The application of lean energy analysis to energy efficiency improvement in the pharmaceutical industry

ETSAP meeting, June 2010, Stockholm

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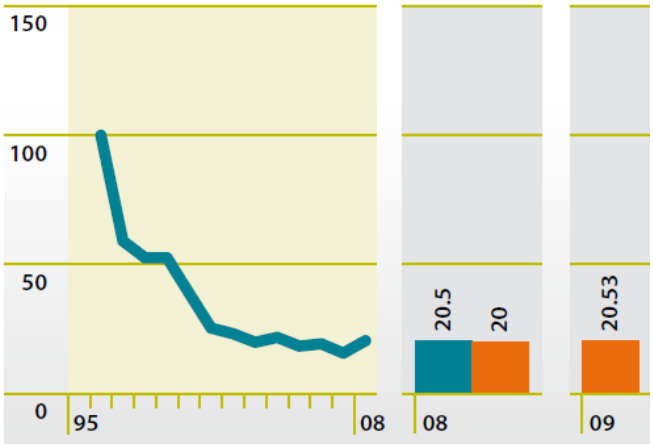
Background

- Lean Energy Analysis (LEA)
  - Any energy that isn't used directly in production or environmental conditioning is waste
  - Regression analysis
  - Quantify baseload
- Energy Management Systems (EnMS)
  - Systematic approach to energy performance approach (data driven)
  - Continuous improvement
  - EN 16001: 2009 (Swedish chair)
  - ISO 50001:2011(?), currently DIS stage

Case Study Plant

- Active pharmaceutical ingredient (API) manufacturing facility
- In production since 1994
- Major emphasis on designing in energy efficiency from the start of each project phase
- Continuous energy performance improvement since 1994
- Numerous corporate, national and international energy management awards
- Challenging plant to attempt further energy performance improvement
- Highly regulated industry making process change critical
- Little academic research in this low energy intensity sector

Energy Performance Improvement



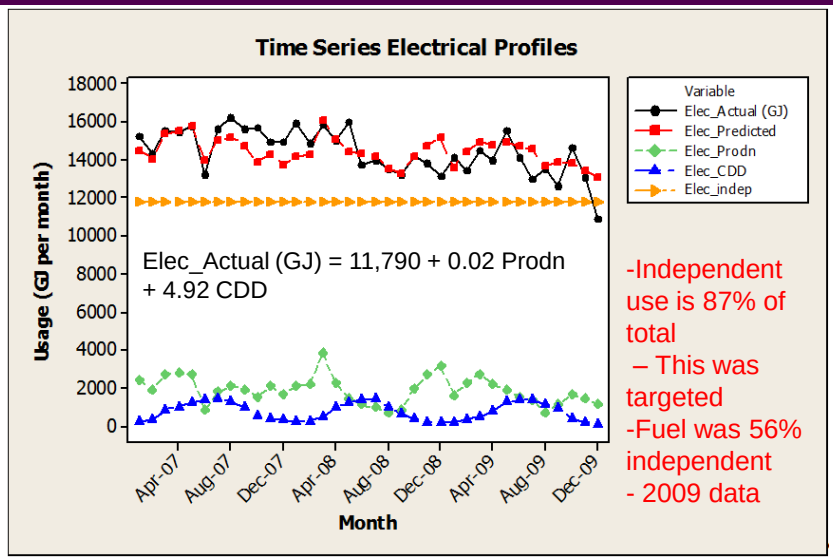
Energy use per unit of production in 2008 was 20% of 1995 value

Source: SEAI LIEN 2008 Report

8 step methodology

1. Analyse energy use and drivers including LEA
2. Identify significant energy users (SEUs)
3. Model SEU energy flows
4. Analyse SEUs against their drivers
5. Use LEA on SEUs
6. Identify causes of waste
7. Rectify causes
8. Implement means to rapidly identify future deviations

