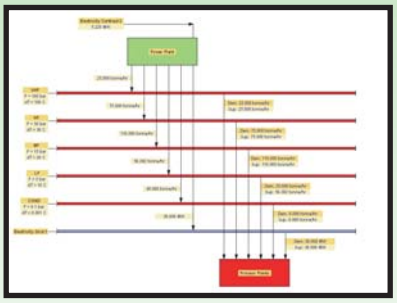
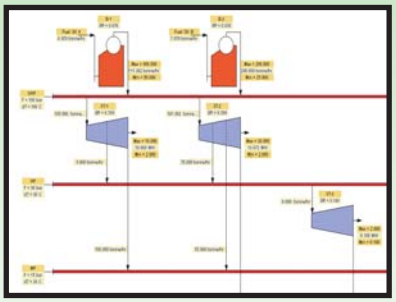
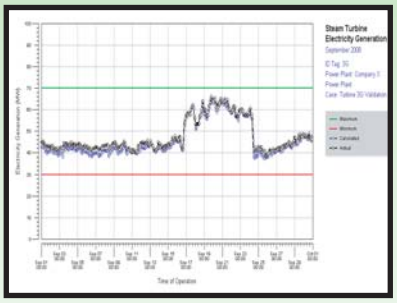
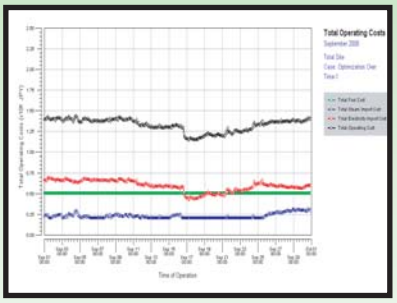
Total Site Energy Management / Pinch Analysis

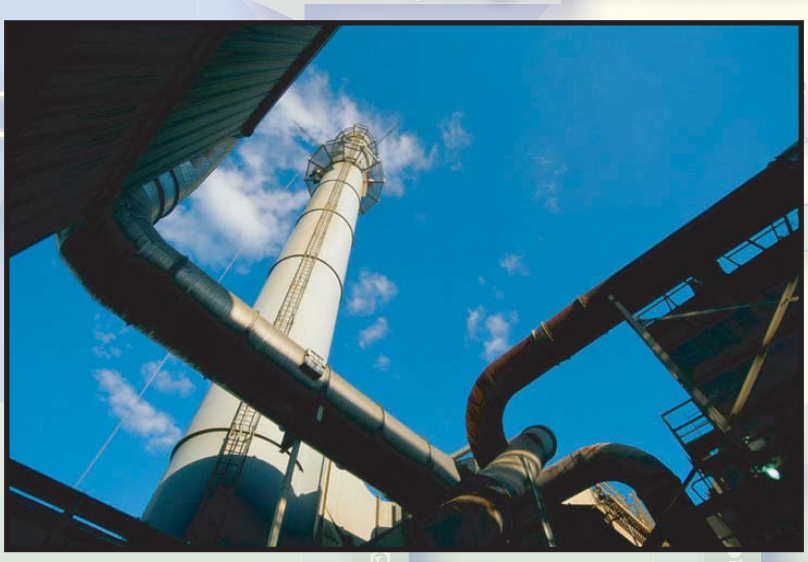
ClearWaterBay Technology
The Process Development Company

The Tool for Optimum Site-wide Utility Consumptions: Minimize Cost , Minimize CO_2 emission

