3rd Training Webinar: Buildings and Industry Technologies

Energy Efficiency Support Programme

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ECONOLER

Part A: Buildings

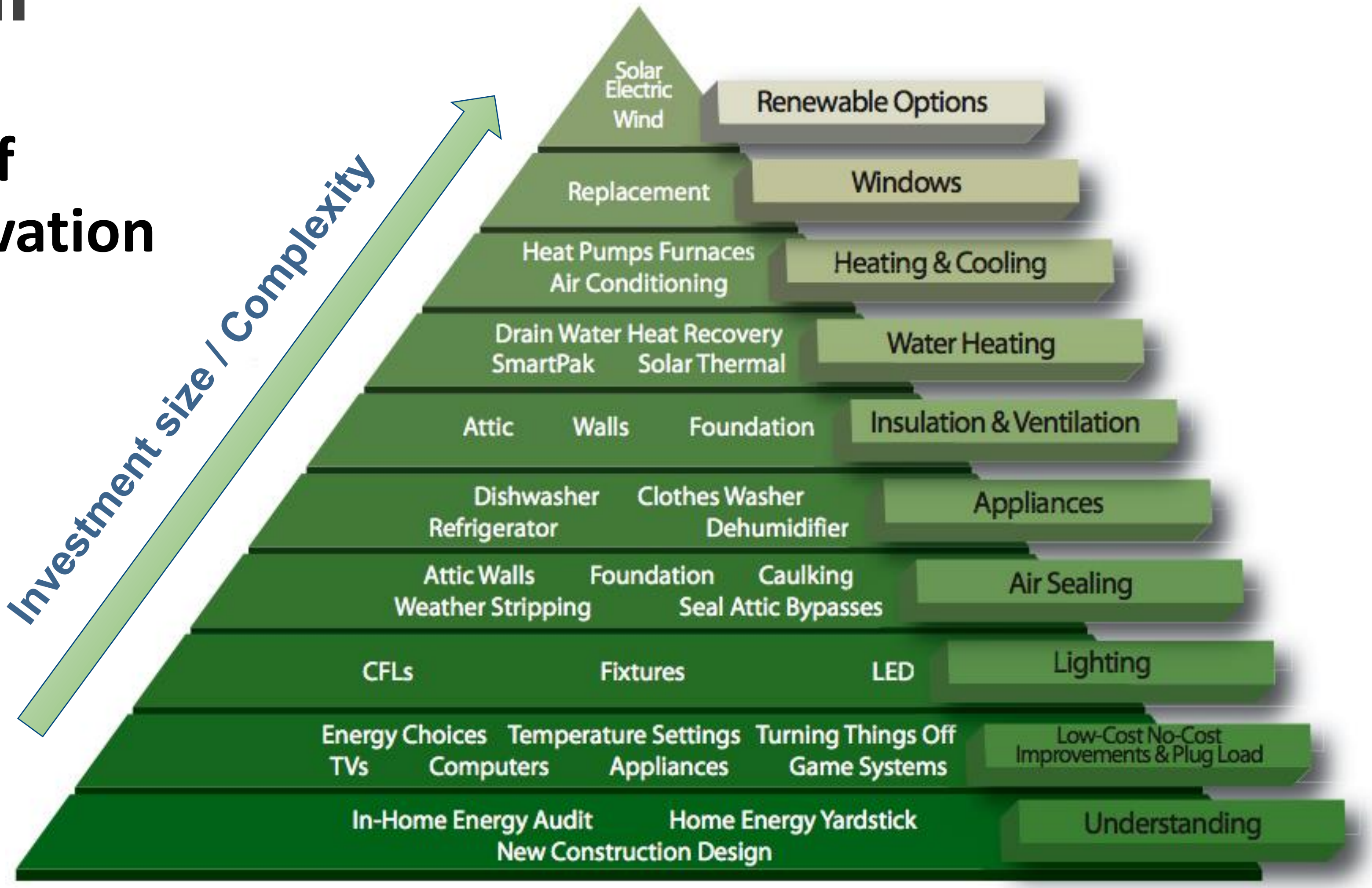
Applications in buildings

Agenda – Part A: Buildings

1. Prioritizing investments
2. Building Management System (BMS)
3. Lighting
4. Air conditioning
5. Cooling

Prioritizing investments: The pyramid of energy conservation

The pyramid of energy conservation



