



# Energy Efficient Products and Production



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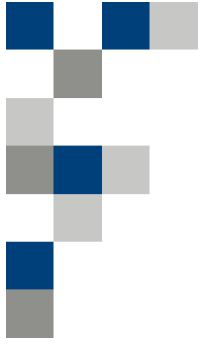


# Energy Efficiency - Definition

- Energy efficiency improvements refer to a reduction in the energy used for a given service (heating, lighting, etc.) or level of activity. The reduction in the energy consumption is usually associated with technological changes, but not always since it can also result from better organisation and management or improved economic conditions in the sector ("non-technical factors"). (World Energy Council)

[http://www.worldenergy.org/publications/energy\\_efficiency\\_policies\\_around\\_the\\_world\\_review\\_and\\_evaluation/1\\_introduction/1175.asp](http://www.worldenergy.org/publications/energy_efficiency_policies_around_the_world_review_and_evaluation/1_introduction/1175.asp)

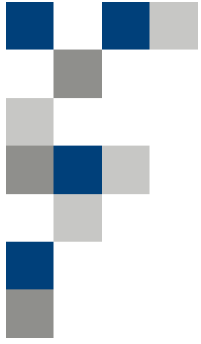




# Energy Efficiency – more definitions

- [http://www.google.fi/search?hl=fi&rlz=1R2SUNA\\_enFI328&defl=en&q=define:Energy+efficiency+&ei=p0sIspOeJJSV-gbGsvDdBg&sa=X&oi=glossary\\_definition&ct=title](http://www.google.fi/search?hl=fi&rlz=1R2SUNA_enFI328&defl=en&q=define:Energy+efficiency+&ei=p0sIspOeJJSV-gbGsvDdBg&sa=X&oi=glossary_definition&ct=title)





# Energy efficient products

- <http://www.buyenergyefficient.org/>
- <http://www1.eere.energy.gov/femp/procurement/>





# Energy efficient production

- <http://www1.eere.energy.gov/industry/forecast/>

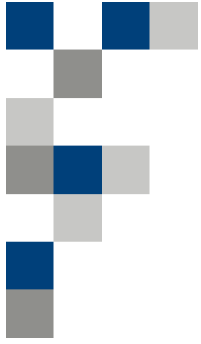




# Energy savings 1

- Decrease in specific energy consumption
- Using the most efficient technology
- Improved co-ordination





