CLEARWATERBAY TECHNOLOGY, INC.
The Process Development Company

CLEARWATERBAY TECHNOLOGY

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ENERGY SOFTWARE — PINCH ANALYSIS

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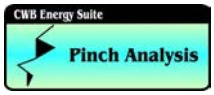
SPECIAL POINTS OF INTEREST:

- **Pinch Analysis Software**
- **Tech Tip: Thermocompressors**
- **Feedback on Process Development Course with ASME**
- **Upcoming Events**

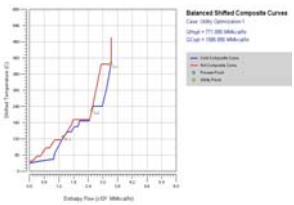
Last spring we unveiled two new softwares as part of our goal to improve existing and design for higher energy efficiency of processes — Total Site Energy Management and Pinch Analysis. Pinch Analysis was released late last year and is now available for licensing. This issue describes some of its features and functionalities.



Pinch Analysis is designed to improve the energy efficiency of individual process plants in a plant site (existing and new). At the heart of this software are the principles of Pinch Technology. However, it is not simply a targeting tool built upon academic research. It provides an intuitive workflow and a set of tools convenient for dealing with energy use in existing and new processes. This workflow is a result of several years of hands-on experience of practical applications in the chemical industry.

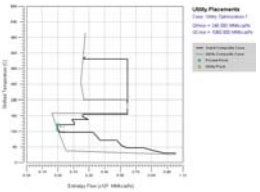
With this software, the user can create stream-based representations of process plants (or parts of process plants) on the site. User can then analyze and study these process plants through several case studies (as desired or required) in order to:

- Evaluate the inherent energy targets and understand/ compare existing energy usage
- Quantify energy penalties from current energy usage and identify offending heat exchangers
- Provide insights to generate ideas for improving existing energy usage:
  - ◊ Ideas for modifying offending heat exchange steps by removing and replacing heat exchangers
  - ◊ Ideas for modifying existing heat exchangers for improved heat recovery
  - ◊ Ideas for improved design of the process itself
- Optimize existing utility usage and evaluate usage of other utilities
- Quantify benefits of integrating one or more process units and penalties resulting from area integrity constraints



The software functionalities include the following *Targeting* and *Design* case studies:

1. Energy targets — Study composite and grand composite curves, and hot and cold energy targets
2. Utility placement and optimization
3. Range targeting — ΔTmin evaluation
4. FCp matrix— Suggest feasible matching streams at pinch temperature
5. Driving force profiles
6. Remaining Problem Analysis— visualize heat exchanger operation and the cross-pinch energy transfers



Total Site Energy Management and Pinch Analysis address the two important problems that comprise the Total Site Analysis. There are great benefits to be had through the integrated use of these two software tools as, among others, the user can study:

◊ The interaction between the supply and demand of steam

◊ The optimum selection of the site-wide and local steam header levels

◊ The impact of plant capacity on the total site utility consumptions

CWBTech is very grateful to all our customers for their thoughtful feedback. All comments and suggestions from the user-perspective have enabled us to create and improve our software tools and provide you with the best technology solutions.

Some of the important highlights of the software are:

⇒ Intuitive & Hierarchical Organization

⇒ Flexibility & Focus on Insights — the software allows user to create stream-based representations of multiple process plants in any workspace

⇒ Handling Constant Temperature Enthalpy Changes — user can input data for streams that represent constant temperature enthalpy changes without any artificial modification to the supply or target temperatures

⇒ Water & Steam Properties — the software provides direct access to the thermodynamic properties of water and steam. The parameters and methods for calculating these properties are based on the IAPWS Industrial Formulation 1997 of the ASME steam tables (IAPWS-IF97).

To learn more about TOTAL SITE / PINCH ANALYSIS software tools please contact us at sales@cwbtech.com.

TECH TIP: ENERGY SAVINGS WITH STEAM THERMOCOMPRESSORS

Jet Compressors are used to circulate steam, boost low-pressure steam, and to mix, transfer, and compress gases. A jet compressor is a type of ejector which utilizes a jet of high-pressure gas as an operating medium to entrain a low-pressure gas, mix the two, and discharge at an intermediate pressure. Gases can be steam, air, or others. When both motive and suction gases are steam, the compressor is generally referred to as a "thermocompressor". Thermocompressors can be used to recover or upgrade energy from low pressure steam by blending with higher pressure steam. Investment in a thermocompressor can often improve the energy efficiency in a chemical plant.

