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Support & Training for an Excellent Energy Efficiency Performance

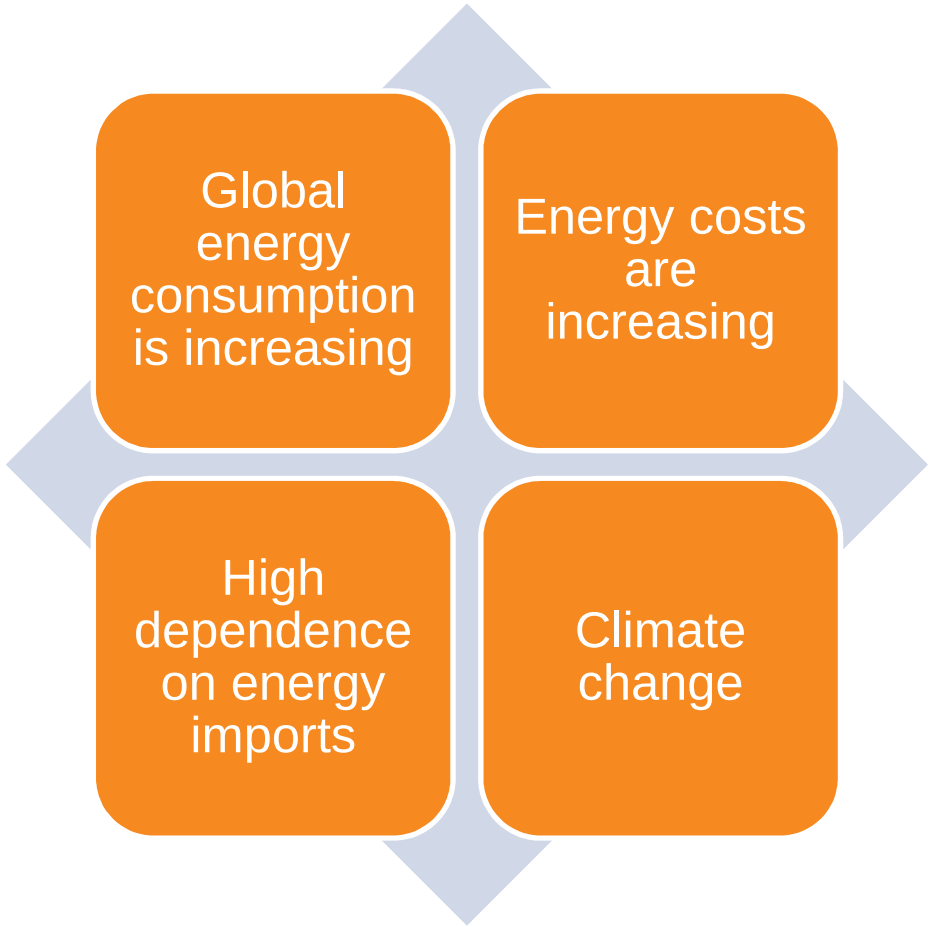
Training Material for SMEs

Co-funded by the Intelligent Energy Europe Programme of the European Union

Energy Efficiency

- It refers to the use of technology that requires less energy to achieve the same performance or perform the same function.
- Energy efficiency focuses on technology, equipment or machinery being used in buildings
- Energy conservation focuses on people's behavior to use less energy (e.g. maximum use of natural light instead of artificial lighting).

Why is Energy Efficiency important?



EU Energy Policy

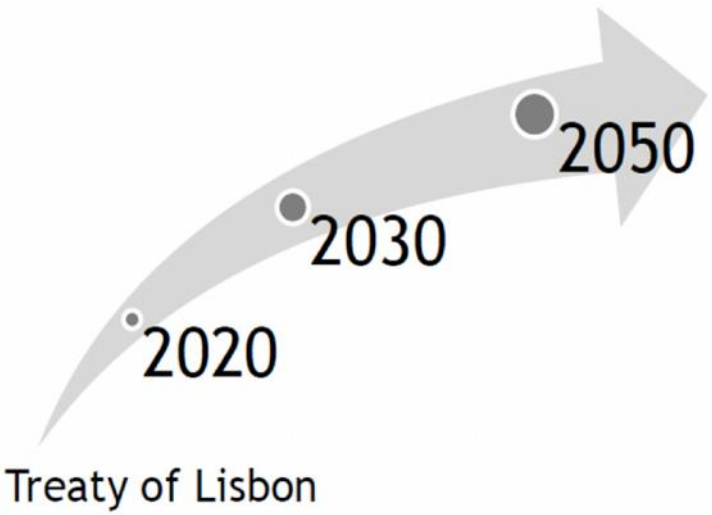
Treaty of Lisbon

- Place energy at the heart of European activity
- Article 194 of the Treaty on the functioning of the European Union

European Union policy on energy shall aim to:

- Ensure the functioning of the energy market;
- Ensure security of energy supply in the Union;
- Promote energy efficiency and energy saving and the development of new and renewable forms of energy; and
- Promote the interconnection of energy networks.

