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# Energy Management in Ireland

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NSAI – Technical Services Manager

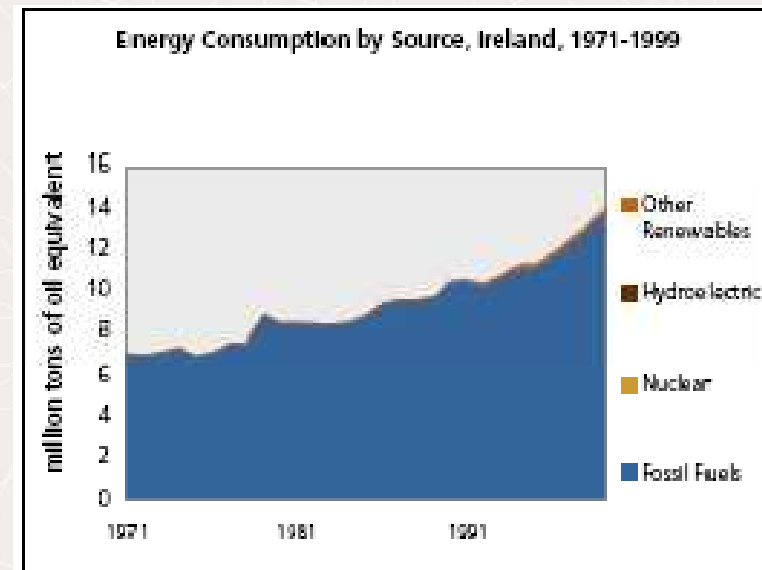
# Time-line



- **2002:**
  - Sustainable Energy Ireland (SEI) established.
  - Agency formed from Enterprise Ireland
- **2005:** Publication on I.S. 393
  - Joint publication between NSAI and SEI
- **2007:**
  - INAB accredit NSAI to I.S. 393
  - December – 1<sup>st</sup> registration
    - Roadstone Dublin
- **2009:**
  - Publication of EN 16001
  - 15 registrations to I.S. 393
  - 30<sup>th</sup> Sept. – INAB accredit NSAI to EN 16001

# Ireland's Profile

- 79% of energy imported
- 98% fossil fuel
  - Coal
  - Oil
  - Peat
  - Gas
- Energy Saving Motivation
  - National Security
  - National Competitiveness
  - CO2 management
  - EU programmes
  - Impact of individuals





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# Sustainable Energy Ireland (SEI)

# SEI Mission

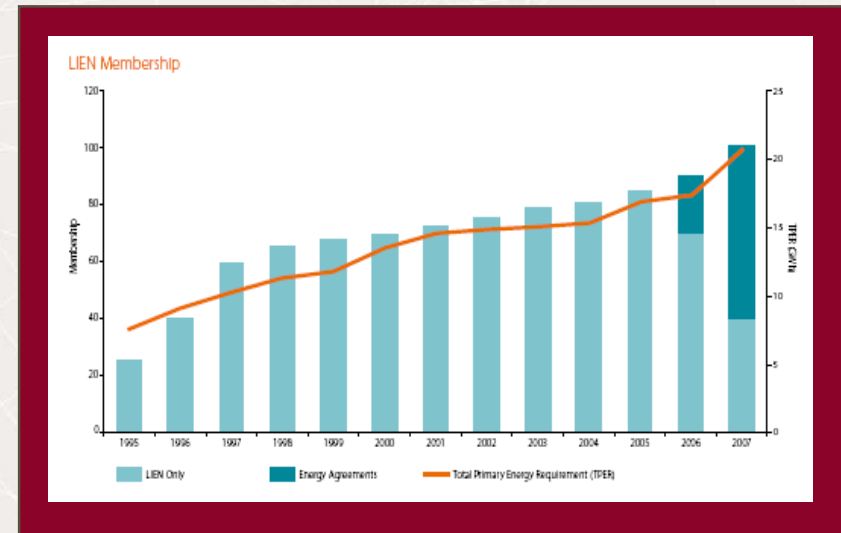
- **To promote and assist the development of sustainable energy in Ireland.**
  - This includes implementing significant aspects of the Energy White Paper: "*Delivering a Sustainable Energy Future for Ireland*" and the National Climate Change Strategy (2007-2012) as provided for in the National Development Plan (2007-2013) such as:
- **improving energy efficiency**
- **advancing the development and competitive deployment of renewable sources of energy and combined heat and power**
- **reducing the environmental impact of energy production and use, particularly in respect of greenhouse gas emissions.**

# SEI other responsibilities

- **advising Government on policies and measures on sustainable energy;**
- **implementing programmes agreed by Government;**
- **stimulating sustainable energy policies and actions by public bodies, the business sector, local communities and individual consumers**

# SEI Initiatives

- Large Industry Energy Network
  - Energy Map
- Buildings Regulations Compliance
  - Building Energy Rating (BER)
- Energy Awards
- Awareness and Education
  - Schools projects
  - "Power of One"
  - Training of assessors



# Grants

- Greener homes
- Warner homes
- Home insulation
- Commercial Grants
  - Renewable Energy
  - CHP
- R&D Grants
- Support for Energy Efficiency Exemplar Projects



# LIEN Energy Agreement

- Members must:
  - **develop a management programme for energy use (Energy MAP)**
  - **set and review energy targets**
  - **undertake an annual energy audit**
  - **produce an annual statement-of-energy account.**

# Energy Map

- **Commit**

- Senior management commitment
- Appoint senior manager to Energy MAP
- Appoint Energy MAP coordinator
- Establish an Energy MAP team
- Establish and Energy MAP Policy

- **Identify**

- Overview of total energy consumption
- Survey energy use and identify significant energy users
- Identify key factors that influence energy consumption and energy performance indicators
- Identify energy saving opportunities