Source : Minnesota Power

Interdependence of EE and RE measures

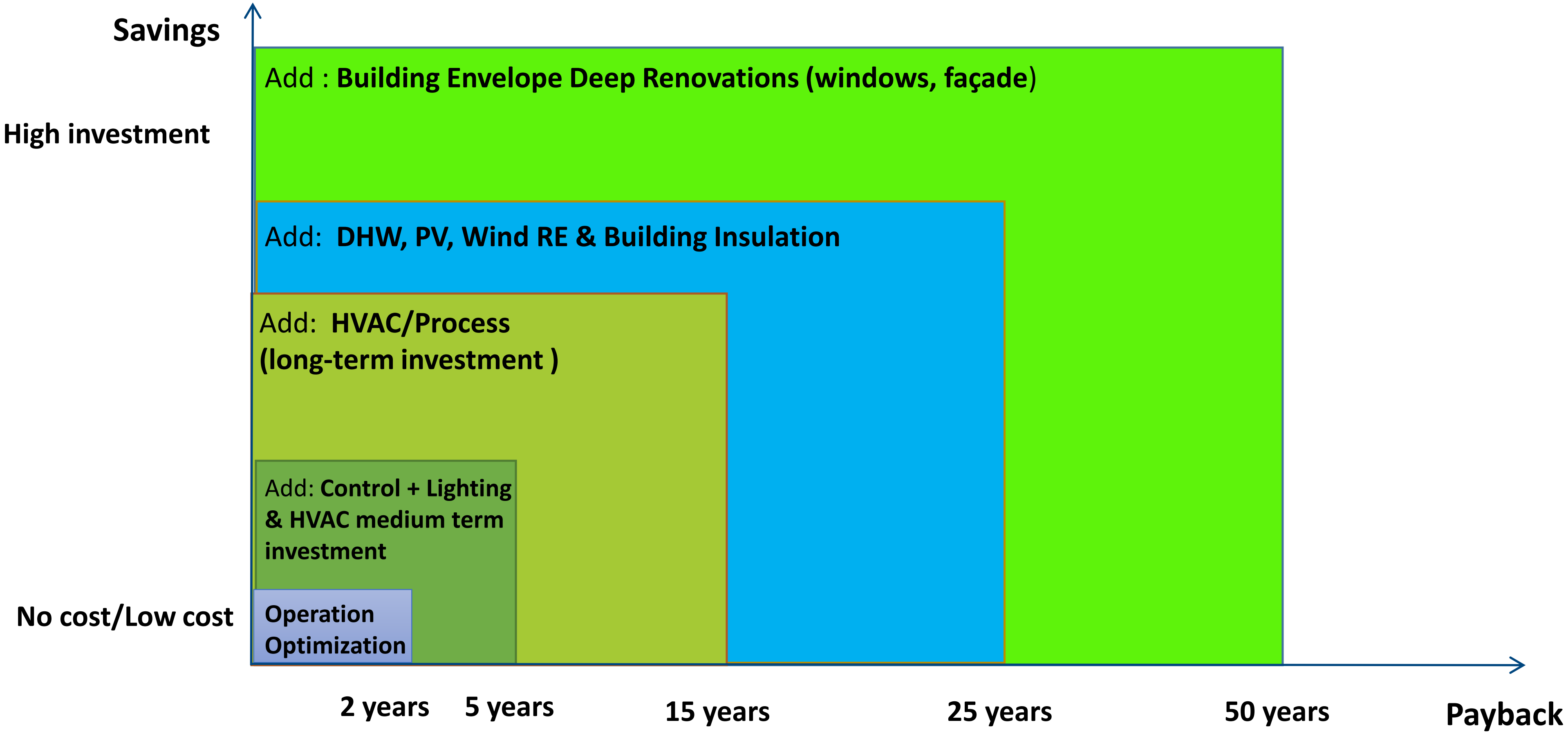
Energy efficiency examples:

- **Lighting projects** should be calculated/implemented before **AC system** improvement
  - The reduced load may result in lower required chiller or ice storage capacity
- Measures of **solar films** should be calculated/implemented before the **AC system** improvement
  - Reduced AC load should be considered
  - Less chiller capacity results in more savings