EU Energy Policy



Energy Roadmap 2050

Reduction of GHG-Emissions to 80%-95% below 1990 levels by 2050

- Decarbonisation of the energy system
- Energy Efficiency
- Renewable Energy
- Early Investments
- Security of Supply

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Energy 2020 – Energy Efficiency

Energy Efficiency Directive (2012/27/EU)

- Implementation for Member States foreseen by June 2014
- Common framework of measures for the promotion of EE
- Use of energy more efficiently at all stages of the energy chain
- Measures included
  - Set indicative national energy efficiency target
  - Easy and free-of-charge access to data on real-time and historical energy consumption
  - Renovating of buildings
  - Efficiency in energy generation

- Ecodesign Regulations (2009/125/EC)

- Art. 8 […] *Member States may set up support schemes for SMEs, including if they have concluded voluntary agreements, to cover costs of an energy audit and of the implementation of highly cost-effective recommendations from the energy audits, if the proposed measures are implemented* […]

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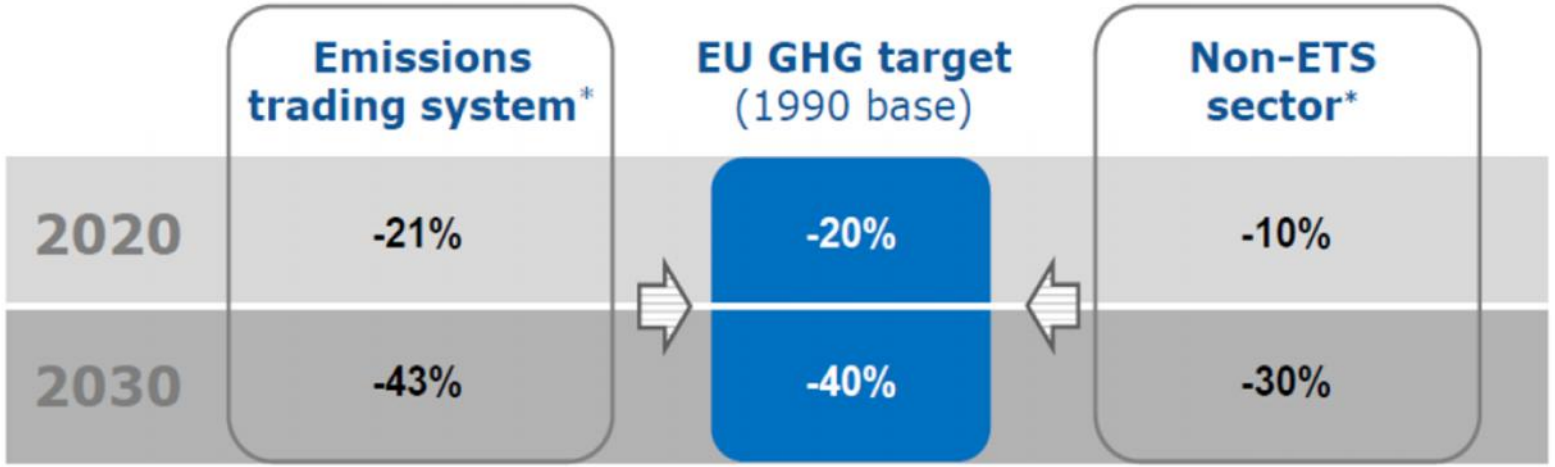
2030 Framework

A cost-effective reduction in emissions



HOW?

- 'Cap and trade'
- Market stability reserve
- Protection against carbon leakage

- Effort-sharing through binding national targets
- Support measures (e.g. standards)

Presentation of J.M. Barroso to the European Council, 20-21 March 2014

Energy Management

“Energy Management is the systematic use of management and technology to improve an organisation’s energy performance. It need to be integrated, proactive, and incorporate energy procurement, energy efficiency and renewable energy to be fully effective”.

Carbon Trust Energy Management Guide

The Need for Energy Management

Why does your company require energy management?

- Energy is a manageable cost
- Regulatory control and limits
- Corporate Responsibility
- Client requirements
- Peer pressure
- To win business

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Benefits for your company

- Cost savings
- Increase competitiveness (reduced costs for clients)
- More information on your company
  - strategic planning and opportunity for improvement
- Risk reduction
- Motivation of employees
- Image

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Energy Management System

- Energy Management Standard ISO 50001
- ISO 50001: Structure
- Benefits of Energy Management Systems
- 10 important building blocks of an EnMS
- Examples

Energy Management Standard ISO 50001

- Purpose: enable organisations to establish the systems and processes necessary to improve energy performance (includes energy efficiency, use and consumption)

- For all types and sizes of organisations

- DOES NOT prescribe absolute requirements/ targets regarding energy performance
  (except adherence to legal obligations and other requirements that the company has subscribed to)

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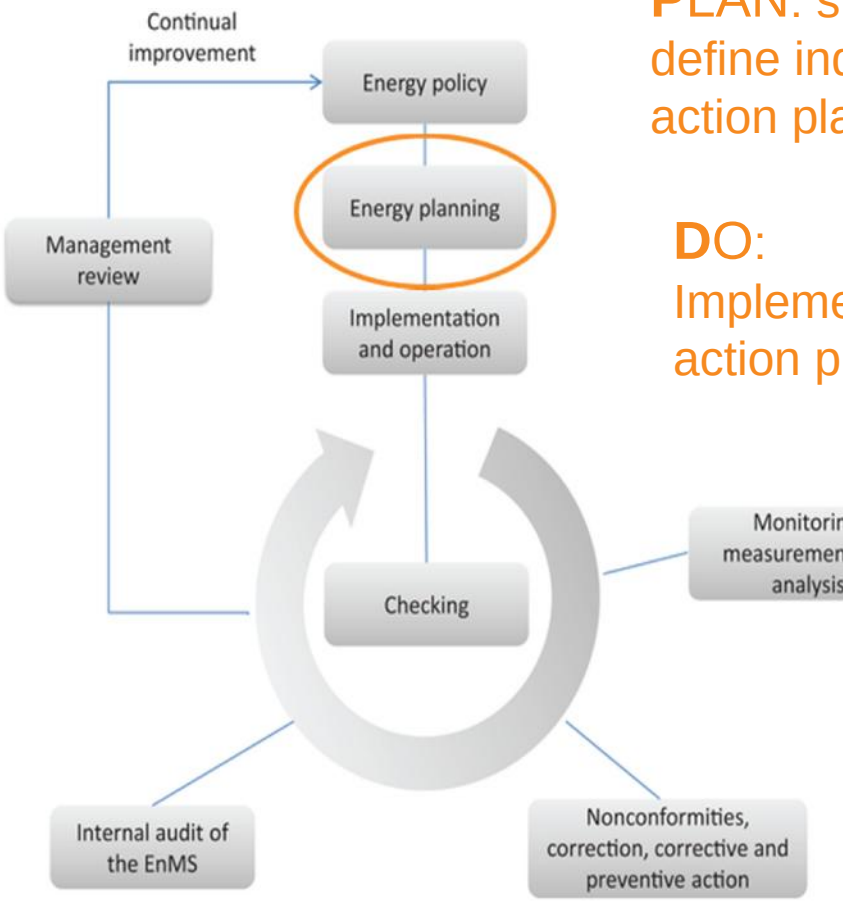
ISO 50001: Structure based on Plan-Do-Check-Act Cycle