- **Plan**

- Set objectives and targets
- Establish Programme
- Formerly allocate resources

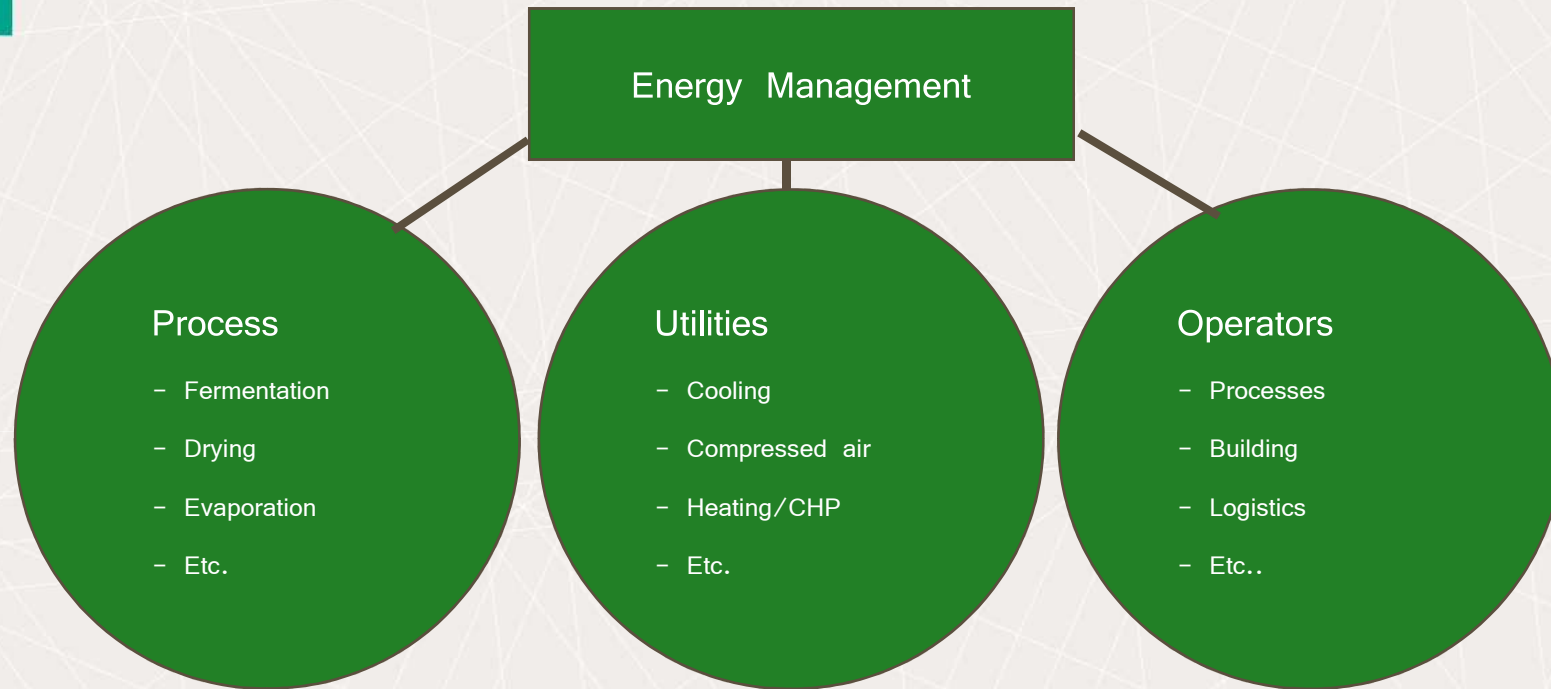
- **Action**

- Implement plan
- Promote energy awareness and good practice
- Train key employees
- Operate efficiently

- **Review**

- Continuously measure and monitor
- Identify Corrective and Preventive actions
- Periodically review Energy MAP
- Management Review of Energy MAP

# Persons influencing Energy Consumption

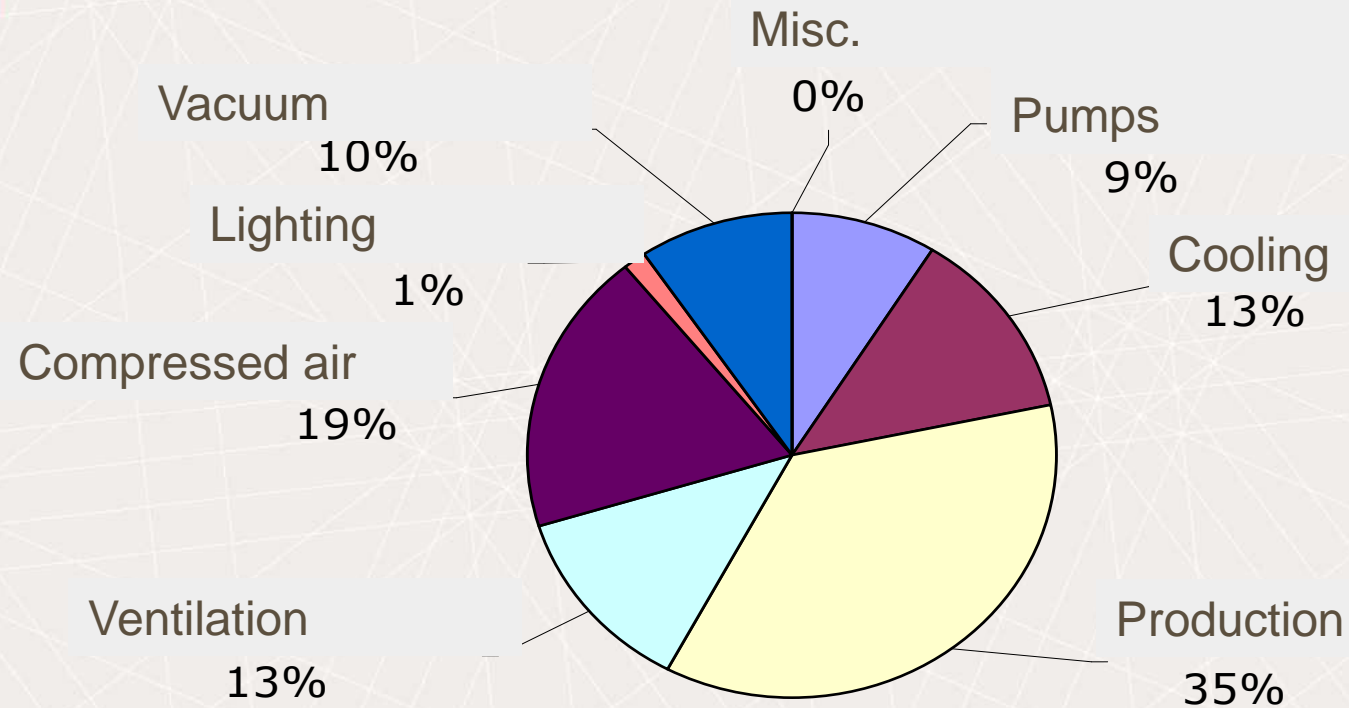


Process Engineers/chemists have the capabilities and responsibilities to change important process parameters

