**Building Efficiency System Tool™ & The Importance of Transparency**

***Transparency****, as used in science, engineering, business, the humanities and in other social contexts, is operating in such a way that it is easy for others to see what actions are performed.*

**Overview:**

The HVAC industry continually discusses the importance of modeling HVAC systems early in the design process but offers mainly complex, data intense, or costly software programs to try and achieve that goal.

The Hydronic Industry Alliance – Commercial (HIA-C) recognized that there needed to be a better way to quickly and easily compare HVAC systems before a building was built or at least before a specific HVAC design type was decided upon. The comparisons also needed to take a holistic approach, looking at total system efficiency and relevant first and life-cycle cost information, so the design team could make appropriate decisions based on the goals of the building project.

ASHRAE 209 - Energy Simulation Aided Design for Buildings lays out the need for this type of process, the importance of doing it early in the building design, and even recommends Box Modeling. After years of testing and refinement the HIA-C has delivered for design teams and asset managers a user friendly, confidential, and comprehensive software tool named the Building Efficiency System Tool or BEST for short. It provides answers in minutes and is FREE for all to use!

BEST is NOT intended to replace comprehensive building energy modeling programs like EnergyPlus, for example. BEST is intended to be an early HVAC system comparison and budget tool based on comprehensive, project relevant inputs. It is built simple enough for anyone that can measure a building cube and select a city, yet powerful enough to allow up to **200 variable inputs per comparison**.

It’s these changeable inputs which are the basis of the program’s power and the HIA-C’s goal of transparency. To make the program easy to use by a non-HVAC engineer we worked with experts from across North America, including some of the leading brands of pumps, boilers, fan coils, geothermal equipment, piping, chillers, and much more. We added to this actual cost data supplied by over 50 mechanical contracting firms. We then spent years testing the program against actual installations, all to prove out and refine the defaults, assumptions and calculations the program is based on. All that knowledge provides a starting point but since almost all the inputs are changeable one can customize the inputs to match what is known, the characteristics of a particular piece of equipment being used, or a personal design preference.

The Hydronics Industry Alliance-Commercial is a non-profit alliance of hydronic equipment manufacturers and partners operating in North America. Operating under the principle that water is the most efficient and greenest energy transfer medium on the planet, the alliance serves as a resource within the HVAC and Service Water Heating industry. Our mission is to educate, integrate, and communicate the advantages of Hydronic System Solutions. We believe water is the best and most efficient way to heat and cool most commercial buildings. But only through complete transparency will others be able to trust the outputs of BEST and be able to see for themselves the benefits of hydronics.

**The following is a review of the changeable inputs in BEST:**

**Project Data:** This is optional and not required to run software. BEST is downloaded to your computer and any output is saved to your own computer or hard drive. Your data cannot be minded from the “cloud” or used for other marketing purposes.

**Weather Data** – Bin weather data from from the National Oceanic and Atmospheric Administration (NOAA) and is loaded based on your selection of city in the United States, Canada, or Mexico.

**Box Model (Building Size)** – You enter the dimensions of your building and number of stories. The majority of the costs and loads are based on per square foot entries totaled from the dimensions input. All systems are compared to the exact same building model.

**Energy Cost** – Utility rates for electricity and fossil fuels taken from the US Energy Information Administration (EIA) and can be changed when you know your actual rates.

**Load Defaults (Heat Loss / Heat Gain)**– These are all changeable. Review of over 1,000 buildings confirmed that there’re typical per square foot loads based on building type and location and can be widely variable in commercial buildings. BEST includes default (changeable) values for heating, cooling, ventilation, and envelope loads plus three options of how to enter the data.

**Life Cycle Cost –** Typical percentages are loaded for cost of money, maintenance cost inflation, energy cost inflation, and project life cycle. All are changeable by user. Input required for annual and life cycle cost analysis.

**User Preferences** – Go even deeper to define the default equipment efficiencies, single pipe / two pipe length ratio, maximum length of refrigerant piping, average pressure drops, temperature differentials for multiple system types, air source heat pump heating capacity ratio, interior heat gain recovery percentage, control system parameters for fan/pump/refrigerant head and flow, and the heating/cooling balance point. Each of these can be applied across all 4 compared systems or changed separately for each compared system.

**System Wizards –** Most people in HVAC cannot name 30 default systems for the entire building. Best includes the **Simple Building Types** and the **Advanced System** Wizards. Plus, the option to create systems by inputting all the data manually. Each individual System Report, up to 4 at a time, show all inputs and outputs, including:

**Heat source & cooling source** type, efficiency, and horsepower

**Distribution system** type and control for heating, cooling, and ventilation, even an option for economizer

**Terminal equipment,** interior and exterior per system type, including heat recovery

**Total annual energy cost** by fuel type and system HP in cooling and heating

**System BEER calculation**, cooling out (annual) / work in (annual) in watts for complete HVAC System selected.

**Life cycle cost** in dollars

**Additional color reports** compare the systems selected on a common report which can be printed or exported to Excel:

**Overview**: System summaries in color charts

**Energy Costs**: Breakdown of cost and efficiency per system

**Monthly Energy**: Each system’s cost or consumption per month broken out for heating and cooling.

**Life Cycle Cost**: comparison and simple payback calculation

**Cost Estimate Wizard –** HIA-C software team worked with over 50 contractors throughout North America. Best defaults to medium pricing and radio buttons allow simple increase or decrease against **first cost**, **maintenance cost**, and **replacement cost** per square foot. Or click on any input and change the per square foot cost based on your contractor’s quoted costs once known.

**Methodology Transparency**

All the calculations running in the program are detailed in BEST’s **Help File.** The Methodology tab shows the logic and formulas used, including:

**Energy Calculation (Bin Method)**

**Balance Temperature**

**Horsepower Calculations**

**Building Energy Efficiency Ratio (BEER)**

**Part Load**

**Equivalent Full Load Hours**

**Variable Speed Calculations**

**Summary**

**Why did HIA-C do this?** The majority of the HIA-C members do not sell complete systems or have products that have EER’s. Hydronic Systems have traditionally been seen as highly efficient but costly. Today’s technology is diverse and simple IEER comparison is only part of the cooling story and may address less than 25% of the total cost impact. HIA-C believes that when asset managers and design teams are given a tool to compare complete HVAC system choices for efficiency against costs which are based on their building, in their city, and meet their requirements is to our advantage. **An informed customer will make informed decisions.**

**Learn More**

[**www.BESThvac.org**](http://www.BESThvac.org) **for tutorial video’s and FREE download of BEST**

[**www.H2Oaccepted.org**](http://www.H2Oaccepted.org) **to learn more about the benefits of hydronic systems**

[**www.hia-c.org**](http://www.hia-c.org) **to learn more about the Hydronic Industry Alliance and to support our mission**