The unit consist of three basic parts, namely: a nozzle, a body, and a diffuser. High-pressure steam, enters the compressor and flows through the nozzle to get converted into a high velocity jet stream, creating a suction and entrainment of the low-pressure steam. The motive and suction steam are then mixed in the body. The diffuser helps attain desired discharge pressure .

The suction ratio (high to low pressure steam coming in), is very important in determining energy savings. The lower the number (i.e. lesser high pressure steam than low pressure steam) higher the savings.

Consider the following example in a process X where the utilities used are: 30K/G (Tsat=235°C), 13K/G (Tsat=194°C), and 3K/G (Tsat=144°C) levels of steam. Two of the reboilers in the process use 30K/G steam since temperature of reboiler A is 194°C and of reboiler B is 196°C. Consider that there is no other process heat available to provide these reboilers, the following process modification options can be considered to achieve energy savings. Note that all the options below require an additional area investment:

- Check the feed, distillate and bottoms temperatures. It may be possible to provide low-grade pre-heat and reduce reboiler steam usage. However, it is important to consider any changes in separation that result, which can be studied using a simulation.
- Check the column temperature profile and consider addition of a side-reboiler at an appropriate stage and temperature (lower than reboiler level) if suitable
- Another option is to create a middle-level utility more hot than 194°C (13K/G) but cooler than 235°C (30K/G) that can supply to reboilers A and B. For example, a new utility 15K/G (Tsat=201°C) can be blended from 30K/G and 13K/G in a ratio of 1:1.1 respectively. It can reduce 30K/G steam usage to give potential energy savings. In addition to new area, thermocompressor investment cost should also be considered when calculating the payback period.

To find out whether or not a jet compressor will provide desired performance and the size required to meet requirements, various vendors provide charts for a desired suction ratio as well as sizing charts based on steam levels to be blended. The design and material of the equipment can be catered to suit the desired performance for any given system.

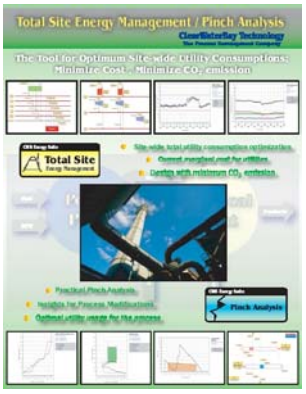
ASME COURSE: PROCESS DEVELOPMENT

CWB Tech in conjunction with ASME conducted a training course in Atlanta, GA on Dec. 10-11, 2009. The topic: Multi-disciplinary Process Development: From Lab to Plant. The course provides an overview of process development starting from the time a process chemistry is invented in the lab to the development of a commercial scale process. This course will be offered again in **Orlando, FL on Dec. 2-3, 2010**. For details or to register, click here: http://catalog.asme.org/Education/ShortCourse/MULTIDISCIPLINARY_PROCESS.cfm

UPCOMING TRAINING COURSES/EVENTS

Date	Venue	Title	Registration
June 27-30, 2010	Lake Ozark, MO, USA	2010 Process Development Symposium (PDS) - **Energy Challenges for Process Development** (desktop display of our software products)	http://www.aiche.org/conferences/Specialty/ProcessDevelopment2010.aspx
Sept. 2, 2010	Prague, Czech Republic	19th International Congress of Chemical and Process Engineering CHISA 2010: "***Workflow for Product Design and Development***" (training course)	http://www.chisa.cz/2010/ScientificProgram.aspx#course
Dec. 2-3, 2010	Orlando, FL, USA	ASME Course CH757: "***Multi-disciplinary Process Development: From Lab to Plant***" (training course)	http://catalog.asme.org/Education/ShortCourse/MULTIDISCIPLINARY_PROCESS.cfm

For detailed information on our upcoming training courses, contact us at shortcourse@cwbtech.com, or Hideo Iketani of I.T. Solutions at iketani@its-ykh.co.jp



Feedback for Process Development Course with ASME

"The course material provides an intelligent approach to help solve even the most complex design problems"

"Very detailed and targeted information that is valuable for value-added knowledge building in process development"

"This is the most systematic approach to R&D process development I have seen"

"Content and relevance was excellent"

"Learning new methodologies for process development was very informative"

CLEARWATERBAY TECHNOLOGY

4000 W. Valley Blvd., Suite 100
Pomona, CA 91789, USA
Phone: +1 (909) 595 8928
Fax: +1 (909) 595 6899
Email: info@cwbtech.com
Web: www.cwbtech.com

Japan Contact:
Hideo Iketani, I.T. Solutions
Phone: +81 45 574 2312
Fax: +81 45 575 2324
Email: iketani@its-ykh.co.jp