Mechanical engineers/technicians have the capabilities to maintain and optimize the operation of utility systems

Operators have the responsibility of operating processes and utility systems during daily operation

# The Next step: Mapping by End-user



Separate mappings for electricity and thermal energy use should be presented – if relevant also for water

# End-users

Thermal end-users (steam, hot water ..)	Electrical end-users	Water end-users
<ul style="list-style-type: none"> <li>- drying</li> <li>- process heating</li> <li>- evaporator lines</li> <li>- boiling</li> <li>- distilling</li> <li>- kilns &amp; furnaces</li> <li>- building heating/HVAC</li> <li>- CIP/SIP</li> <li>- water heating</li> <li>- conversion losses</li> <li>- distribution losses</li> <li>- etc.</li> </ul>	<ul style="list-style-type: none"> <li>- refrigeration</li> <li>- natural cooling</li> <li>- compressed air</li> <li>- process air</li> <li>- fans/HVAC</li> <li>- air-conditioning</li> <li>- production machinery</li> <li>- pumps</li> <li>- hydraulics</li> <li>- small motors</li> <li>- lighting</li> <li>- etc.</li> </ul>	<ul style="list-style-type: none"> <li>- process (additives)</li> <li>- steam injection (heating)</li> <li>- water for injection (WFI)</li> <li>- RO-plants</li> <li>- humidification of air</li> <li>- cleaning of premises</li> <li>- CIP/SIP</li> <li>- condensate losses</li> <li>- cooling towers</li> <li>- showers</li> <li>- accommodation</li> <li>- etc.</li> </ul>



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# I.S. 393

# I.S. 393

- Danish Standard – DS 2403:2001
  - Considered the first energy standard
- I.S. 393 used ISO 14001:2004 and DS 2401:2001 as models
  - Risk Assessment
  - Policy
  - Objectives and Targets
  - Responsibilities and competencies
  - Communications and Documentation
  - Operational aspects
  - Monitoring and measuring aspects
  - Management Review

# I.S. 393 Experience

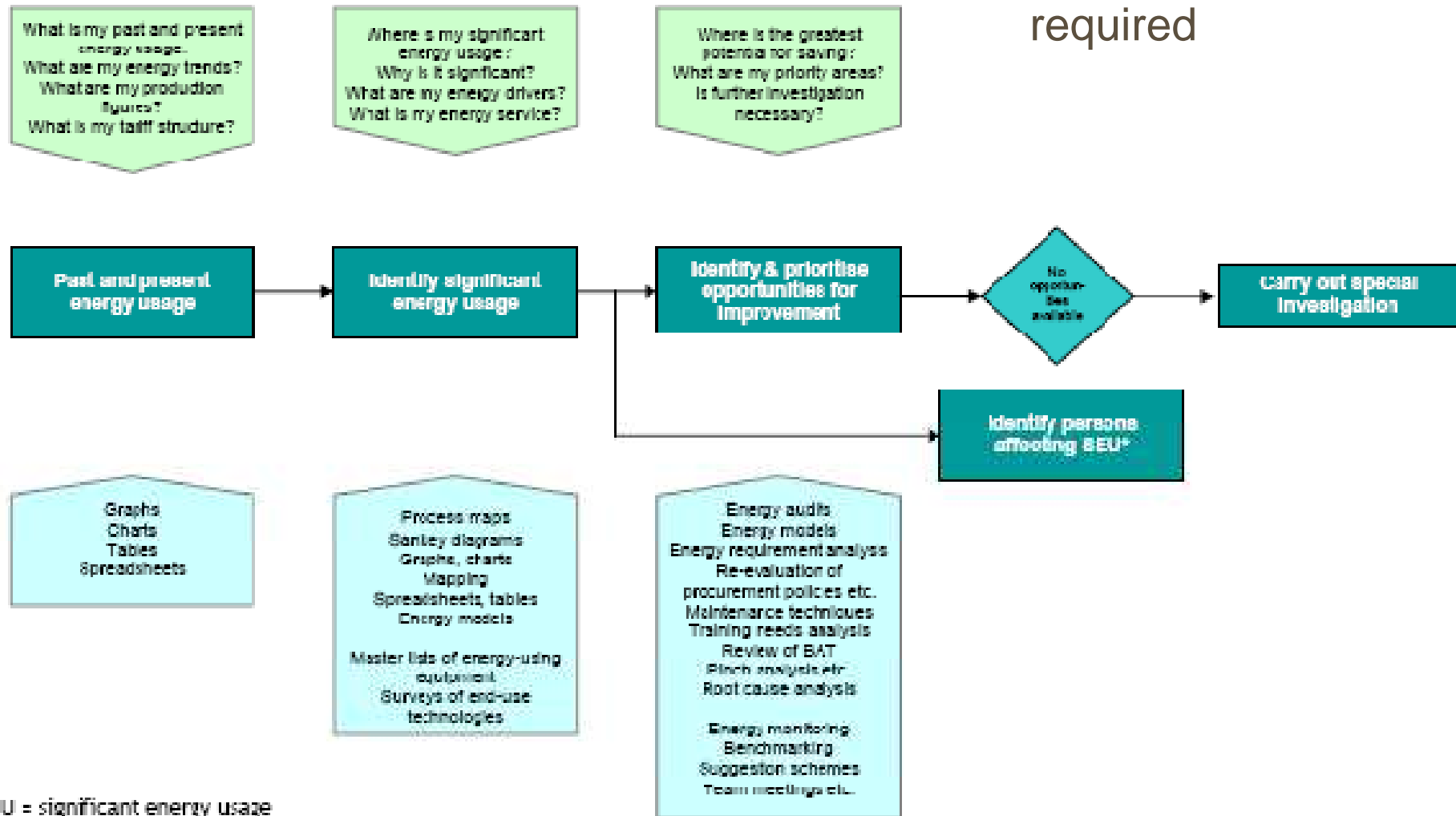
- SEI require LIEN members to use:
  - I.S. 393
  - The SEI Guidance Document
  - The addendum
- The addendum gives guidance but also includes additional requirements such as:
  - Annual Performance Statement
- INAB require the use of energy experts in audits