ACT: measures to improve the EnMS and the energy performance

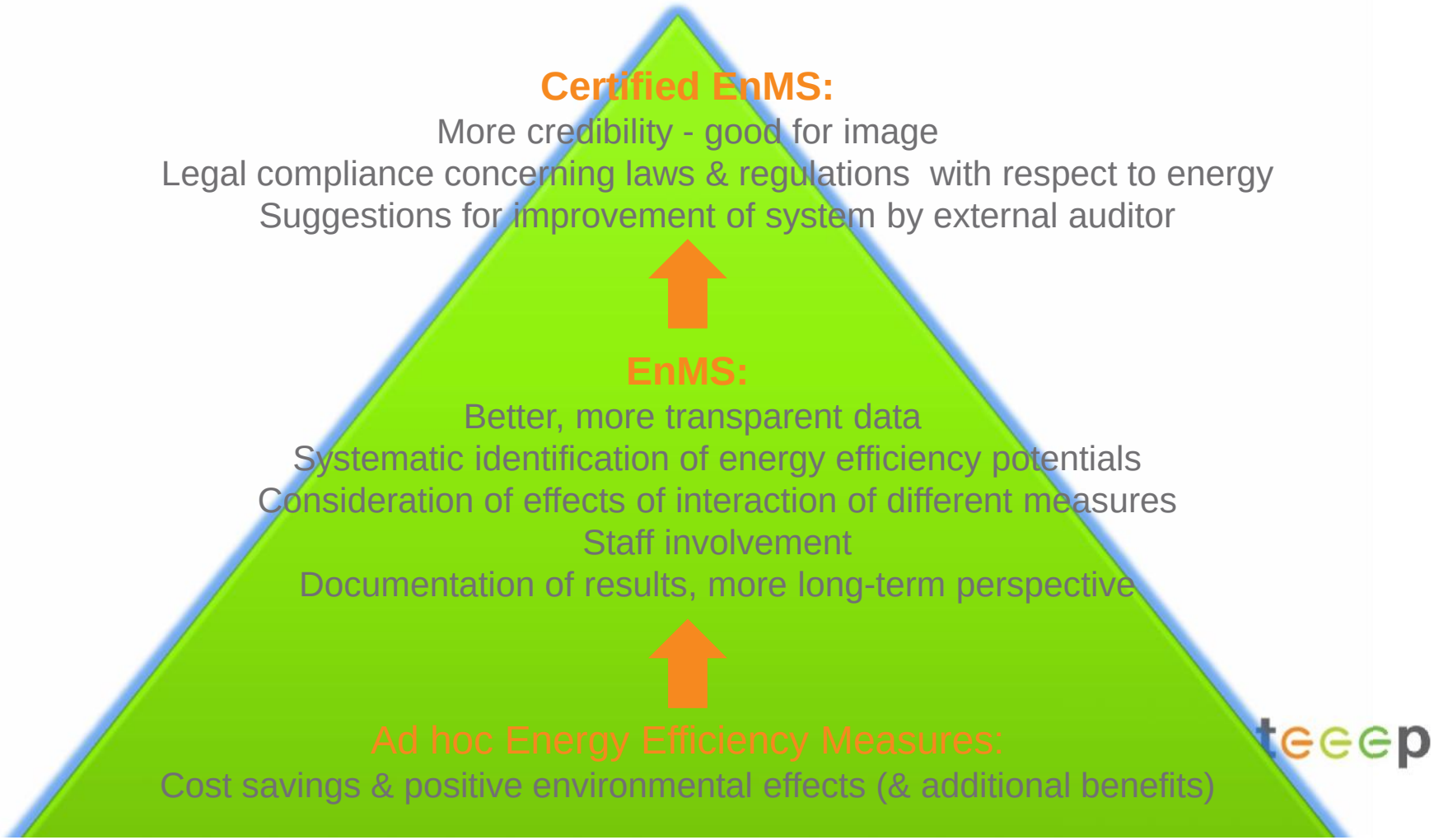


PLAN: status quo analysis, define indicators, goals and action plans

DO: Implementation of action plans

CHECK: monitor processes, measure results, documentation

Benefits of Energy Management Systems



10 important building blocks of an EnMS

1. Overview of energy situation of organisation (technical, organisational, efficiency potentials & opportunities)
2. Energy policy = Commitment of Top Management to improvement of energy performance
3. Designate Energy Manager
4. Set up energy information system / energy accounting
5. Set strategic and operative energy targets.
6. Define energy management programme = concrete measures, responsibilities and resources for implementation

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10 important building blocks of an EnMS

