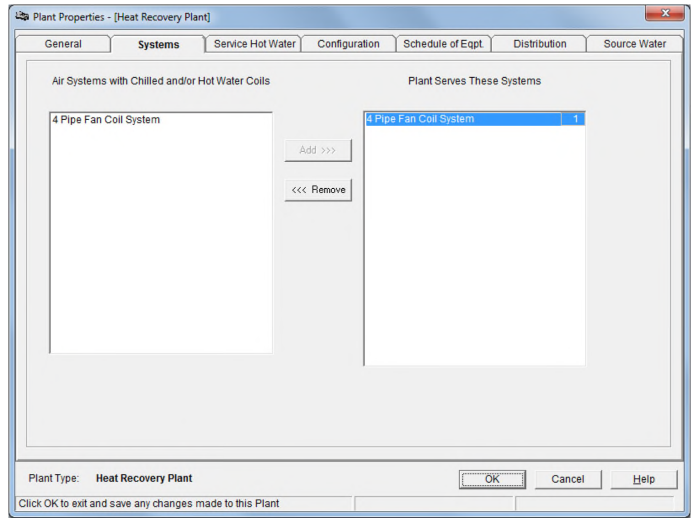

Figure 8.

Step 4b – Systems Tab

On the Systems tab link one or more air systems to the plant (Figure 8). Among these systems at least one must have chilled water cooling coils. Typically one or more will also have hot water heating coils.

In warm climates where space heating is not required, all of the air systems might be chilled water cooling-only. In that case the heating load for the plant would come from the service hot water (SHW) system (see Step 4c).

Step 4c – Service Hot Water Tab

If the heat recovery system serves service hot water (SHW) loads, define those loads and the associated equipment components and controls on the Service Hot Water tab (Figure 9).

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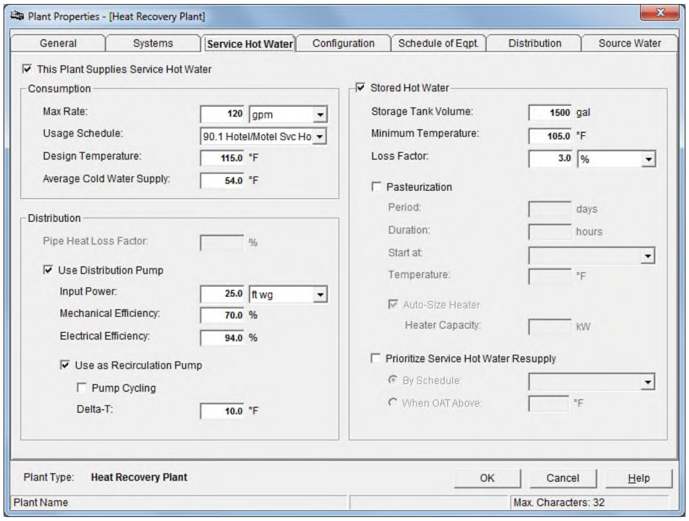

Figure 9.

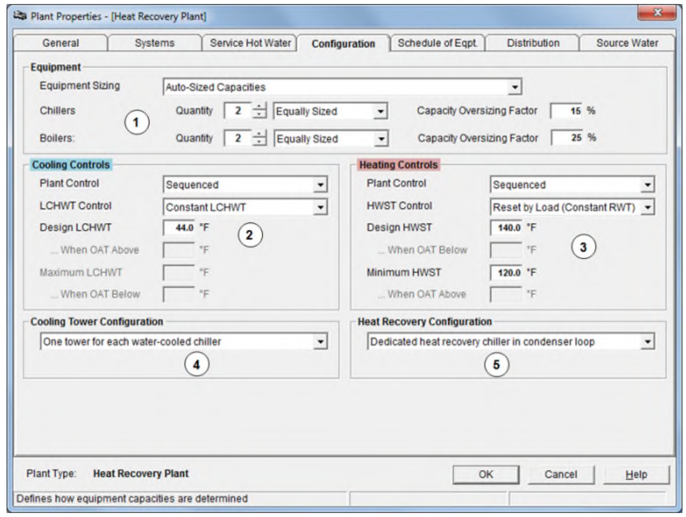

Figure 10.