# Illustration from Guidance Document

Figure 1: Review of energy aspects

Three years of data required



Note: This diagram is for illustrative purposes only, and merely provides a synopsis of the guidance on the Review of energy aspects

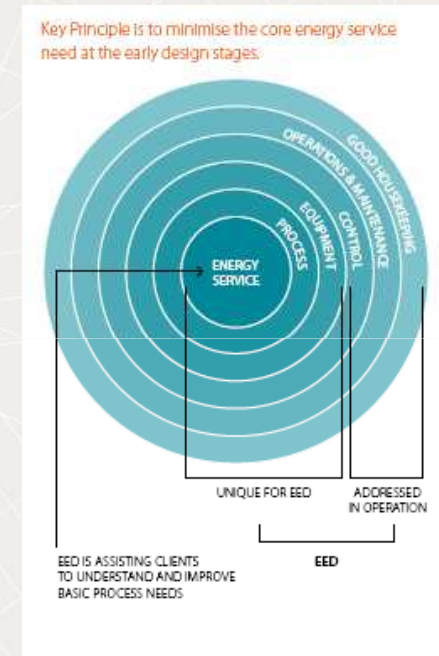


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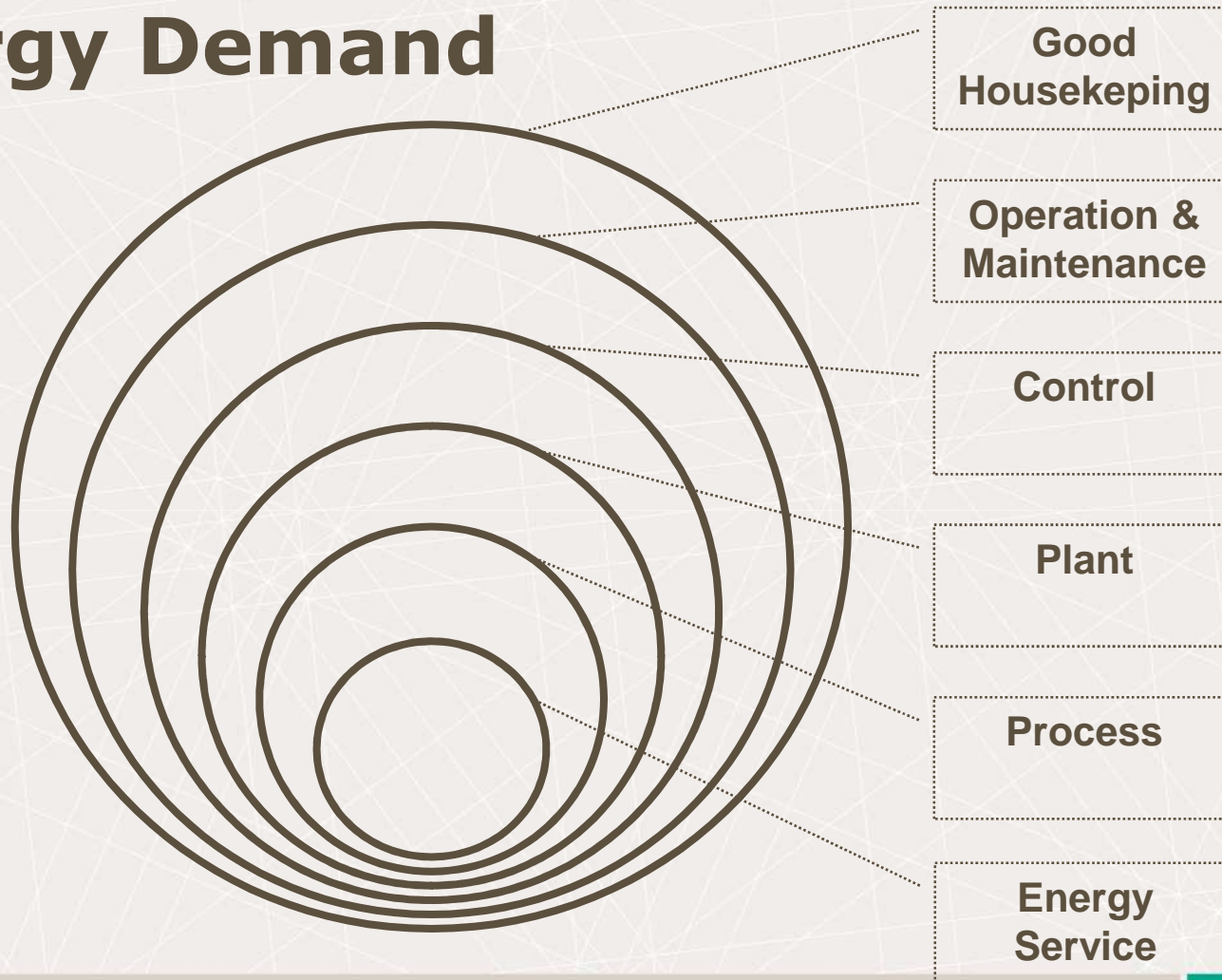
# Audit Feedback and Techniques

# Feedback from audits / techniques:

- I.S. 393 is not ISO 14001
- It's about the energy service
  - Operation
    - Control, Maintenance and Housekeeping
  - Energy Service
    - Design (process and equipment)



# The "Onion" Diagram – Energy Demand



# From Energy Service to Energy Bill

1. Reduce the "Energy Service"
2. Use energy efficient technology
3. Optimise efficiency of plant and technology
4. Ensure a correct operation of the plant
5. Re-use waste/excess energy



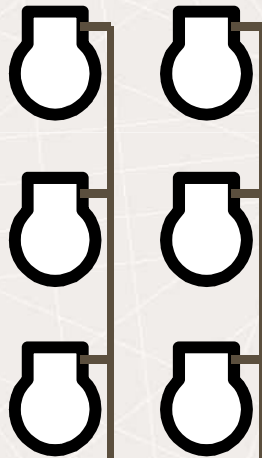
# Example: Removal of Dust from Cement-Bags