7. Check energy relevant processes, plan them as efficiently as possible, and document criteria

8. Raise awareness among staff for energy topics (internal communication), inform about efficient behavior (trainings, operating instructions), involve in improvement process (suggestion scheme)

9. Regularly check and record fulfilment of goals and correct operation of energy relevant processes

10. Correct deviations, update goals and energy management programmes, and develop them further.

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Example:
Energy objectives, targets & programmes

Energy aspect	Objective	Target	Programme	Indicator(s)
General wash-up in dairy processing plant	Reduce warm water usage.	Reduce warm water usage in litre/m2 by 5% of current levels within 1 year.	Replace hose nozzles with more efficient models. Ensure solid waste residues on floor are swept up instead of flushed away. Ensure leaks are detected and fixed. Raise awareness.	Warm water usage in litre/m2 p.a. Mean temperature of water.
Heating and cooling in connection with processing of a product (food, chemicals, medical etc.).	Reduce energy used in heating (fuel based steam) and cooling (outside air ventilated though the material).	Reduce energy consumption to the minimum required to perform the aim of the processing (changing the structure and/or contents of the material processed).	Install more accurate temperature measuring equipment. Improve process management. Train those responsible for controlling the process. Install energy efficient ventilators & motors. Install frequency steering on ventilator motors. Reduce air leakage in vent. system	Use of fuel per ton processed. Use of electricity per ton processed.

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Source: Technical Guideline I.S. 16001:2009 – Sustainable Energy Ireland

Example:
Operational controls & monitoring

Energy aspect	Programme	Indicator(s)	Operational control	Monitoring and measurement
General wash-up in dairy processing plant	Replace hose nozzles with more efficient models. Ensure solid waste residues on floor are swept up instead of flushed away. Ensure leaks are detected and fixed. Raise awareness.	Warm water usage in litre/m2 p.a. Mean temperature of water.	Specification for fitting new nozzles. Work instruction for floor cleaning. Procedure for detecting, reporting and fixing leaks. Basic instruction in basic correct floor cleaning.	Bi-weekly monitoring of warm water usage for cleaning. Regular monitoring of water temperature. Spot checks on operators.
Heating and cooling in connection with processing of a product (food, chemicals, medical etc.).	Install more accurate temperature measuring equipment. Improve process management. Train those responsible for controlling the process. Install energy efficient ventilators & motors. Install frequency steering on ventilator motors. Reduce air leakage in vent. system	Use of fuel per ton processed. Use of electricity per ton processed.	Specify max. and min. temperatures in connection with heating of the processed material. Specify max. and min. temperatures in connection with cooling of the processed material.	Daily or weekly monitoring of steam or fuel usage (frequency depending on potentials). Daily or weekly monitoring of electricity used for ventilation.

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Source: Technical Guideline I.S. 16001:2009 – Sustainable Energy Ireland

Energy Efficiency in Practice

- Energy consumption and costs are related to technical and human factors
- When analysing your energy use, you need to consider the following:
  - Lighting system
  - Heating system
  - Cooling system
  - Building
  - Compressed Air system
  - Office equipment

Lighting

- Maximise the use of daylight
  - Reduce luminance to minimum required levels
- Choose light colored interior wall finishes in your building.
  - The more dark colours you have, the more artificial light is needed
- Selective switching: light only where necessary
  - Switch off lights when not needed/ in unoccupied areas
  - Split the lighting into multiple groups

Lighting

Investments:

- Install programmable timers and/or occupancy sensors (10 to 20% saving) in toilets, corridors, cellars, garages…
- Install daylight harvesting controls in every area receiving natural light.

→ Together they can reduce energy usage and costs by up to 45%

- Replace electromagnetic chokes of fluorescent tube lights with energy efficient electronic ballasts
  - Limit the amount of current in an electronic circuit. They consume two to three times less than the magnetic ballast
- Relighting: switch to energy efficient lighting

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Energy efficient lighting

Do you know that inefficient light bulbs have been banned in the EU?

- Since 01.09.2010 clear 75W (over 750 lumen)
- Since 01.09.2011 clear 60W (over 450 lm)
- Since 01.09.2012 clear 20W-40W (over 60 lm)

- From 01.09.2013 tightened standards on CFLs and LEDs
  - No lamp type will be removed from the market,
  - only lamps with poor performance will be banned.

- 2014 review of the regulations by the EU Commission.
- From 01.09.2016 tightened standards for clear halogen lamps
  - Only energy class B halogen lamps (C for some special cap lamps) will be permitted. All other halogen lamps will be banned!

Ensuring electrical products safety:
ENEC is the high quality European Mark for electrical products that demonstrates compliance with European standards (EN).