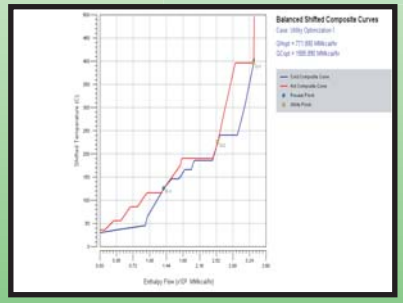
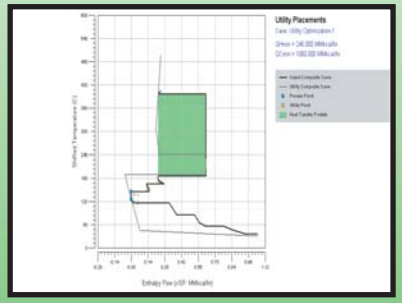
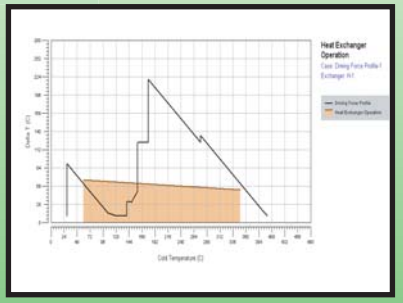
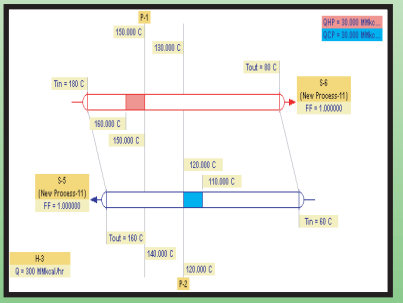
CWB Energy Suite
Total Site
Energy Management

- Site-wide total utility consumption optimization
- Correct marginal cost for utilities
- Design with minimum CO_2 emission



- Practical Pinch Analysis
- Insights for Process Modifications
- Optimal utility usage for the process

CWB Energy Suite
Pinch Analysis

Introduction

Pinch Analysis and **Total Site Energy Management** are CWB Tech's state-of-the-art software and workflow solutions for handling the site-wide energy usage and CO_2 emission issues of any processing complex. Total Site Energy Management and Pinch Analysis together address the two important problems that comprise the **Total Site Analysis.**

Pinch Analysis

The Pinch Analysis software is based on the well-established concepts of Pinch Technology, developed by Prof. Bodo Linnhoff and his co-workers from the mid-1980's, combined with the practical considerations and years of process development experience accumulated within CWB Tech. It is designed to deal with the problem of improving the energy efficiency of individual process plants in a plant site. With Pinch Analysis the user can:

- Evaluate the inherent energy targets and understand existing energy usage
- Identify the cross-pinch exchangers and evaluate the cross-pinch duties
- Select the optimum levels of utility for the process
- Help in generating ideas for process modifications for more efficient energy use

The software includes the fundamental features for Pinch Technology such as: calculation of energy targets, composite and grand composite curves, utility placements and optimization. The software, in addition, provides the following special features that further help users to practice the technology.

Pinch Analysis - Data Handling

Area Integrity

The software allows the users to separate the stream data for a given process into several parts and then use the pinch analysis tools on various combinations of the parts. In doing so, engineers can consider the potential energy penalty in considering practical process constraints due to plant layout or freedom on operation.

Constant Temperature Phase Changes

The software allows the users to input the phase changes at the same temperature without any artificial modification on the target temperature of the phase changing stream to denote vaporization or condensation. The same is applicable for representing reactor heat available. By doing so, engineers can obtain accurate results for their processes in cases where these changes occur in the vicinity of the pinch temperatures.

Pinch Analysis - Water and Steam Properties*

The software provides direct access to thermodynamic properties of water and steam. These properties are retrieved by specifying the appropriate saturation pressure or temperature. The user needs to specify the steam pressure and degree of superheating for steam usage, while for the steam generation the user can specify boiler feed water supply temperature, pressure and degree of superheating (or final temperature).

Pinch Analysis - Range Targeting

How is a certain ΔTmin (and hence heat exchanger area requirement) determined for a process? The software uses the Range Targeting functionality to assess the potential for change in target with respect to ΔTmin . Range targeting (and supertargeting) can help select the optimum ΔTmin for designing a given heat exchanger network such that we can avoid the topology traps. In the software, engineers can also evaluate how utility placements, usage and costs change with ΔTmin perform the range targeting based upon single or multiple utility considerations.