<u>Step 4d – Configuration Tab</u>

The Configuration Tab (Figure 10) is divided into five sections containing important information about the configuration and control of the cooling and heating portions of the plant:

- **Equipment** (see 1 in figure) - Specify whether chillers and boilers will be “autosized” or whether you’ll use equipment with directly specified capacities. “Autosizing” is typically used for preliminary screening studies. User defined sizing is used for studies where you’ve designed the system and chosen specific equipment capacities. This section also defines the quantity of chillers and boilers in the plant. For this type of heat recovery plant the quantity of chillers refers to the cooling only chillers. The DHRC machine will automatically be added and is not included in this quantity.
- **Cooling Controls** (2) – Specify how chillers are staged (e.g., sequenced or equally unloaded) and any chilled water reset controls.
- **Heating Controls** (3) – Specify how the boilers are staged (e.g., sequenced or equally unloaded and any hot water supply reset controls.

  For a heat recovery plant it may be beneficial to use hot water supply temperature reset, if heat recovery is used for space heating and if it’s feasible. Hot water reset reduces the hot water supply temperature either as outdoor temperatures warm, or as heating loads decrease. Reduced hot water supply temperatures can result is cooler return water temperatures in the hot water loop. It will also cause the DHRC leaving hot water supply temperature (HWST) to be reset. The combination of cooler return temperatures and reduced HWST can allow the DHRC machine to operate more efficiently.
- **Cooling Tower Configuration** (4) – Specify whether the cooling-only chillers use individual cooling towers (1 to 1 ratio between chillers and towers) or whether a single large cooling tower is used for all cooling only chillers.
- **Heat Recovery Configuration** (5) – Select the “Dedicated heat recovery chiller in condenser loop” option in this drop-down list.

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Step 4e – Schedule of Equipment Tab

The Schedule of Equipment Tab (Figure 11) is used to select the chillers, boilers and the DHRC machine used in the plant:

- The **Equipment Table** (see 1 in figure) contains one row for each chiller or boiler in the plant, and one additional row for the DHRC. In the example in Figure 11 there are two chillers, color coded as blue and designated as CH-1 and CH-2. There are also two boilers, color coded as red, and designated as BLR-1 and BLR-2. There is one DHRC machine, color coded green and designated as "DHRC". If you've previously defined the chiller, DHRC, and boiler equipment (in Step 3 above), these items will appear on the drop-down list and can be selected. If the equipment has not yet been defined, you can select the "create new chiller", "create new heat pump", or "create new boiler" option in the list to create and link the equipment.
- The remaining items on this tab (2) are display only and provide reference information about equipment flow rates and capacities (if available).

Step 4f – Distribution Tab

The Distribution Tab is used to define the performance of the chilled water and hot water distribution loops. The tab contains two sub-tabs: one for the chilled water supply loop, color coded blue, (Figure 12) and one for the hot water supply, color coded red (Figure 13).

- Inputs on the **Chilled Water Supply** sub-tab function the same as for a conventional chiller plant. You can select from a list of different system types (primary-only, primary/secondary) and then define the fluid properties and pump performance characteristics.

  In Figure 12 note that there are two rows in the Primary Loop Pumps section color coded blue and labeled as CH-1 and CH-2. These are the primary chilled water pumps for the two cooling-only chillers in our example. A third item shown in green and labelled as "DHRC" is the circulating pump on the evaporator side of the DHRC. This pump circulates water from the condenser water loop to the DHRC.

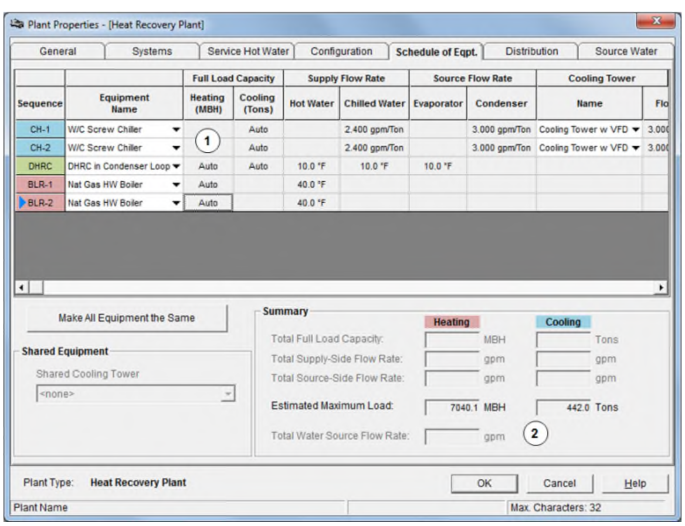

Figure 11.