Renewable energy example:

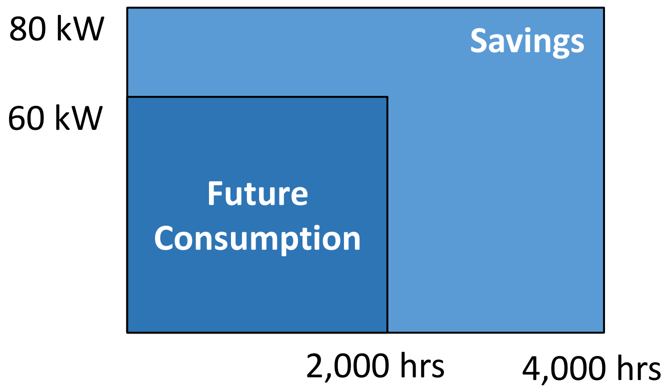
- **Aerators, low-flow showerhead and heat recovery** measures should be considered before sizing **solar hot water systems**
  - Always first calculate the reduction in load and then the solar hot water produced for the reduced load
- Implementing first energy/water conservation and energy efficiency measures allows for sizing smaller renewable energy equipment

Investment size, savings and payback period

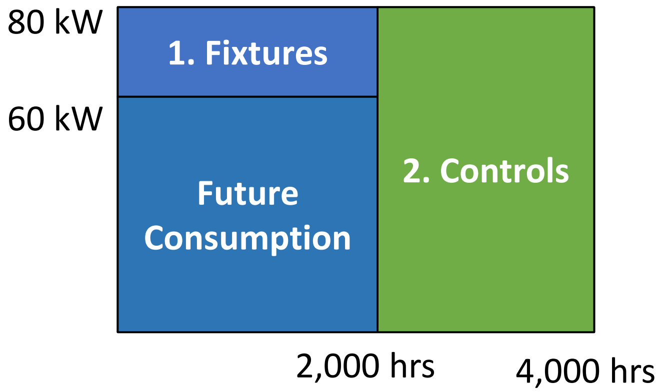


Presenting combined energy savings

- The order in which projects are calculated will have an influence on energy savings and payback for each measure
- Calculating high returns and short paybacks first often results in less measures implemented due to reduced interest for the last measures presented.
- **Example:** Project with lighting fixtures replacement and control technology

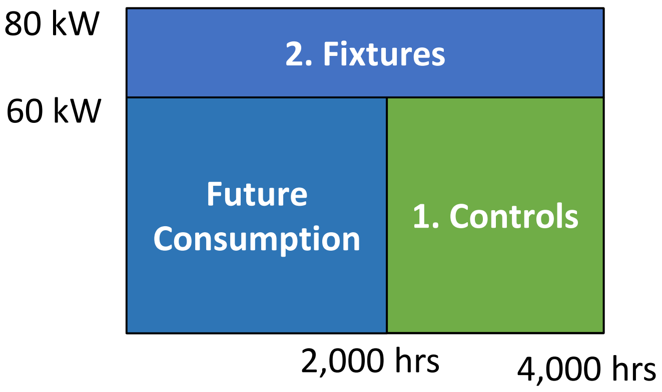


Presenting combined energy savings



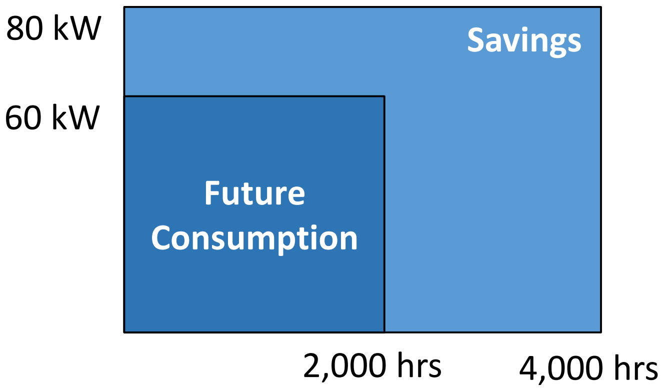
If we implement controls first

- Hours reduced by 50%
  Payback: 6 months
- Then the economics of the fixture replacement will be less appealing
  Payback: 9.6 years
  (rejected)