1. "Energy Service" = removal of dust
2. Technology = compressed air vs. "mechanical" solution
3. Efficiency = minimize pressure need etc.
4. Operation = minimize idle load etc.
5. Re-use of waste = utilise excess heat for building heating

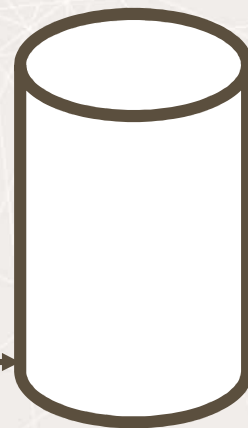


# Autoclave in Healthcare Industry

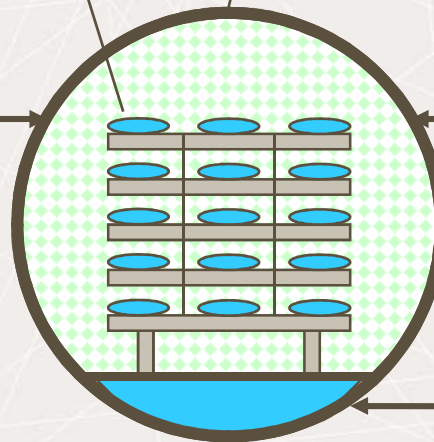
6 compressors of each 150 kW delivering 8.5 bar compressed air



Compressed air receiver at 8.5 bar



Trays with plastic tubes in bags with sterile water



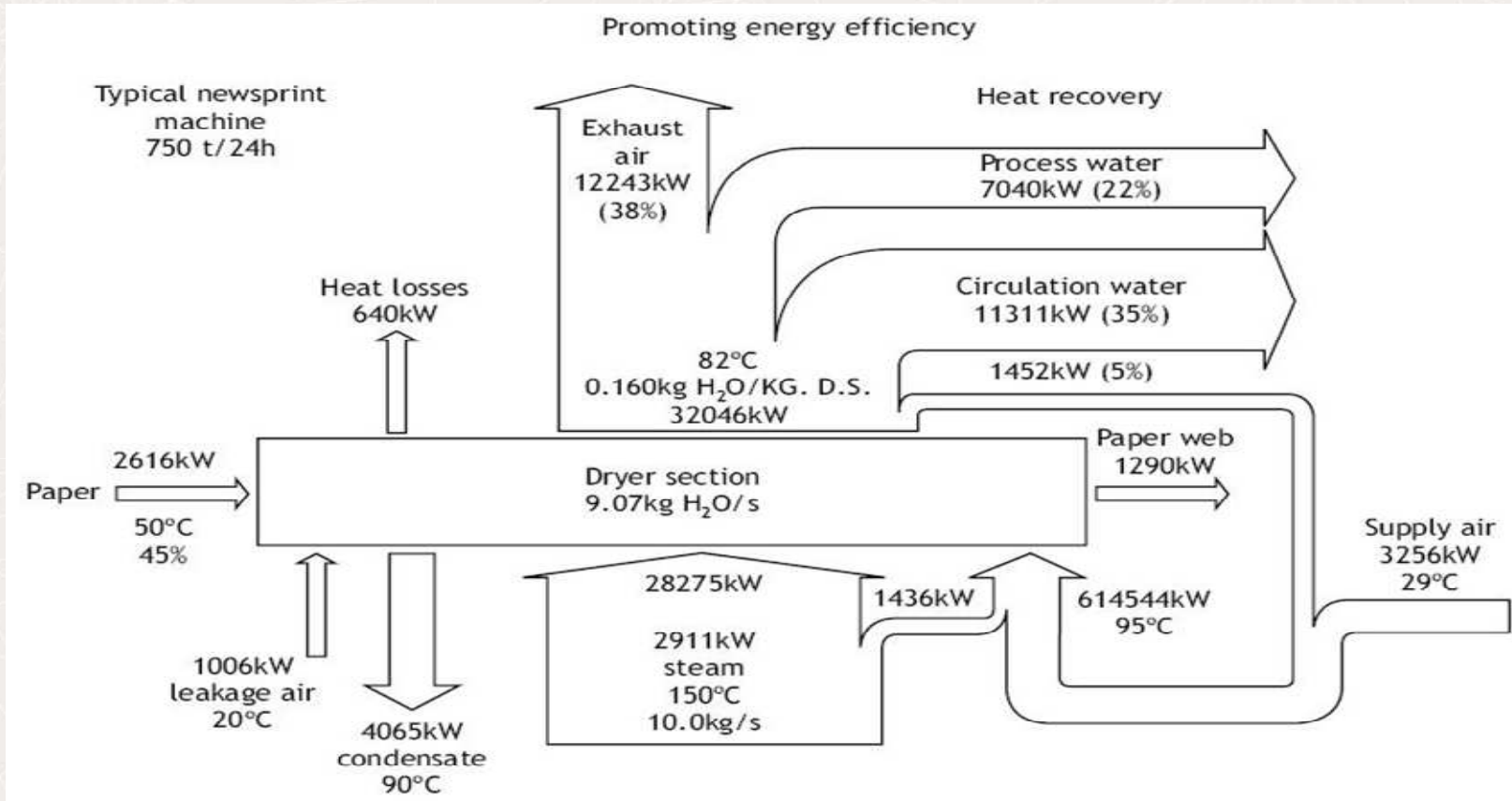
Sterilisation of products at 100% humidity and 120C for 50 min.