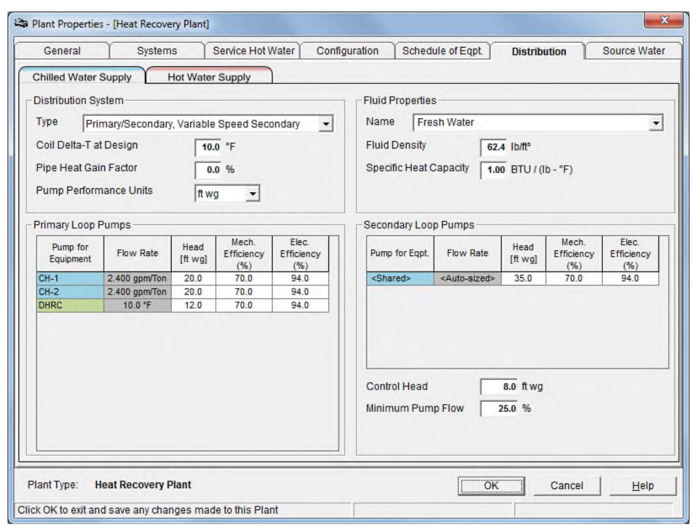

Figure 12.

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- Inputs on the **Hot Water Supply** sub-tab (Figure 13) are similar to those for a conventional hot water plant. You select the distribution system type, specify fluid properties and pump performance.

  In Figure 13 note that there are two rows in the Primary Loop Pumps section color coded red and labeled as BLR-1 and BLR-2. These are the primary hot water pumps for the two boilers in our example. The third line item color coded in green and labeled as "DHRC" is the heat recovery booster pump. In Figure 1 this is the pump in the heat recovery leg of the system (middle left in Figure 1) that circulates water from the hot water return pipe to the DHRC machine.

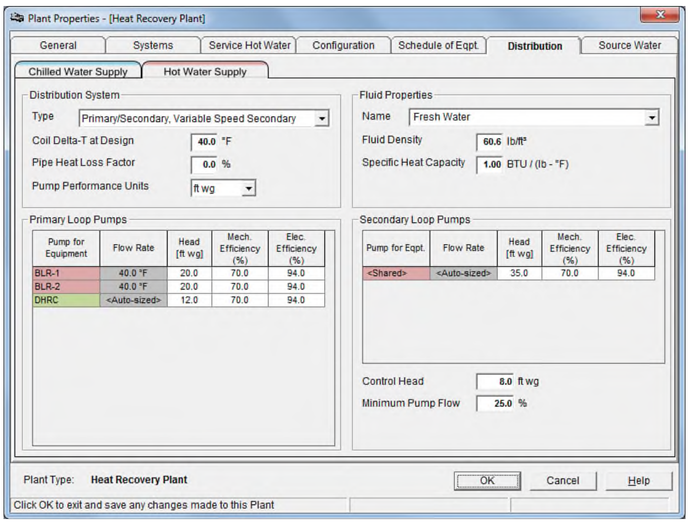

Figure 13.

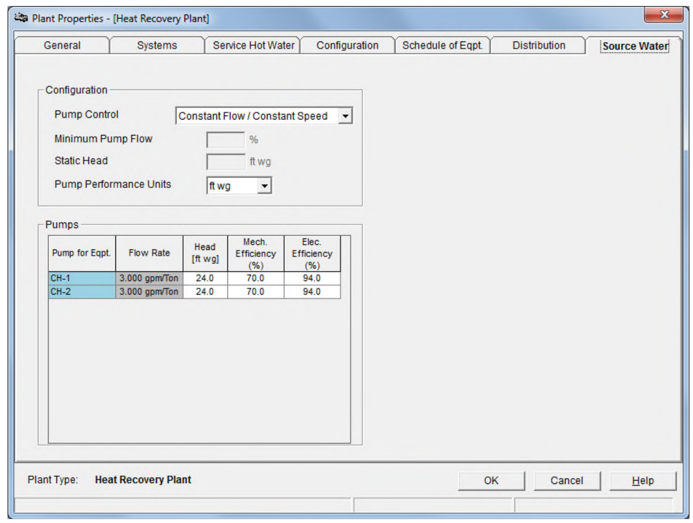

Figure 14.

Step 4g – Source Water Tab

The "Source Water" tab (Figure 14) for this type of heat recovery plant contains data for the condenser water loop which serves the cooling-only chillers and the DHRC. Inputs on this tab are similar to those for a conventional chilled water plant with water-cooled chillers and are used according to standard HAP procedures. You can specify whether the system is constant speed or variable speed, and specify the performance of the individual condenser water pumps.

Step 5 – Run the Simulations

Once both the conventional and heat recovery plants have been defined, create two "buildings", one to represent the conventional scenario and one to represent the heat recovery scenario. Then run the energy simulations and evaluate the results.