If fixture is replaced first

- Hours of operation : 4,000 hours
  Payback : 4.8 years
  (much better)
- Control is then replaced
  Payback : 1.4 years
  (still quite good)

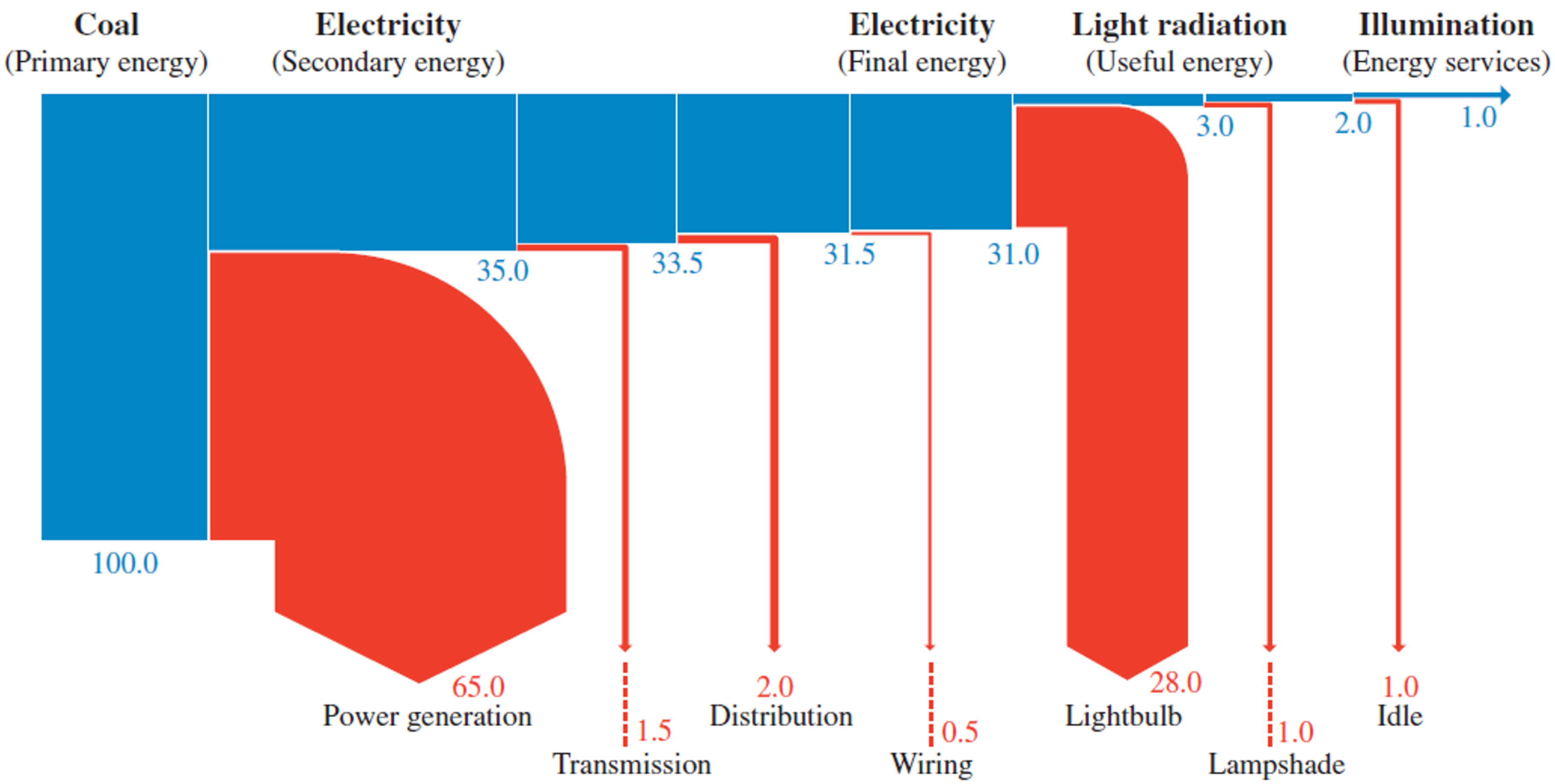


Bundled into one measure

- Payback : 2.3 years
  (perfectly acceptable)
- <u>Order of calculation and presentation matters</u>

