TRACE 700 Chiller Plant Analyzer

Preface

In 1973 the first version of Trane Air Conditioning Economics, TRACE, became the first computer program of its type. It is a complete load, system, energy and economic analysis program that compares the energy and economic impact of such building alternatives as architectural features, HVAC systems, HVAC equipment, building utilization or scheduling, and economic options.

TRACE 700 Chiller Plant Analyzer was created using the backbone of TRACE. It is, in essence, an analytic tool for building system analyzers. It enables them to optimize the equipment designs on the basis of energy utilization and life-cycle cost. This program is not intended for building design.

TRACE 700 Chiller Plant Analyzer can also be invaluable for assessing the energy and economic impact of chiller plant renovations.

Introduction

To fully appreciate the capabilities of TRACE 700 Chiller Plant Analyzer and to obtain maximum value from its use, the following is a thorough explanation of the program.

Program Organization

The TRACE 700 Chiller Plant Analyzer program incorporates five major phases, each with specific tasks or functions that must be performed to provide a complete energy and economic analysis. The names of these phases are load, design, system simulation, equipment simulation and economic analysis.

The calculation procedures used in TRACE are based upon 8,760 hours of operation of the building and its service system. These procedures use techniques recommended in the appropriate ASHRAE publications or produce results which are consistent with such recommended techniques.

This document shows the calculation procedures used in the TRACE program.

Load Phase, Design Phase, Airside System Simulation

The Load, design, and system simulation phases are all done behind the scenes in the program. These results are dependent on the weather and the selected building type and are then passed on to the Equipment Simulation.

Equipment Simulation

The equipment loads, by system and by hour, are then provided to the equipment simulation phase, along with a description of the equipment to be used in the system.

The previously described weather information is also input into this phase. Regardless of whether the equipment has air-cooled or water-cooled condensing, the weather affects the overall part load efficiencies.

The essential function of the equipment phase is to translate equipment loads, by hour, into energy consumption by source. The loads are translated into kilowatt-hours of electricity, therms of gas, oil, district hot water or chilled water, even to the extent of calculating the total gallons of make-up water required by a cooling tower or the energy consumed by the crankcase heaters of a reciprocating compressor. The entry requirements of this phase consist only of the equipment types for heating and cooling as well as pumping heads and pump motor efficiency for each system where hydronic pumping is involved.

This data is utilized within the program to call for the equipment library, which is the performance information for the various pieces of equipment. This information is used to convert system loads into energy consumption for subsequent processing to the economic analysis phase.

It is important to note it is not necessary for the user to enter the part load performance of equipment accessories into the program. They are already contained in the equipment library and are accessed when called for by the user.

Economic Phase

The next and final major phase of the program is the economic analysis phase. This phase utilizes user entries, such as the utility rates and equipment installed cost data, along with other economic information such as mortgage life, cost of capital, etc., to compute annual owning and operating costs. It also calculates the various financial measurements of an investment such as cash flow effect, profit and loss effect, payout period and return on additional investment between alternatives.

In very simple terms, the program determines how much it costs to operate one plant compared with another. It then computes the present worth of the savings and the incremental return on the additional investment. It is keyed to provide information the owner needs to make his or her final economic decision, including monthly and yearly utility costs over the life of the HVAC system.