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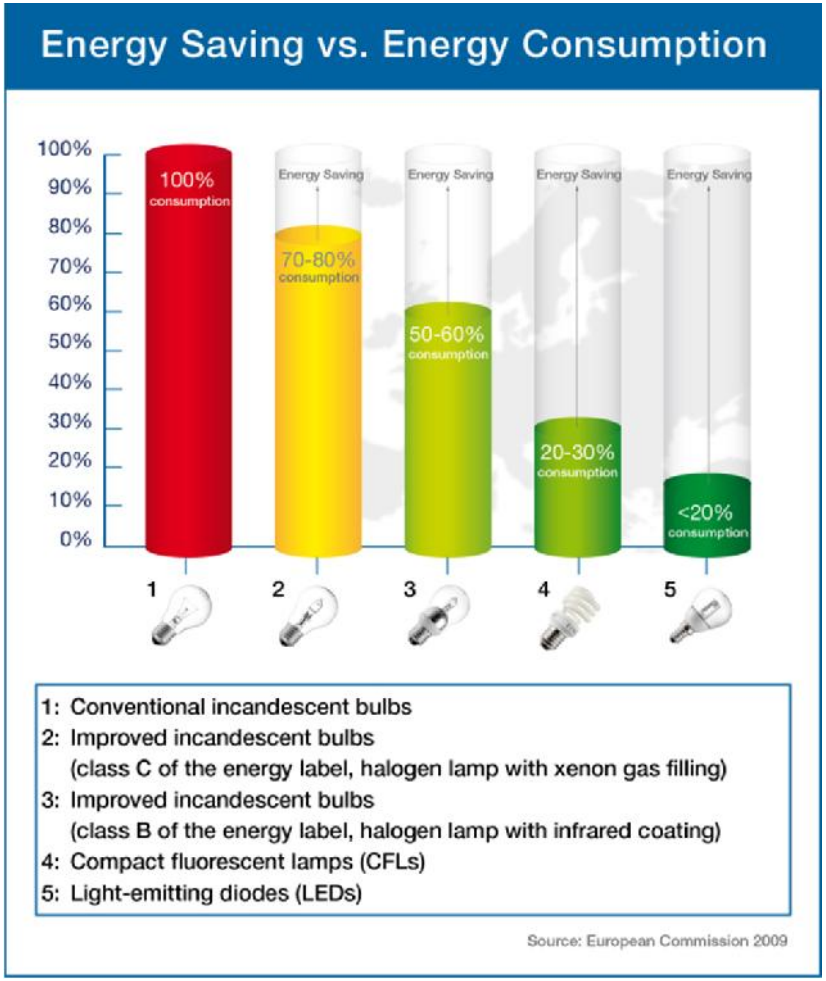
Lighting

Choose efficient light bulbs
(~life 6000 – 15000 hours compared to 1000 hours for conventional incandescent bulbs) :

- Improved incandescent bulbs
- Compact Fluorescent Lamps (**CFL**)
- Light Emitting Diodes (**LEDs**)



- Which bulb do I need?

→ Light bulb selector

→ The new bulbs: a guide

- Exercise

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Effect of relighting: New lighting & fixtures

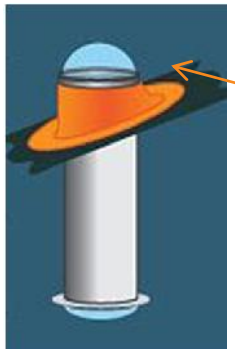
Colour rendering (CRI 100)
Lumen output (lumen/watt)
Colour temperature (Kelvin)

Before relighting: 2 x 58W - 75lux

After relighting: 1 x 60W – 180lux

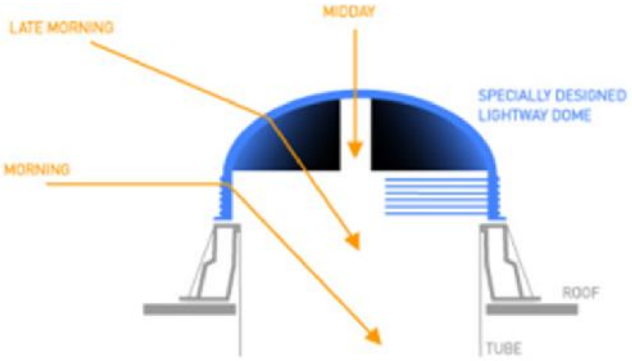
Lighting - Smart light domes

- Bring or enhance the natural light in areas that do not have openings to the outside, or in addition to an existing opening.



Dome which catches the light, simple or with a special device to reflect light

Diffusor of light



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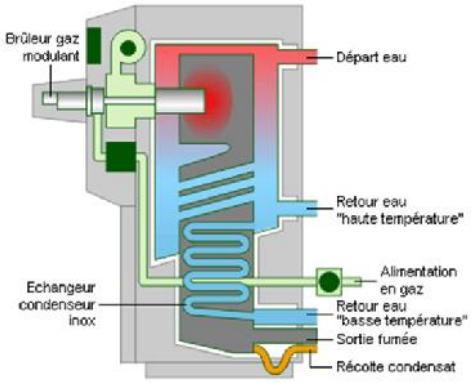
Heating

- No cost measure: adjust rooms and boilers temperature
- Choose thermal insulation of boilers, hot water tanks and water pipes
- Clean the boiler: 1 mm of soot = 50 ° c fume temperature = yield loss of 4 - 8%
- Switch to high efficiency boilers:
  - Condensing boiler: designed to use the latent heat released by the condensation of water vapor produced during the combustion process
  - efficiency of around 109%
  - Up to 40% savings compared to conventional boilers
- Place a weather-dependent control on the heating/cooling system
- Choose radiant heating instead of heating air



Condensing boiler

Example of infrared radiant heater

Heating

- Choose for the CV
- Recover the heat of the ventilation and re-use it
- Reduce the zones to be heated
- Large consumers of electric and heat energy may consider cogeneration / CHP (Combined Heat and Power) in order to generate efficiently both electrical power and heating
  - hotels, hospitals, care facilities, swimming pools, offices, schools,
  - micro and mini–CHP for residential and small business (5 – 10kW)
- Consider a solar collector (water heater) for pre-heating and heating domestic hot water

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Cooling

- Set the evaporating temperature as high as possible and the condenser temperature as low as possible
- Maximise heat recovery of the heat produced by the cooling machines
- Avoid heat sources (e.g. lighting) in cooled areas
- Insulate cold pipes
- Allow air to circulate well around the units
- Establish a chiller efficiency-maintenance program, defrost regularly
  - Cleaning the air conditioning reduce the related energy consumption of 10% in case of light clogging, of 30% in case the cleaning has never been done

Cooling - climatisation

- Reduce sources of heat
- Use solar glazing
- Choose outdoor shades
- Freecooling: use cold external air temperature during the night in warm periods)
- Install, if possible, patio & fountain
- Choose green roofs and facades

→ Choose electric cooling only as a last option

1°C temperature decrease/increase

=

about 6% energy savings

Energy Management in Buildings

- Energy management in buildings is about ensuring more comfortable, safe and healthy working circumstances with the same amount of energy or less energy.