Presenting energy loses against actual energy services delivery: Lighting example

- Example of a lighting system with electricity produced from coal (Sankey diagram)

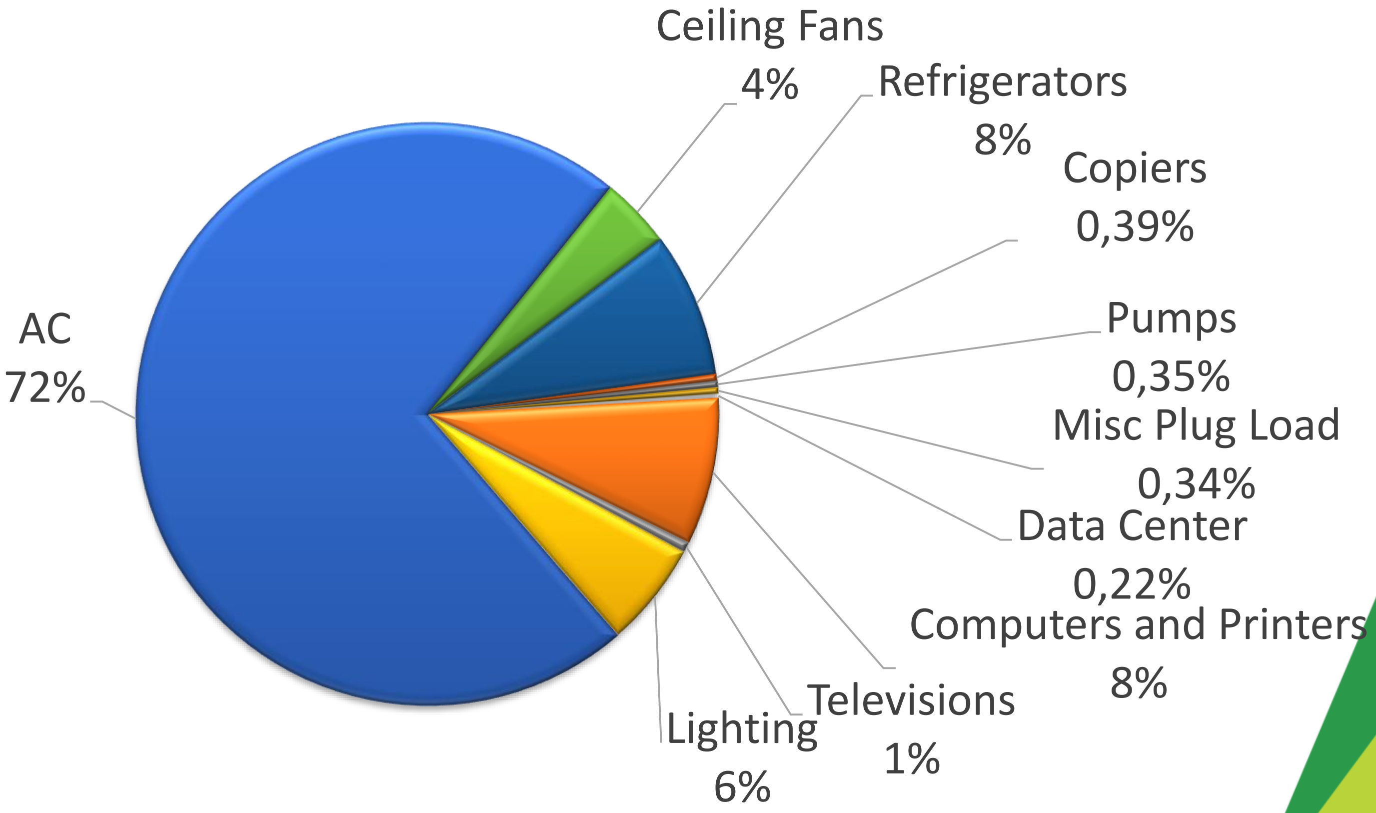


Source: GEA, 2012: Global Energy Assessment – Toward a Sustainable Future

Energy balance example: Hotel in Ghana

Energy balance

- Can be developed for energy and for demand
- Can be compared with benchmarking figures of average building and with best practice
- Identification of the most important energy users in the facility
- Reduce the risk of overestimating or underestimating savings