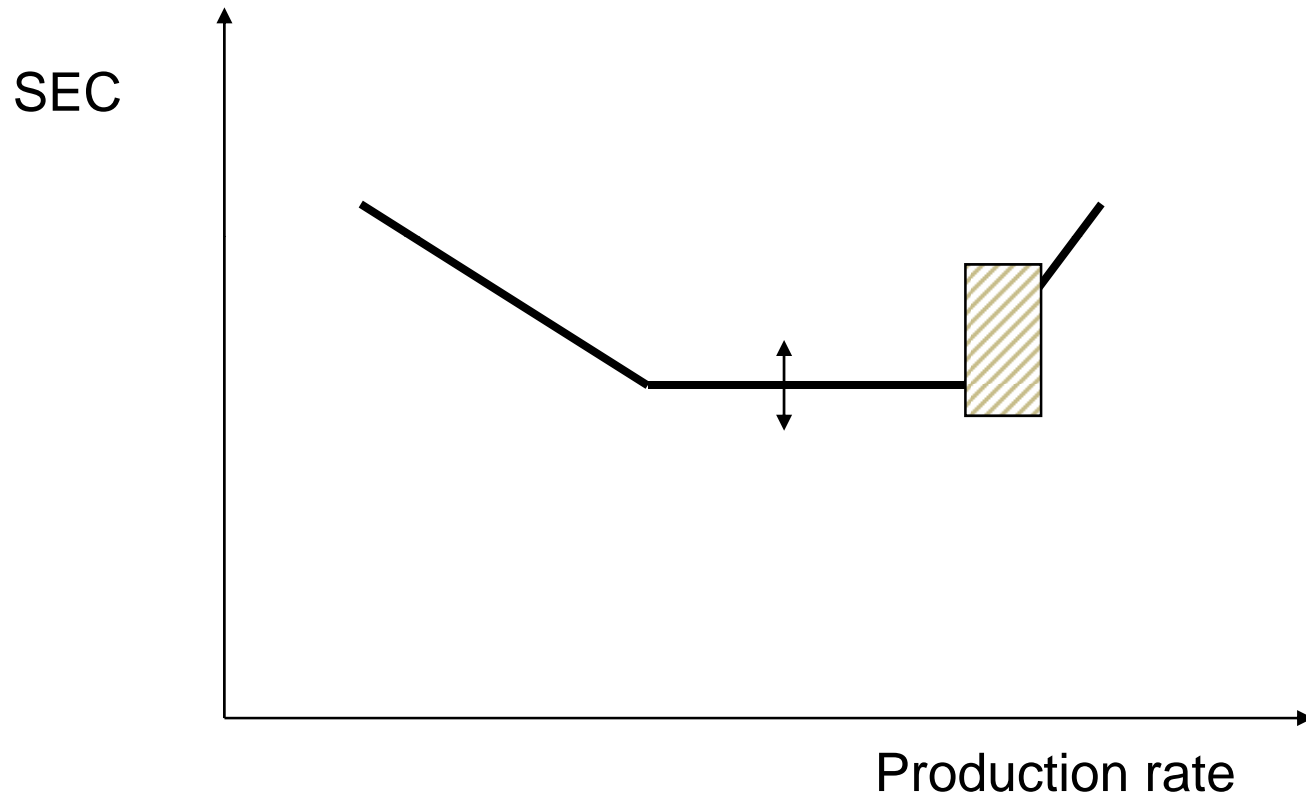
# Energy savings 1

- Decrease in specific energy consumption
  - Control based on energy balance
  - Finding and keeping the optimum operation point
  - Decreasing energy losses
  - Maximising the use of the cheapest fuel





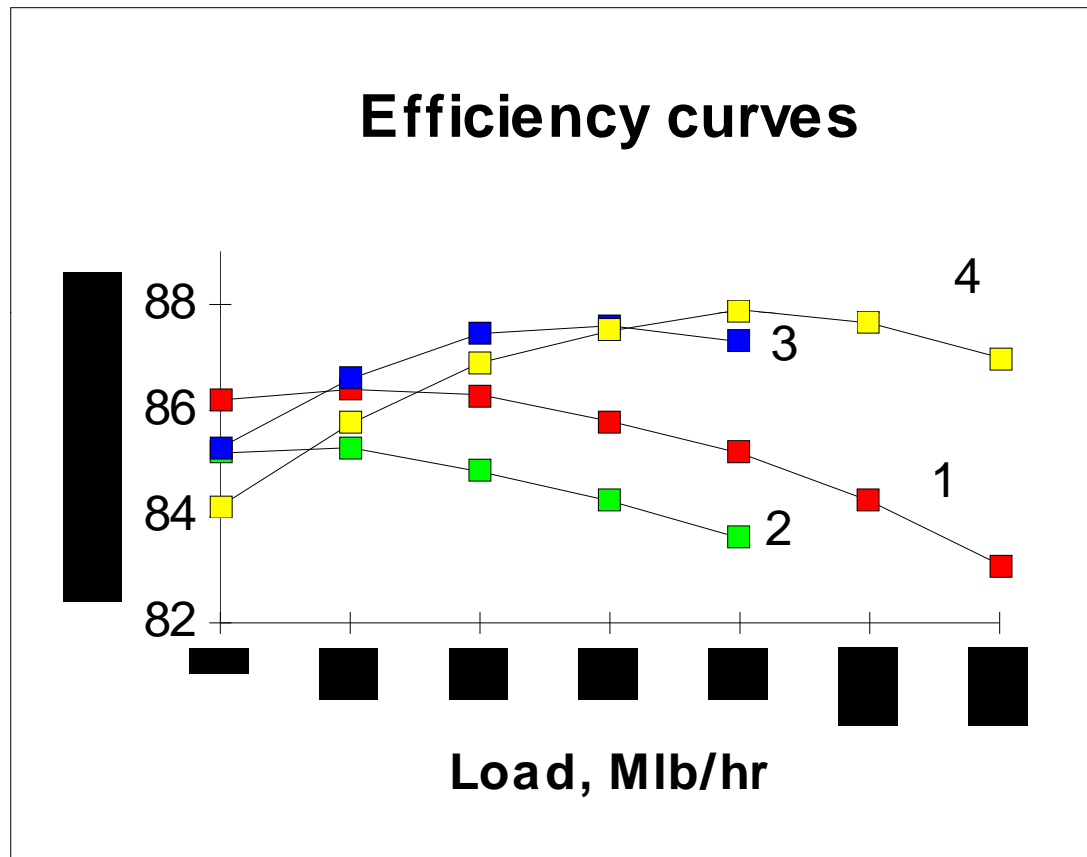
# "Bath tube" curve





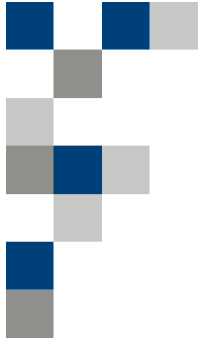


# Boiler load allocation



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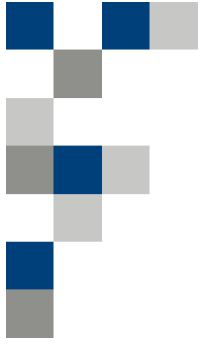