20 autoclaves of each 15 meter length and 2 meter diameter

8 bar steam

10C water

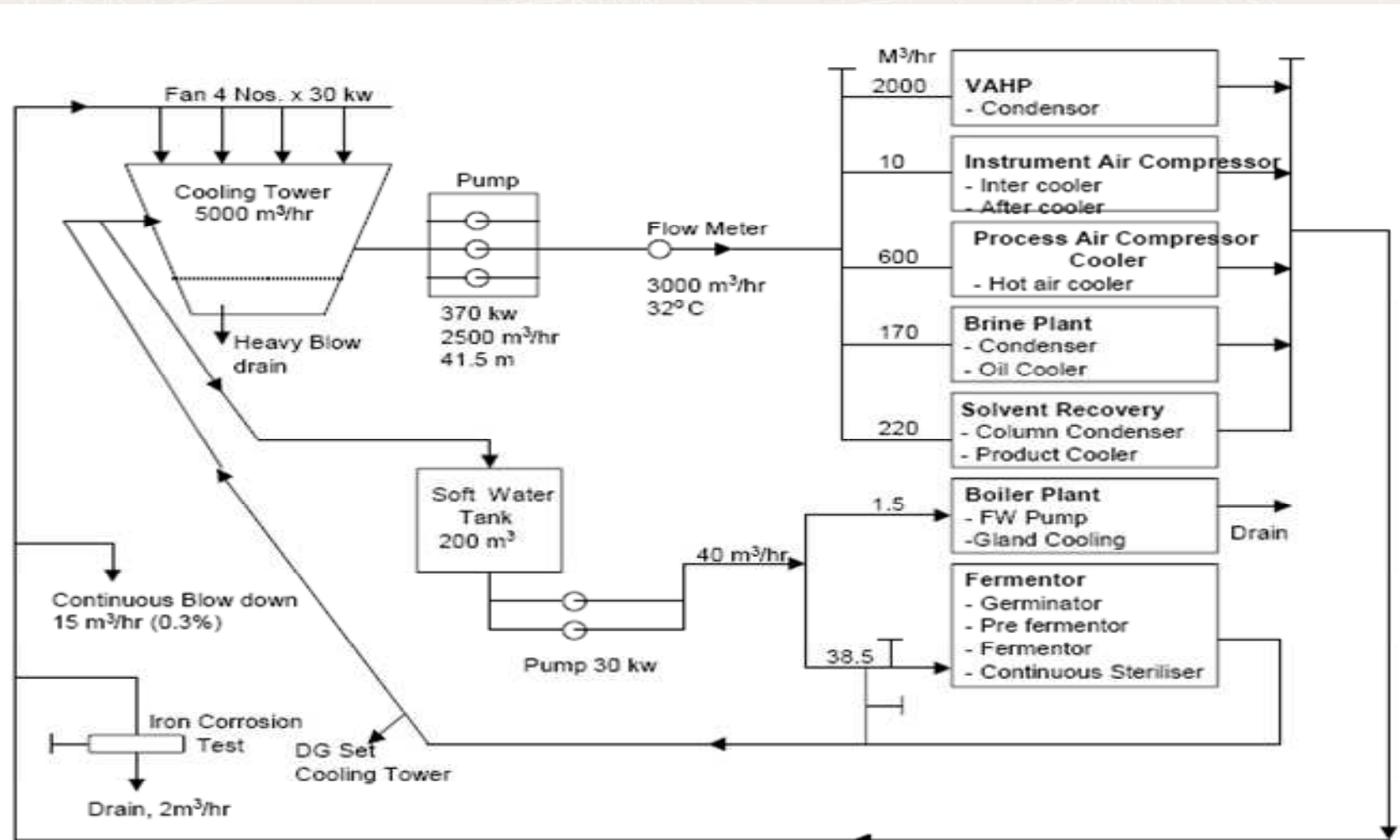
# Energy Balances/Sankey Diagrams



An energy balance can explain the overall efficiency of a process



# Mass Balance for Cooling System



Such minic diagrams can often be found in BMS or monitoring systems

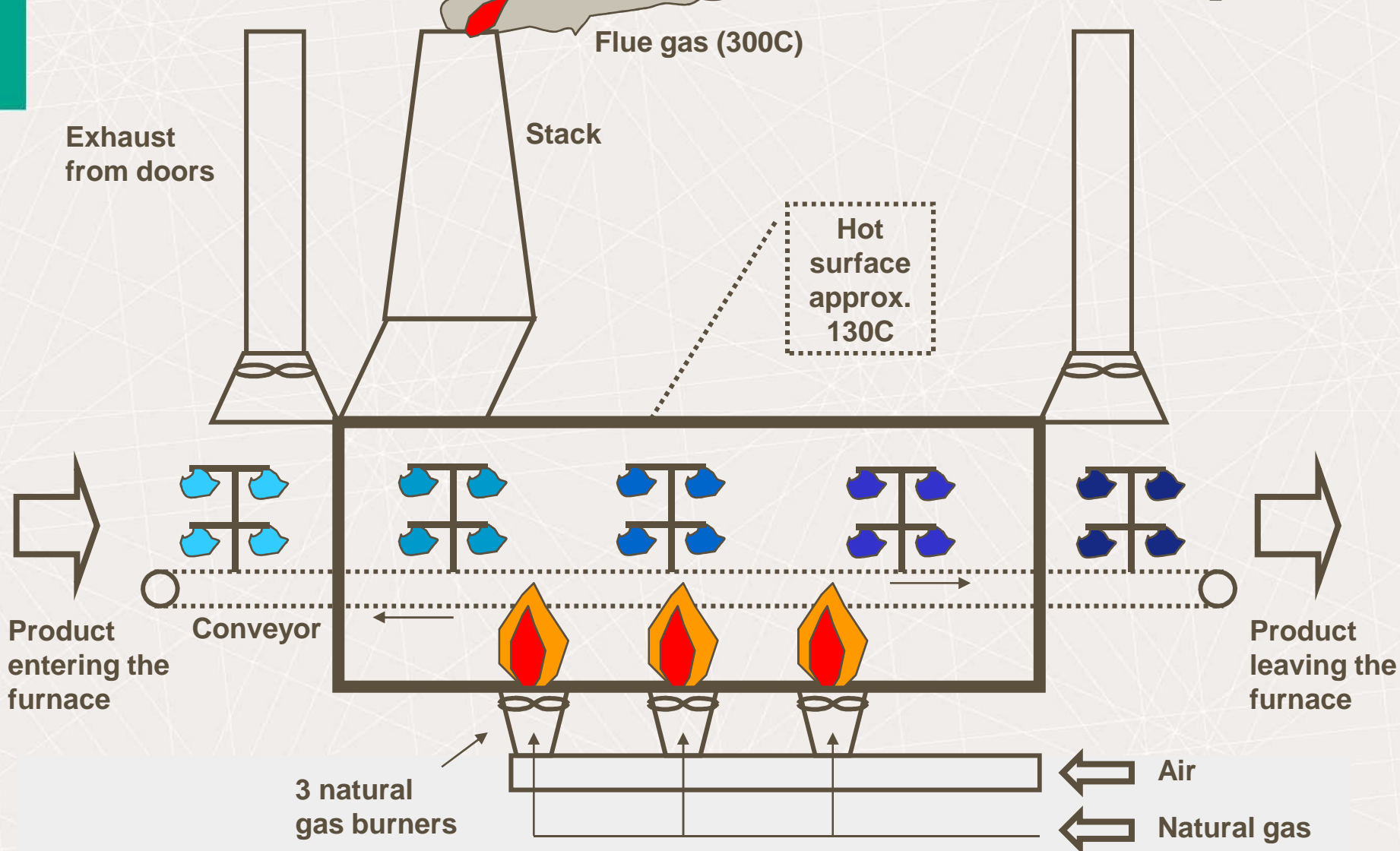
## Review of Design Parameters

### Food Ingredients:

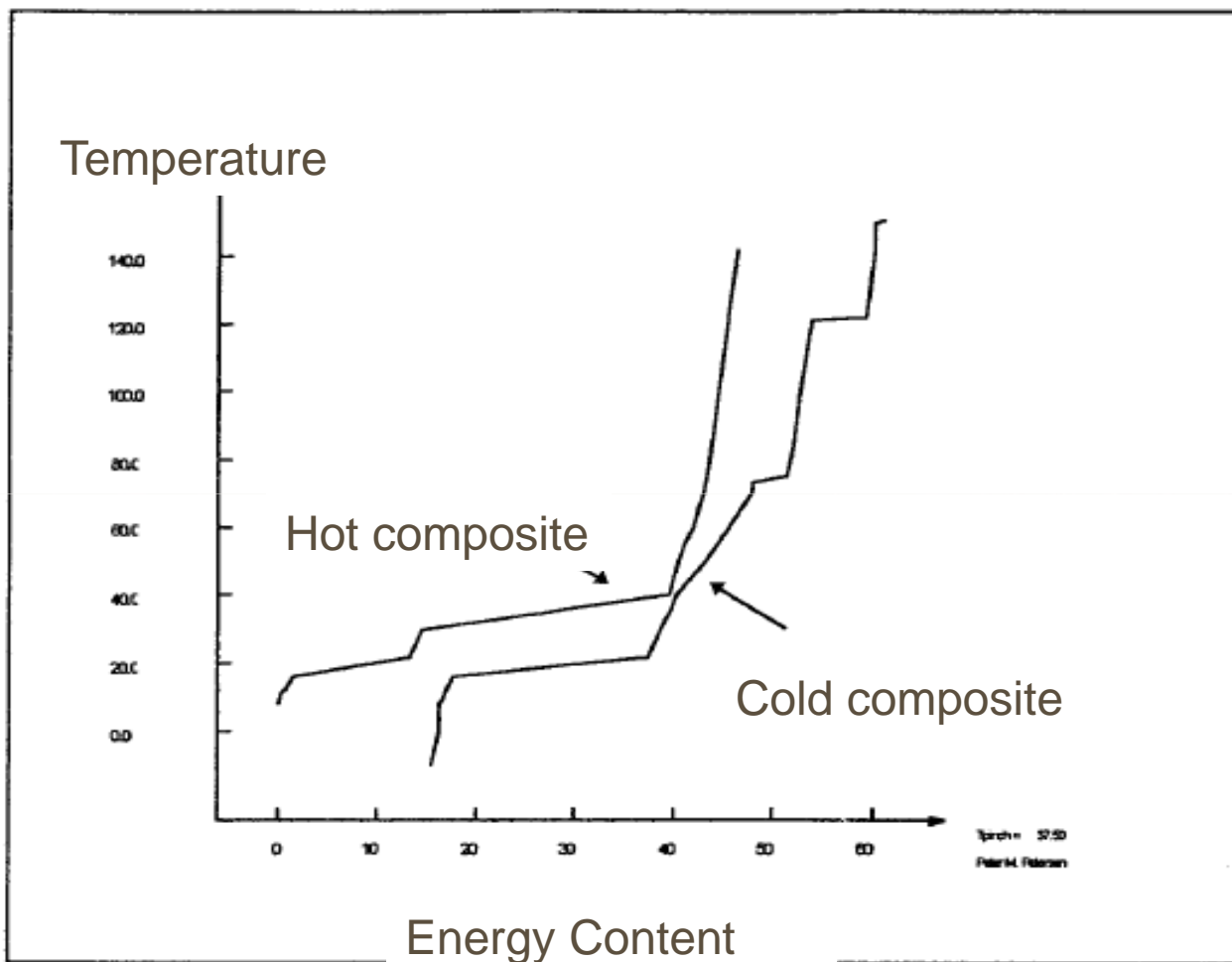
- Need for ventilation in packaging area was before audit 10 times per hour
- Review of product requirements and change of equipment reduces ventilation to 4 times per hour
- Annual cost saving Euro 25,000  
Pay-back = 0 years



# Furnace for Coating of Metal Alloys



# Composite Curves



The "composite"-  
principle identifies:

- Improved supply
- Heat recovery

The "composite"-  
principle can be  
applied also for:

- Compressed air
- Water/waste water
- Etc.

# Fourier's law – Delta T ( $\Delta T$ )

... the time rate of heat transfer through a material is proportional to the negative gradient in the temperature and to the area at right angles, to that gradient, through which the heat is flowing.