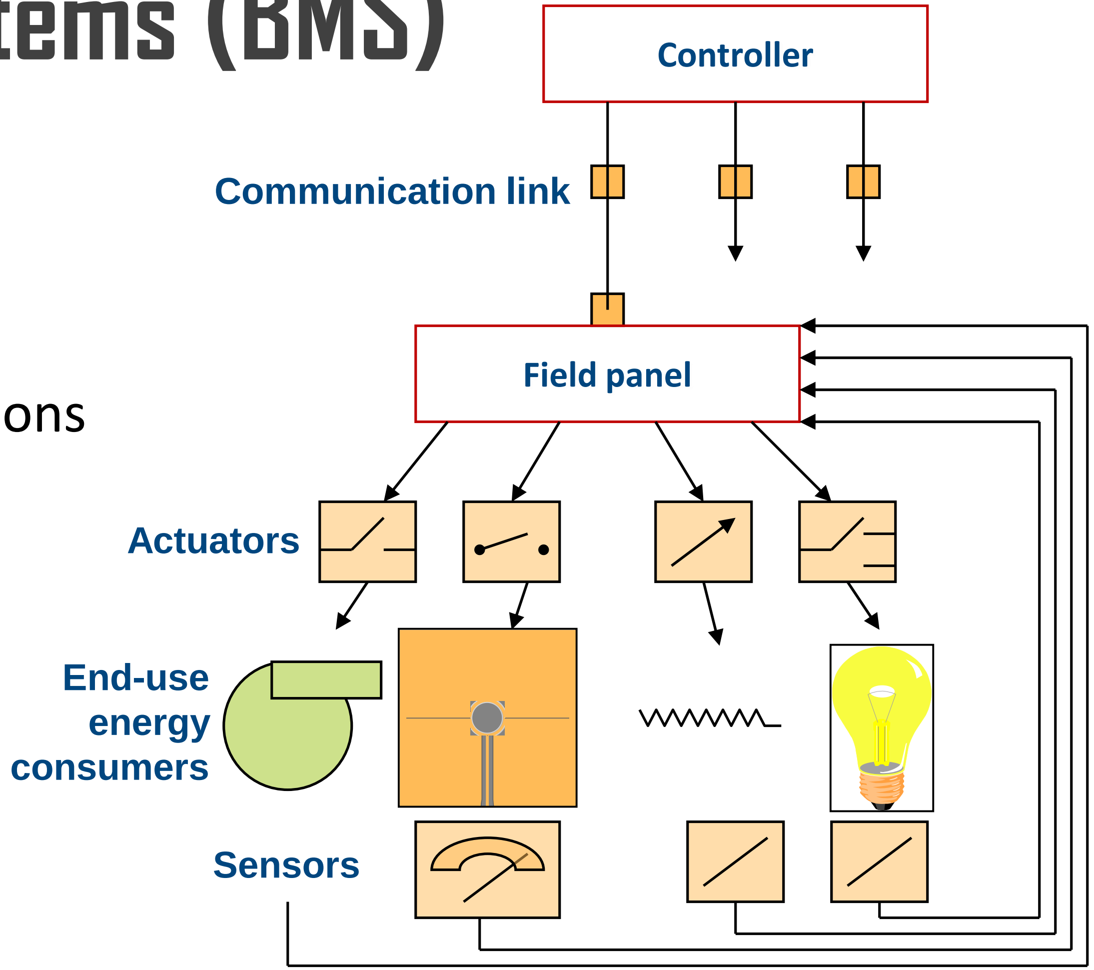


Agenda – Part A: Buildings

1. Prioritizing investments
2. Building Management System (BMS)
3. Lighting
4. Air conditioning
5. Cooling

Building Management Systems (BMS)

- Centralization of controls
  - Remote diagnosis and adjustment
  - Very efficient for some buildings
  - Can include energy management options
- Most common functions of energy management controls:
  - Start/stop control
  - Temperature setback
  - Flow control
  - Enthalpy control (for outside air control)
  - Chiller and boiler optimization
  - Duty cycling
  - PID algorithm of ventilation control instead of P
  - Monitoring/alarm