## Energy savings 2

- Using the most efficient technology
  - Machinery
  - Control
  - Static optimisation

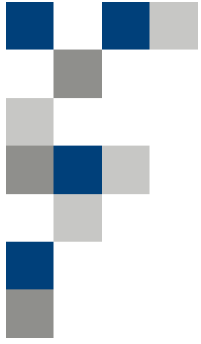




# Pulp digester selection

[http://www.sesec.org/pdf/4/SESEC4\\_Fellegi.pdf](http://www.sesec.org/pdf/4/SESEC4_Fellegi.pdf)





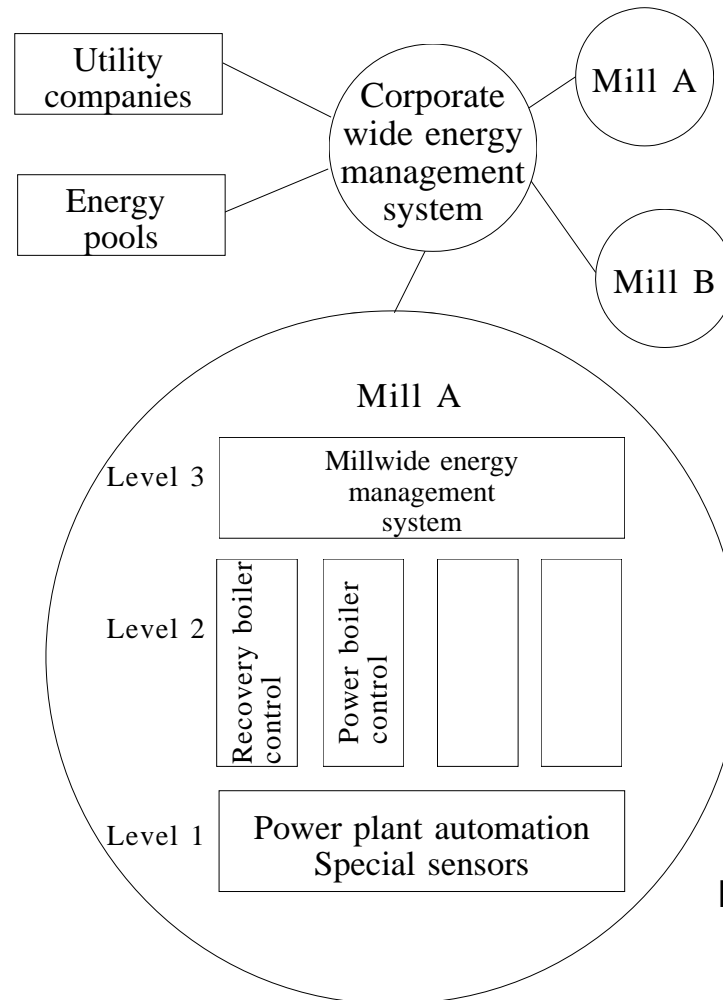
## Energy savings 3

- Improved co-ordination
  - Information systems
  - Production control
  - Energy management systems
    - Power plant optimisation
    - Energy levelling and compensation of disturbances
    - Optimisation in bought energy