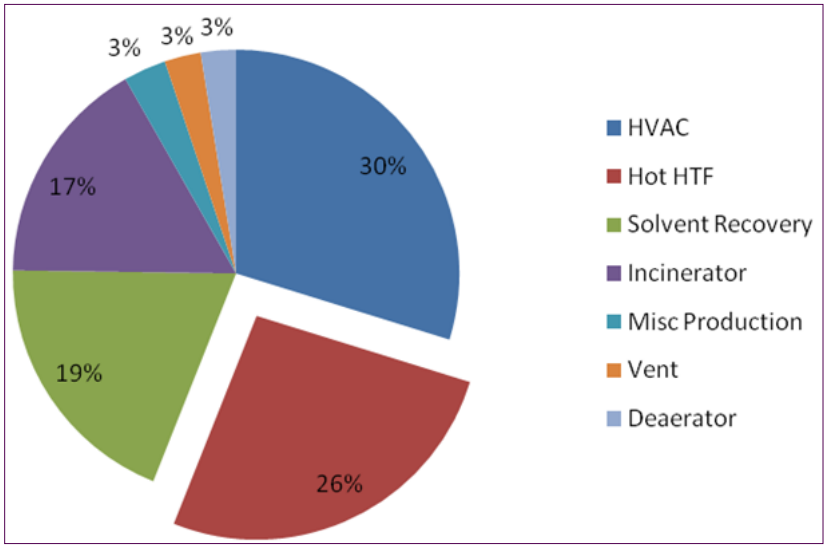
Plant electrical baseload



-Independent use is 87% of total – This was targeted

-Fuel was 56% independent - 2009 data

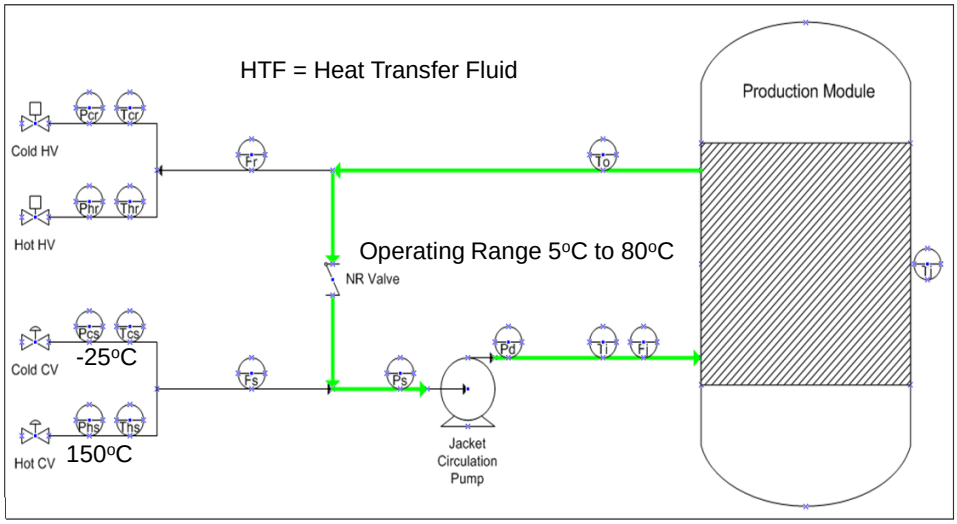
Identify significant users - Steam



Process heating and cooling

- 21% of total purchased energy use in 2009
- Excellent process and energy database
- Analysed the largest of 5 systems
  - 31 user modules
- Currently verifying on next largest system
- No correlation of use to production activity
- Identification of "real" driver
  - Positions of heating and cooling Control Valves (CVs)

Process description - HTF



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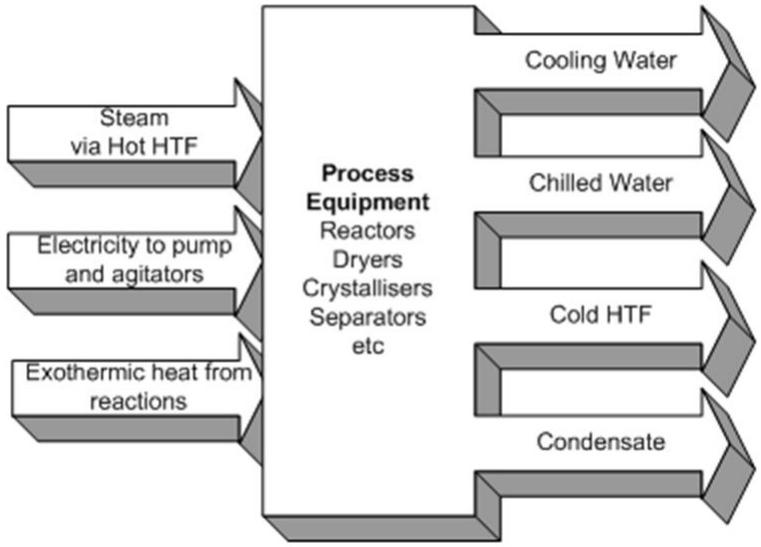
Building thermal balance