Agenda – Part A: Buildings

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Lighting: Definitions

Lighting Definition of Common Terms

- **Lumen**: measure unit of the total "amount" of visible light emitted by a source (symbol: lm)
- **Lux:** unit of illuminance and luminous emittance, measuring luminous flux per unit area; equals 1 lm/m^2 (symbol: lx)
- **Luminous efficacy**: measure of how well a light source produces visible light; it is the ratio of luminous flux to power in lm/W
- **Colour temperature of a light source:** the temperature of an ideal black-body radiator that radiates light of comparable hue to that of the light source

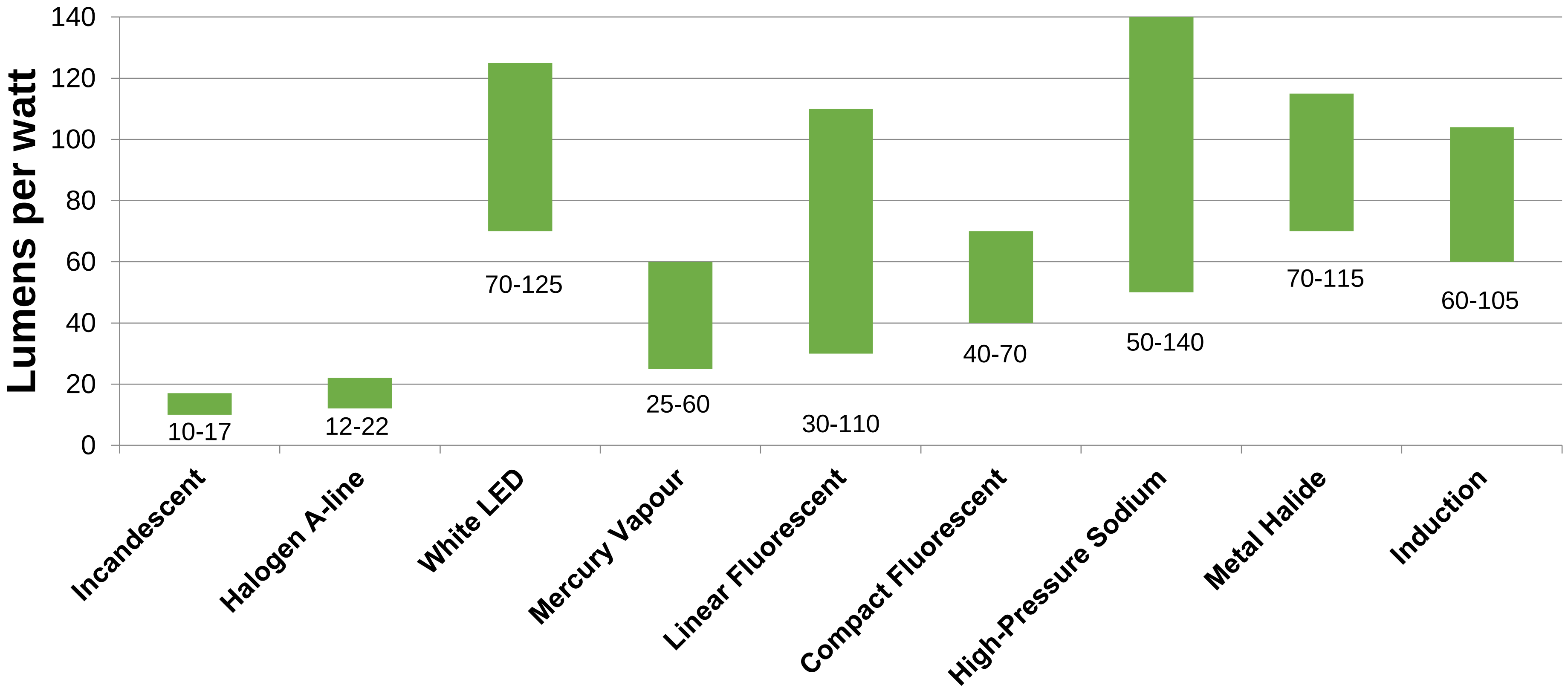
Lighting: Recommended levels

Lighting Level Recommended by the Illuminating Engineering Society (IES)