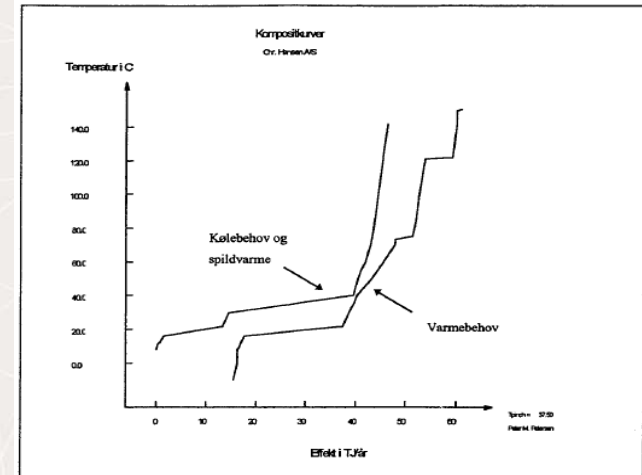
- Review  $\Delta T$ 
  - What is the optimum difference / delivery
- Review how energy is transmitted
  - Is the transfer suitably efficient

# Example: Heat Recovery

- Large waste heat amounts in most industrial sectors
- In food sector, pharmaceutical sector etc. large amounts of waste heat has temperatures  $< 100\text{C}$
- The most easy solutions might be utilised already (building heating)
- ...but large hidden energy demands might be found in heating of water for processes and cleaning purposes etc.



- Use the composite-principle
- Establish water/heat storage ( $70\text{ C}$ )



# Non-conformances raised

Applicants fall into two groups

- Well prepared
  - Virtually no NCs
- Poorly prepared
  - False starts
  - Many fundamental issues at stage 1
  - Many NCs raised at Stage 2 (although not major)

# Types of NCs of second group

- Continual Improvement process not documented
- The policy does not address the standard.
  - scope and boundaries, availability of information, resources to achieve objectives and targets etc.
- Competence and qualification requirements not formalised
- Poor root cause analysis
- Metering plan not defined
- Energy factors not addressed
- External communication requirements not addressed
- Management Review outputs incomplete
  - Improvement in energy performance
  - Changes in energy policy
  - Allocation of resources etc



# Types of NCs of second group

- Interval for reviewing energy aspects is not defined
- Future energy use is not forecast as part of the review process
- Opportunities for improvement are not prioritised
- Programmes are not kept up-to-date
- Gap analysis / internal audit for EN 16001 (moving from I.S. 393) not completed
- Internal audits do not cover all areas / aspects
- Insufficient depth of analysis of energy service
- Lack of data concerning significant energy aspects



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# EN 16001

# EN 16001:2009

- EN 16001 is very similar to I.S. 393
- The following slides are part of our upgrade training and serve to show some of the key concepts in EN 16001.
- # = key aspects

## 3.2 Policy

- Has to define scope and boundaries of EnMS#
- Commits to ensure availability of resources and information
- Regularly reviewed and up-dated

## 3.3.1 Identification and review of Energy Aspects

- Review at pre-defined intervals
  - Discussion:
    - Was annual. Would 2 years be OK now?
    - Review does not mean change
- Energy factors introduced#
  - E.g. production output, weather, working hours, staff numbers etc.
- Identification of significant changes in energy use during last period
- Estimate of expected energy consumption#
- Register of energy saving opportunities to be maintained#

### **3.3.3 Objectives, targets and programmes**

- Clauses merged from I.S. 393
- Up-date objectives, targets and programmes at pre-determined intervals

## 3.4.2 Awareness, training and Competence

- Management Representative needs to be appropriately competent and qualified
  - DISCUSSION
    - Difference between competent and qualified.
    - Qualified added because certain countries have a regulated qualification for energy manager (e.g. Italy). Can be ignored otherwise.

## 3.4.2 Awareness, training and Competence

- All employees and all persons working on its behalf have to be aware .. #
- Each level of management to be appropriately trained on energy management ...#
  - DISCUSSION
    - What is a tool?      Could be a light switch?
    - Why “pertinent” instead of “appropriate”
    - Could be very onerous.



## 3.4.3 Communication

- Requirement to communicate internally on performance and EnMS to all.
  - DISCUSSION
    - This would include guards, receptionist etc.
- Consider external communication on EnMS and performance
  - If part of SEI's LIEN, there is a requirement to communicate externally (to SEI)

## 3.4.6 Operational Control

- Purchase of equipment, raw materials and services need to consistent with energy policy etc. #
  - DISCUSSION
    - Why “should” in last line of c)?
    - Assumed it means when it is relevant
- Evaluation of energy consumption when design, change or restoration of assets
- E) repeats 4.3.2 but adds “other relevant parties”

## 3.5 Monitoring and Measurement#

- Energy metering plan required
- Relationships to be defined and reviewed at defined intervals between energy consumption and associated energy factors
  - DISCUSSION
    - Importance of word “practicable”
    - Might be no energy factor
    - Onion Diagram important
- Compare energy performance indicators to benchmarks
- Records to be kept of significant accidental deviations from expected consumption
  - With causes and remedies

## 3.5.5 Internal Audit

- Audit schedule to take “significance” into consideration
- Actions to be taken without undue delay
- Follow up actions and reporting on verification of results required
- Internal Audits may be the basis of self declaration of conformity
  - DISCUSSION
    - Implication on 3<sup>rd</sup> party certification
    - SEI require accredited 3<sup>rd</sup> party certification for LIEN members

## 3.6 Management Review

- New “inputs” / “outputs” approach
- Review energy aspects and policy
- Review projected energy consultation for following period
- Report on improvement in energy performance since last review.
- Report on allocation of resources

# SEI Requirements

- Conformity with
  - I.S. EN 16001:2009
  - I.S. EN 16001:2009 Annex
    - There are 4 “shall”s in the Annex
    - A.3.1, A.4.3 and A5.5
  - SEI Guidance document
    - Being up-dated for EN 16001
    - Plan to issue in August 2009

## ***SEI Guidance Documents***

- Three additional EN 16001 guidance documents will be issued in August
  - How to Internal Audit
  - Implementation Guide
  - Gap assessment checklist

## Key Dates

- 10 September 2009
  - Launch of EN 16001 in Brussels
- November 2009
  - Next ISO TC meeting on 50001
    - Comments on CD
- European Cooperation for Accreditation
  - Guidance Document EA 7/XX???



# Thanks and Acknowledgements

- Thanks to SEI LIEN Manager, John O'Sullivan and his team who provided input to these slides at the meeting on 28 July 2009.
- Thanks to Viegand Maagøe for illustrations
- Thanks to George O'Gorman and Michael Kelleher for their audit feedback
  
- [www.sei.ie](http://www.sei.ie)
- [www.nsai.ie](http://www.nsai.ie)
- <http://www.vmas.dk/index2.php>
  
- END