- Benefits of energy management in buildings:
  - Reduces energy consumption → cost-savings
  - Increases comfort and safety
  - Reduces pollution
  - Increases the energy security
  - Reduces dependency on energy sources

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Energy performance of Buildings

- The potential for making energy savings in the building sector is widely recognized, especially through the refurbishment of existing buildings.

- The Energy Performance of Buildings Directive, EPBD (Directive 2002/91/EC): main EU policy instrument to improve the energy performance of buildings. Among other measures, it introduced a framework for energy performance certification.

- The recast of the EPBD in 2010 (Directive 2010/31/EU) strengthened the role of Energy Performance Certificate (EPC), for example by demanding publication of the energy performance indicator of the EPC at the time of advertising a building for sale or rental.

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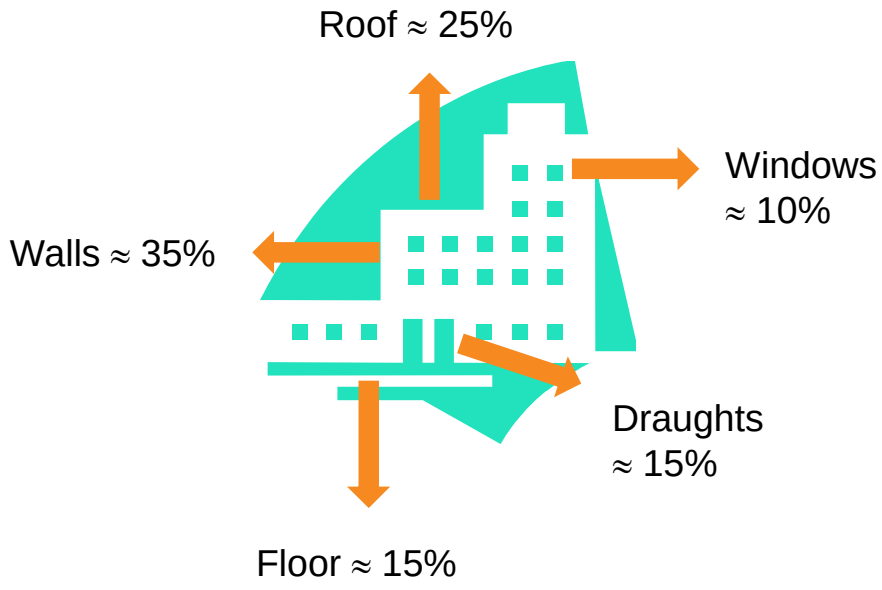
Energy saving measures and investments for buildings

Consumption profiles may vary but heating, cooling and lighting are the major energy users in buildings

Heating supply

- Boiler (gas, fuel boiler)
- Heat pump
- Electrical heating
- Geothermal heating system
- Solar heating
- Biomass boiler
- Wood and pellet boiler

Heat losses



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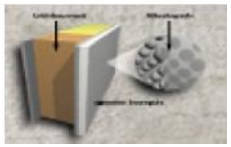
Energy saving measures and investments for buildings

- Ventilation
  - Mechanical or forced ventilation
  - Natural ventilation (windows, trickle vents)
- Air conditioning
- Water supply (cold, hot)
  - Cold water
    - Water-saving solutions (e.g.: aerator for using less water)
  - Hot water
    - Creation of full circulation system
    - Insulation
    - Pipeline replacement
    - Solar collector
- Insulation
  - Against cold and hot weather
- Insulation, replacement of windows and upgrading of other heating & ventilation systems result together up to 40% of energy saving.

Intelligent building



a. **Good insulation**

b. **sufficient windows**

e. **Good sun protection**

c. **Green roof**

f. **Cooling at night**

g. **Controlled ventilation**

d. **Building engineering**

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Future?

- Buildings may become an energy (thermal &/or electric) production unit for local needs.
- They can even contribute to global electricity production.
- New opportunities for European businesses, affordable energy bills for consumers.
- Increased energy security through a significant reduction of natural gas imports and a positive impact on the environment.
- EU energy efficiency target for 2030 (Energy Efficiency Communication, released on 23 July 2014):
  - the proposed target of 30% builds on the achievements already reached: new buildings use half the energy they did in the 1980s and industry is about 19% less energy intensive than in 2001.

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Compressed Air

- Compressed air represents 10 to 20% of the electricity invoice.
- Do you know how much electricity you consume for compressed air?
- Is the use of compressed air really necessary?

90% of the energy consumption = heat!

Consider replacing with devices powered by batteries

- Do you take care on your leakages and do you know how much they cost?