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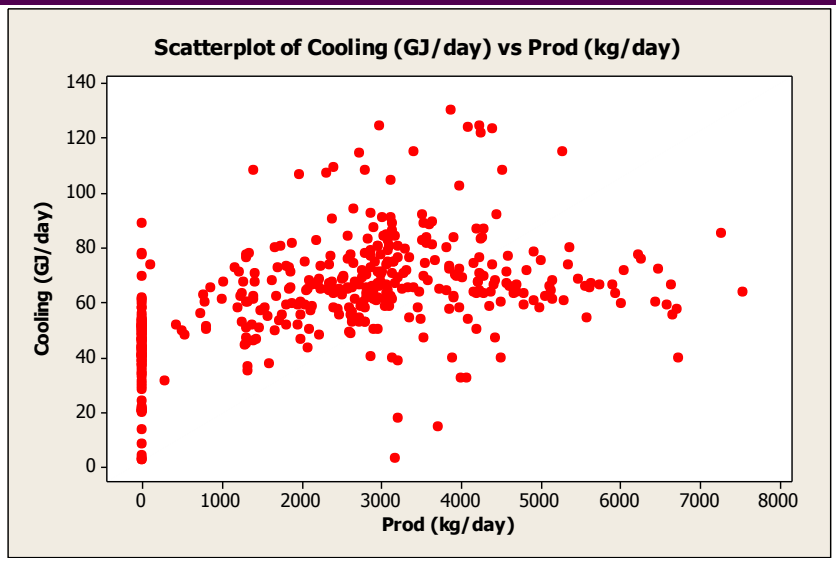
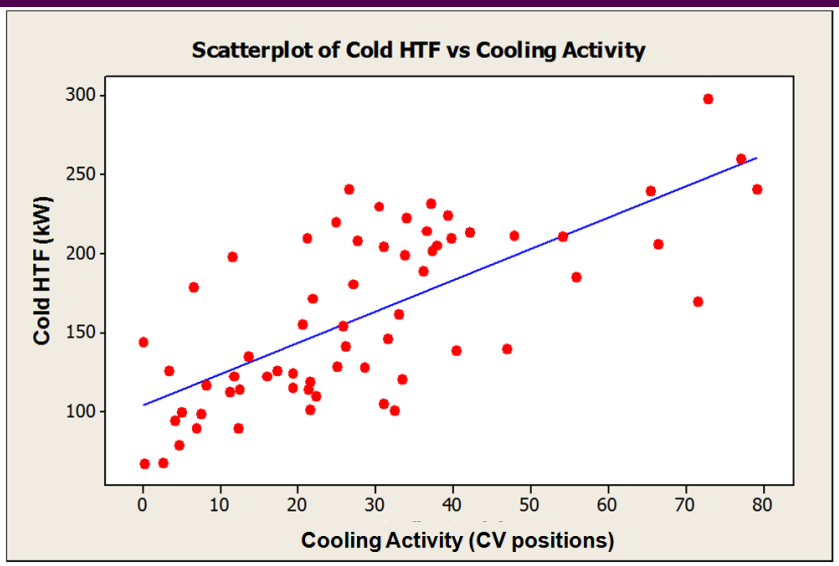
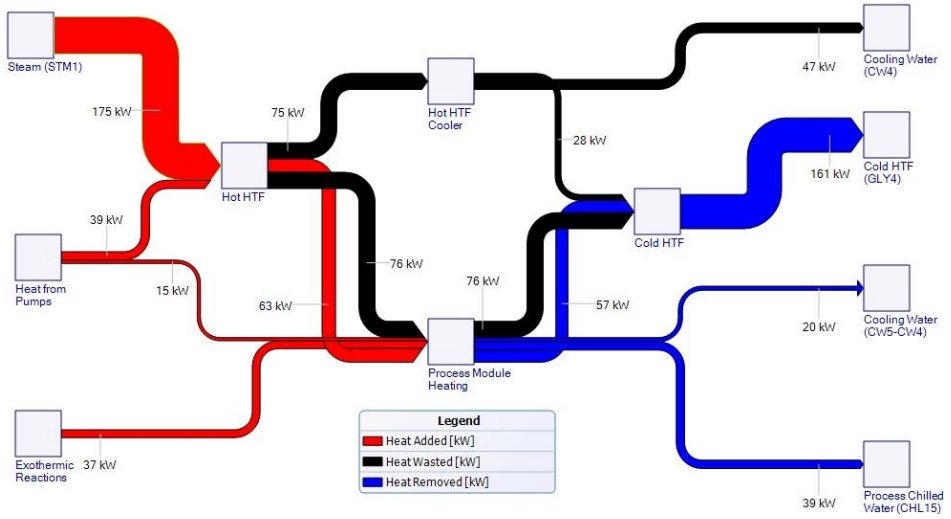
Cooling v Production



Cooling load (kW) v Cooling activity



Energy Balance



Conclusions

- The traditionally accepted high baseload energy use in this industry can be challenged
- There appears to be a significant opportunity to reduce energy use even in this high performing facility
- Next step is to implement identified opportunity and verify optimum process conditions
- Further work on automated deviation reporting
- Replicable in pharmaceutical and bulk chemical industries

Thank you