# Energy management system

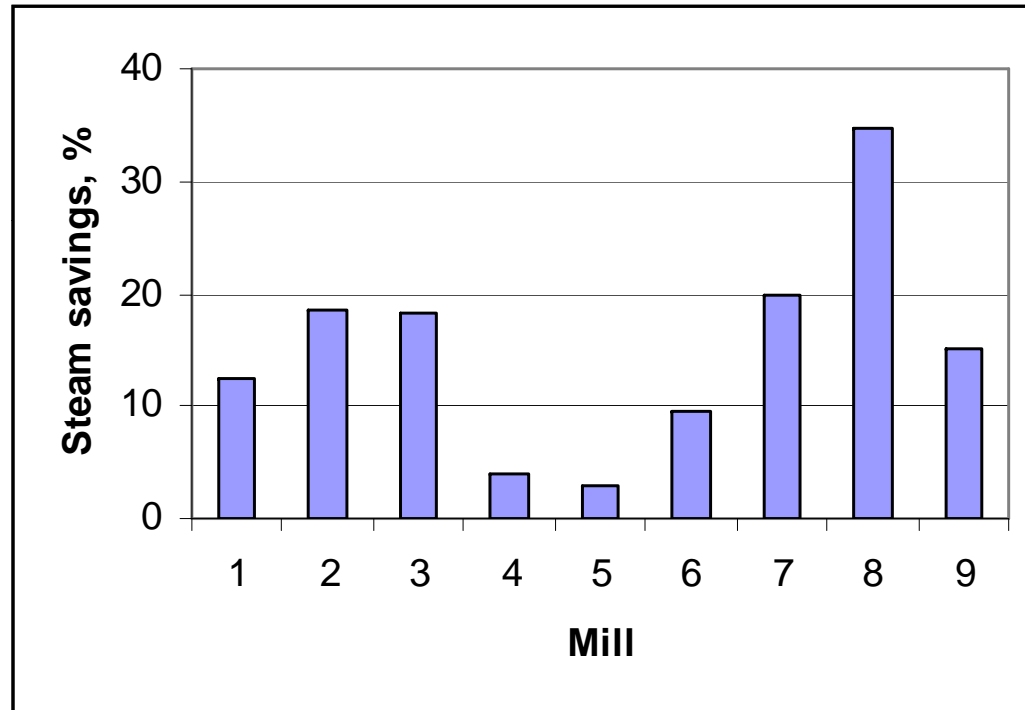


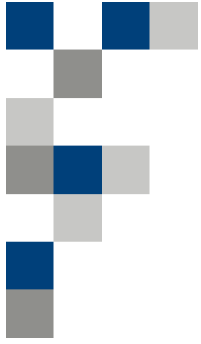
Leiviskä, 1999



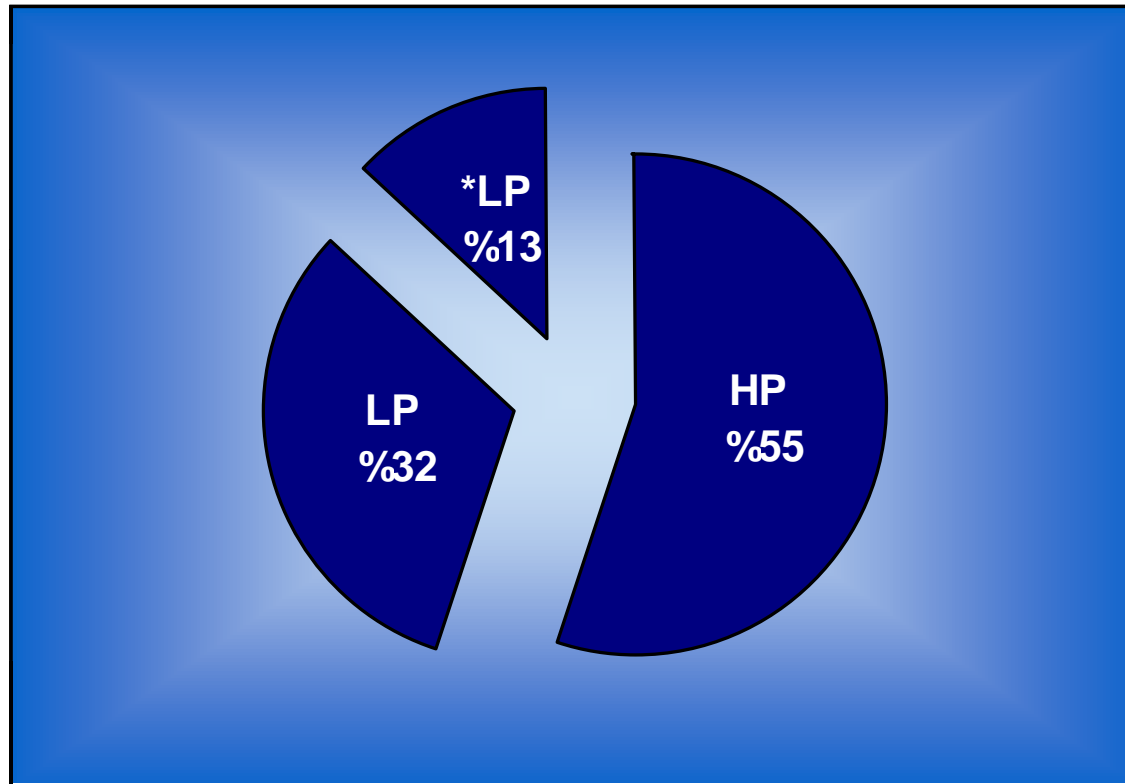


# Pulp digester control 1





# Pulp digester control 2





# Summary

- There are many definitions for energy efficiency, but mainly it is understood as using less energy for the same activity (SEC)
- Energy savings come from better design and control, from choosing more efficient machinery and from better co-ordinating and organising activities