Detecting leaks = saving money

  - Carry out periodic leak tests to estimate the quantity of leakage.
  - At a working pressure of 7 bar a compressed air leak
    - of 1mm costs 450€/year
    - of 3mm costs 4.400€/year
    - of 5mm costs 12.600€/year

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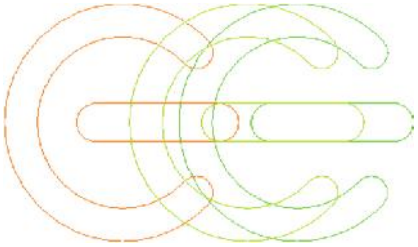

Compressed Air

- Set the system on minimum working pressure
  - Reduce the operating pressure to what is really necessary:
  - a reduction of the operating pressure of 0.5 bar means 3.5% less energy consumption
- Look after the cold air supply (remove the compressor from the boiler room! A right ventilation of the equipment room = a temperature drop of 10 C and 3,5% of energy savings)
- Limit the distance of the compressed air pipes. Place the compressor as close to the point of use
- Recover the heat of the compressor to generate hot air or water for process application
- Choose frequency controlled compressors

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Energy Efficiency in the office

- Office equipment is the fastest growing electrical load in the business sector. With the widespread use of desktop computers, printers and other devices, an office can have hundreds of units and the energy costs can add up.
- Office equipment and other miscellaneous uses accounted for over 40% of electricity consumption in large office buildings with most of that by office equipment.
- By purchasing the most efficient products, the electric bill will be reduced, adding to the bottom line.

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Energy Efficiency in the office

COMPUTERS

- largest energy consumers among office
- ENERGY STAR computers and monitors automatically power down when not in use and are available from almost every manufacturer. Both computers and monitors power down to about 15% of their maximum power usage

Energy Calculator for PC equipment

FAX MACHINE

- Because fax machines need to be available 24 hours a day, they have a huge potential for power saving technology
- They also power down to 15 to 45 Watts or less when not in use, and can save over 50% on annual energy costs

ENERGY STAR

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Energy Efficiency in the office

COPIERS

The most energy intensive pieces of office equipment!

- Energy consumption can be quite high, even when not in use.
- ENERGY STAR copiers are equipped with power saver features that allow them to go to low-power mode after 15 minutes of inactivity and to an off-mode of five to 20 Watts after two hours of inactivity.
- These features can reduce annual electricity costs by up to 60 %
- Copiers with double-sided or duplex copying also help to save energy and reduce paper costs

PRINTERS

- ENERGY STAR printers power down to 15 to 45 Watt and can save over 60% on annual energy costs. Printers with double-sided printing capability are more energy efficient and also help reduce paper costs.

Energy Calculator for Imaging Equipment

ENERGY STAR

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Other tips (I)

- Turn the equipment off at the power source when not in use overnight or on weekends. Plug-in timers automatically turn equipment off at the power sources at certain times of day.
  - They are especially useful for copiers and printers.

- If the computer must be left on at night and weekends, save energy costs by turning off the monitor.
  - Monitors typically use more energy than the computer itself.

- Power-saver features need to be set up by the user on many products.
  - Check the setup when you install new equipment and periodically to ensure that the power-saver functions are still working.

Other tips (II)

- Screen savers do not save energy. Their purpose is to extend the useful life of the screen and avoid images being “burned” into the screen.
  - Make sure the screen saver is compatible with the power management features of the computer and that the settings allow the unit to go into the power saver mode
- Laser printers consume more energy than inkjet printers. Color printers use more energy than black and white.
- Laptops draw about one-tenth the power of a conventional desktop computer.
  - You can connect a laptop computer to a conventional monitor and still save almost half the energy of a standard computer.

Smart Meters

What does it offer?

- Accurate bills
- Software, "Online" reading, local and remote
- GSM / GPRS communicator
- Meter single-phase and three-phase

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Smart Meters - System

- Measurement, records, monitoring, management
- Automated computerized measuring system
- Wireless communication with the center
- Counter <-> GPRS communicator <-> PC application
- The meter measures the active and reactive energy, power, current, voltage, load curves 1MB of data ...
- On your computer, all the data for analysis
- Maintenance costs, negligible (X per month)

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An example of smart meter: Linky in France

- Decision by French government to equip all energy consumers (businesses and households) with a smart meter called “Linky” by 2021 (www.erdf.fr/Linky)
- Linky allows to measure at any moment one’s real energy consumption

- Linky is being used in several smart-grid projects such as IssyGrid (www.issygrid.com)

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Conclusion

The system enables:

- Measuring, recording, understanding
- Monitoring, Management

- cost Control
- Reducing costs €
- Reducing pollution

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Renewables

ENERGY EFFICIENCY + RENEWABLES

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SUSTAINABILITY

- The EU target:

→ 20% of its energy from renewable sources by 2020.

Renewables

Some Aspects of Renewable Energy:

- It exists perpetually and in abundant in the environment
- Ready to be harnessed, inexhaustible
- It is a clean alternative to fossil fuels
- “energy that is derived from natural process that are replenished constantly” – defined by the RENEWABLE ENERGY WORKING PARTY of the INTERNATIONAL ENERGY AGENCY

Renewables

Major Renewable Energy Sources:

- Hydro Energy
- Wind Energy
- Solar Energy
- Biomass Energy
- Tidal Energy
- Geotermal Energy
- Wave Energy
- Bio-fuel

Renewables

BENEFITS FOR YOUR BUSINESS:

- Improved capacity for compliance with environmental demands
- Better marketing opportunities due to improved renewable energy

- Reduced operating costs
- Increased energy security
- Improved reliability of equipment and manufacturing process
- Better positioning in production chains
- Reduction of CO2 emissions