Pinch Analysis - Cp Matrix and Driving Force Analysis

While designing a heat exchanger network, selection of "Pinch matches" is critical. This tool enables the users to select these matches by providing a list of feasible matches for a given stream (if any), without violating the ΔTmin. The Driving Force plot is the other tool that is useful to users to determine optimum usage of available driving forces. It plots the driving force available between hot and cold composite curves as a function of the hot or cold composite curve temperatures and also shows the driving force profiles for the specified existing heat exchangers.

Pinch Analysis - Remaining Problem Analysis

Remaining Problem Analysis is a tool that assists in improving the heat recovery of an existing process. This function analyzes the existing heat exchangers and identifies the degree of cross-pinch heat transfer. Identifying such an exchange can help lower the utility usage due to energy integration. This function can identify critical improvements in the process.

Total Site Energy Management

On the other hand, Total Site Energy Management is a software package focused on solving the site-wide issues of a chemical processing site and is designed to deal with the problem of how best to supply the steam and electricity needs of an entire plant site. This software helps engineers in optimizing the cost and in reducing the CO_2 emissions via better usage of the invested infrastructure. It also helps in identifying the limitations of the existing infrastructure due to machine ageing, mismatch of supply and demand, and other such energy-related practical applications. With this tool you can:

- Analyze past performance and effectiveness of energy use in the site
- Minimize wasteful use of energy and maximize site-wide profitability of current operation
- Make planning and business decisions to maintain profitable operation in the future

Pinch Analysis and many other process improvement technologies focus on the improvement of processes to reduce utility demands. However, when considering any given site, it is critical to consider the balance between the supply and demand. Total Site Energy Analysis (TSEM) is our state-of-the-art software for handling this supply and demand optimization. It provides an environment that enables the user to simulate, validate, and optimize the energy flows (fuels, steam at various levels, and electricity) in the plant site.

Total Site Energy Management - Analysis Tools

The analysis tools are used to create and analyze models for the power plant unit operations (such as boilers, steam turbines, gas turbines, and steam generators) based on historical data. The analysis tools also provide direct access to thermodynamic properties of water and steam. *Calculations of thermodynamic properties of water and steam are based on the IAPWS Industrial Formulation 1997 of the ASME steam tables (IAPWS-IF97).

Total Site Energy Management - Simulation Tools

The simulation tools are used to simulate the performance of individual power plant unit operations, of individual power plants, and of the entire site. These simulations provide insights into efficiencies of operation and can be used to identify and evaluate general improvements to the current operation. This functionality can analyze a site with single or multiple power plants. In addition, they can also be used to evaluate and compare the operating costs of several "What-If?" scenarios that help make future planning decisions.

Total Site Energy Management - Optimization Tools

The optimization tools can be used to optimize the energy (steam and power) flows through the entire site at any instant of time or over a period of time based on the operating capacities of the process plants and the operating constraints of the power plants. They can also be used to quantify the operating cost savings that can be obtained from the current operation of the site, and to evaluate operating cost savings from additional capital investment and the associated trade-offs. These tools also calculate the marginal ("true") costs of utilities (all levels of steam and electricity). Marginal costs can then be used to make decisions such as whether or not to buy electricity and at what price the electricity contract is attractive. The optimization tools also provide the ability to evaluate how sensitive the optimal operation and the optimal operation costs are to changes in demands of various levels of steam and electricity.

Summary

There are also great benefits through the integrated use of these two 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

Total Site Energy Management gives the user an understanding of the energy (steam and power) flows through the plant site. It also gives the user powerful tools to manage the plant site fuel and power consumption. With such a tool, the planning and business decisions for maintaining profitable operation of a plant site become easy.

Pinch Analysis enables the user to deal with the problem of improving the energy efficiency of individual process plants in a plant site, and to select the optimum levels of utility for the process.

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