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Avoiding Simulation Pitfalls

Heat recovery plants are complex engineered systems. Energy models of these plants are complex as well. When modeling the "air-cooled chillers with heat recovery condenser" plant in HAP there are several key details to consider to ensure high quality, accurate results.

1. **Lack of Heat Recovery Savings** – The most common questions arising from heat recovery energy simulations are "Why didn't heat recovery provide any savings?" or "Why are the heat recovery savings so small?". In many cases the answer is the building lacks heat recovery potential because of the small number of hours with simultaneous cooling and heating loads.

   Figure 3, shown earlier, contains an example of a building which is not a good candidate for heat recovery. Cooling (blue) is predominant in summer. Heating (red) is predominant in winter. There are very few hours where simultaneous cooling and heating demands occur. This example is for an office building in a cool climate. The building uses floor-by-floor VAV AHUs with an outdoor air economizer. The economizer provides partial free cooling when the outdoor air dry-bulb (OADB) is between 55 F (12.8 C) and 75 F (23.9 C), and provides full free cooling when the OADB is less than 55 F. While an outdoor air economizer is a useful device for reducing cooling energy use, and may be required by prescriptive codes, it reduces heat recovery potential because it reduces the number of hours when simultaneous cooling and heating loads exist.

   Figure 2, shown earlier, shows an example of a building which is a good candidate for heat recovery. Again cooling coil loads are shown in blue and heating coil loads are shown in red. This is a hotel building in a warm climate. It uses 4-pipe fan coils to cool and heat guest rooms, with a dedicated outdoor air system (DOAS) for ventilation, and it has significant service hot water (SHW) loads throughout the year. These characteristics result in cooling loads for much of the year and persistent heating plant demands all year long. As a result there are many hours throughout the year with simultaneous cooling and heating demands where heat recovery can operate.

   You can assess the heat recovery potential of your building using HAP as follows:

   a. Create the conventional chiller plant and hot water plant using standard HAP procedures.
   b. Run the plant simulations for these two plants.
   c. For the chiller plant request a graph of hourly simulation results for January 1 thru December 31. Choose the "Plant Cooling Load" item as the data to be graphed (Figure 15). This will plot the total hourly cooling load imposed on the plant for the full year.
   d. For the hot water plant request a graph of hourly simulation results for January 1 thru December 31. choose the "Boiler Output" item as the data to graphed (Figure 16). This will plot the total hourly heating load imposed on the plant, including space heating and SHW loads.
   e. Place the graphs side by side to visually evaluate whether simultaneous cooling and heating demands exist during the year.

2. **Plant Heating Control – Design HWST** – As a design issue, the design hot water supply temperature (HWST) for the heating plant should be carefully selected and should be synchronized with the full load HWST of the DHRC machine.

   Example 1: Suppose the Design HWST is set to 180 F (82.2 C). The hot water system delta-T is set to 40 F (22.2 K). At full load this means the return water temperature will be 140 F (60 C). For part-load operating conditions, the return water temperature will be higher. Suppose the DHRC machine is specified with a full load HWST of 140 F. Therefore, if return water in the hot water system is 140 F or higher, and the DHRC is constrained to providing 140 F outlet water temperature, there is no way for the DHRC to supply heat to the hot water loop. Therefore no heat recovery will occur.

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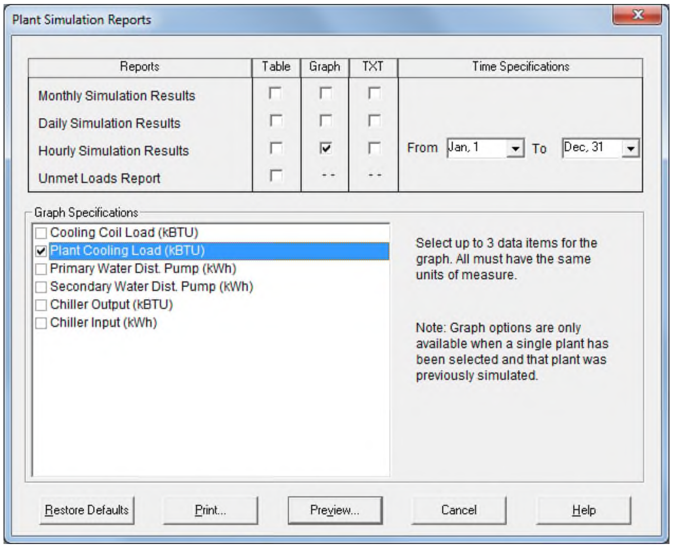

Figure 15.