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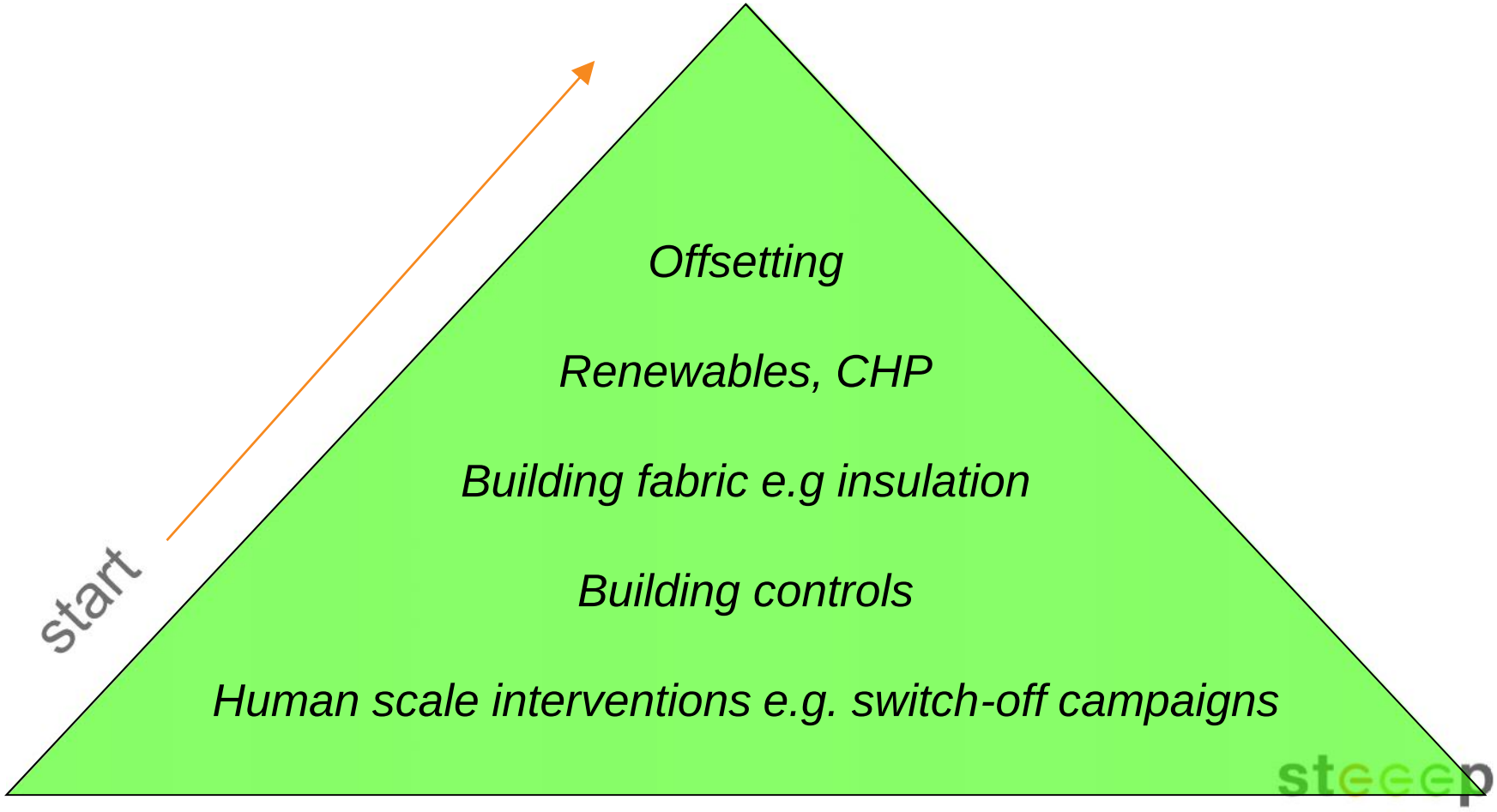
Energy Pyramid



Low – hanging fruits

IT Consumption *Switch-off rates for monitors around 30%*

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Low – hanging fruits

Saturday Evening around 6PM, Canary Wharf

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Low – hanging fruits

Saturday Evening around 6PM, Paris

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Low – hanging fruits

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...and now? Energy management plan

- Appoint an Energy manager
- Define your goals
- Collect your data → analysis of status quo
- Evaluation (benchmarking and best practice examples)
- Identify possible obstacles and responsibilities
- Develop a concept (identify energy efficiency measures)
- Implement measures

Control is knowing where to **act**

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Energy Management

- Analyse your energy consumption
  - an audit of your energy consumption indicates potential savings and possible measures to be adopted
- Identify behavioral and operational changes
- Organize awareness campaigns
  - Explain your programme to the staff
  - Find the right motivations (improved comfort, increased productivity, possibility to implement EE at home, etc.)
  - Find the right communication channels,
  - Involve the staff in agreeing the solution

Energy Management

- Reduce standby consumption
  - Eliminate standby consumption during nights and weekends
  - Make an inventory of the equipment that should guarantee the operational safety of the company during the unproductive periods and switch all other equipment off (lights, ICT, air-conditioning, …)

- Peak shaving: reducing your electrical power consumption during periods of maximum demand = 10% energy savings
  - Shift demand from "peak times" (e.g. Morning, noon) to times with lower demand (e.g. night)
  - “Start up ater on devices/installations that do not need to run immediately

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Energy Management

- Identify improvements to equipment and buildings
- Choose energy-efficient appliances
- Choose green power

- Aim at a good power factor
  - It is a measure of system electrical efficiency
  - Supplied electrical power = productive power (kW) + reactive power (kVAr)
  - Power factor is the ratio of productive power to the total supplied electrical power (kVA)
  - Utility companies charge a penalty for poor power factor

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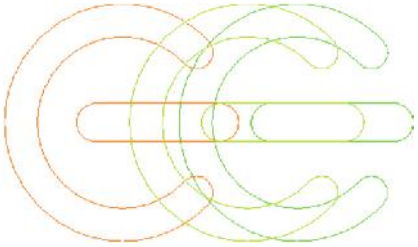

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