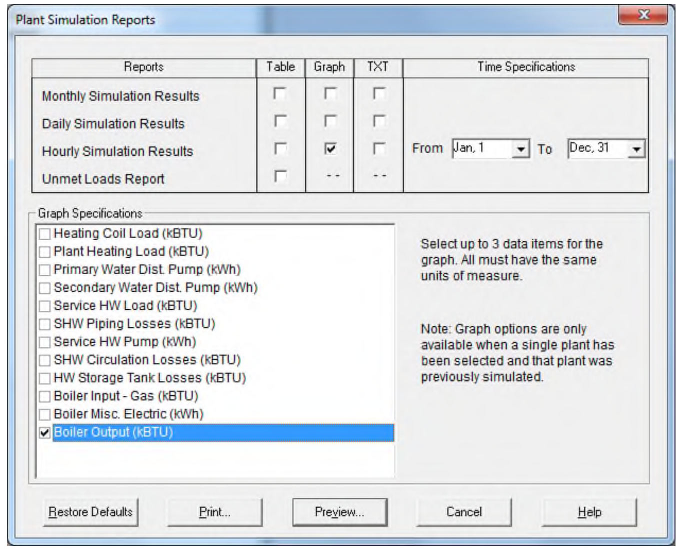

Figure 16.

Example 2: Suppose the Design HWST is set to 160 F (71.1 C). The hot water system delta-T is set to 40 F (22.2 K). At full load this means the return water temperature will be 120 F (48.9 C). As the heating system moves from 100% load to 50% load the return water temperature rises from 120 F to 140 F (60 C). For heating system part-load ratios less than 50%, the return water temperature will be warmer than 140 F. Suppose the DHRC machine is specified with a full load HWST of 140 F. When the heating system is between 100% and 50% load, the DHRC will be able to supply heat to the hot water system because the hot water entering the DHRC is less than 140 F. The DHRC can add recovered heat to warm the water to 140 F outlet temperature. When the heating system is below 50% part load ratio, the return water temperature is 140 F and warmer. As a result the DHRC machine cannot provide recovered heat because the entering water temperature equals or exceeds the DHRC leaving hot water set point of 140 F. In this situation heat recovery will occur, but it will be limited to times when the hot water system is above 50% load. The full potential of heat recovery will not be realized.

3. **Plant Heating Control – HWST Reset** – As noted in Step 4d in the HAP tutorial, it can be beneficial to use hot water supply temperature reset, if heat recovery is used for space heating and if reset is feasible. Hot water reset reduces the hot water supply temperature either as outdoor temperatures warm, or as heating loads decrease. Reduced hot water supply temperatures can result in cooler return water temperatures in the hot water loop. It also resets the leaving HWST set point for the DHRC. Together this can allow the DHRC to operate more efficiently, increasing the energy savings provided by the heat recovery plant.

4. **Condenser Water Pump Performance** – Because condenser water flows through the evaporator of the DHRC, condenser pumps will face additional resistance to flow. Condenser pump performance inputs (head, BHP or kW) must reflect this additional resistance produce accurate estimates of condenser pump energy use.

5. **DHRC Performance Data**– When defining the data for the DHRC machine, make sure the specified Full Load HWST is synchronized with the temperature levels in the hot water system, the Full Load EWT is synchronized with temperature levels in the chilled water system, and the performance map spans the range of expected source water entering temperatures.

   Synchronizing the Full Load HWST is part of the issue described in Step 3 in the HAP tutorial.

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Synchronizing the Full Load EWT and performance map data is necessary to match equipment performance with the operating temperatures in the chilled water part of the plant. The Full Load EWT should correspond to the minimum expected condenser water temperature entering the DHRC evaporator. The performance map, as noted earlier in Step 3 in the HAP tutorial should span the expected range of condenser temperatures entering the DHRC evaporator.

Further Information

If you have further questions about modeling heat recovery plants using the "dedicated heat recovery chiller in the condenser water loop" configuration and you are located in the US or Canada, please contact Carrier software support at **software.systems@carrier.utc.com**. Otherwise, please contact your local Carrier sales office for assistance.

HAP also offers simulation models for the following five additional heat recovery schemes:

- Air-cooled chillers with heat recovery condensers.
- Dedicated heat recovery chiller in parallel with cooling-only chillers.
- Heat exchanger in condenser water loop.
- Chiller with double-bundle condenser.
- Chiller with desuperheater.

For separate e-Helps explaining how to model these other heat recovery schemes, please visit the **Carrier software application support** web page.