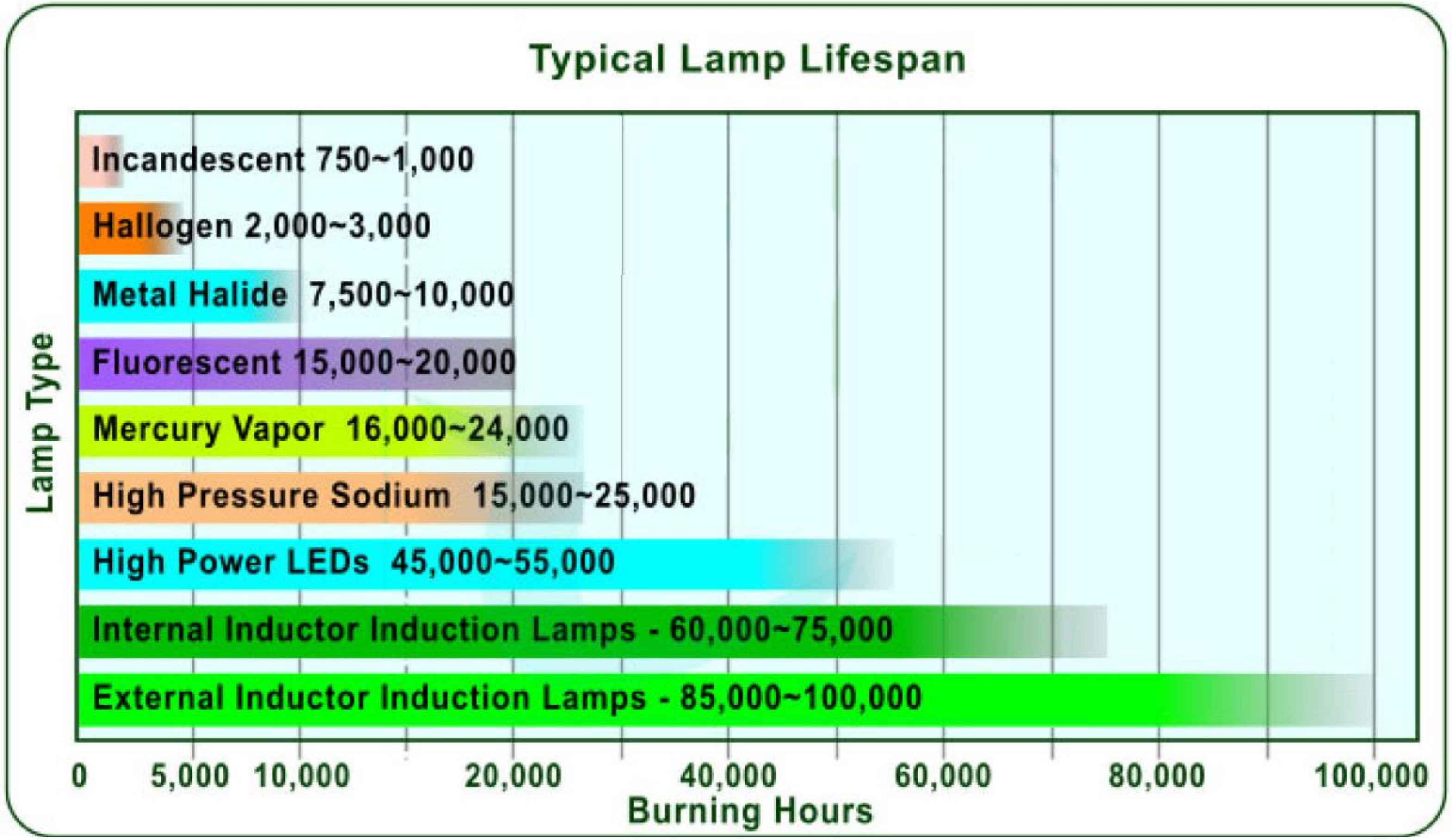
Building area	Lux
• Office – general	300-500
• Auditorium	400
• Restroom	100-300
• Dining room	100
• Conference room	300-500
• Corridors and stairs	50-100

Exterior	Lux
• Local roads	3 to 8
• Highways	6 to 14

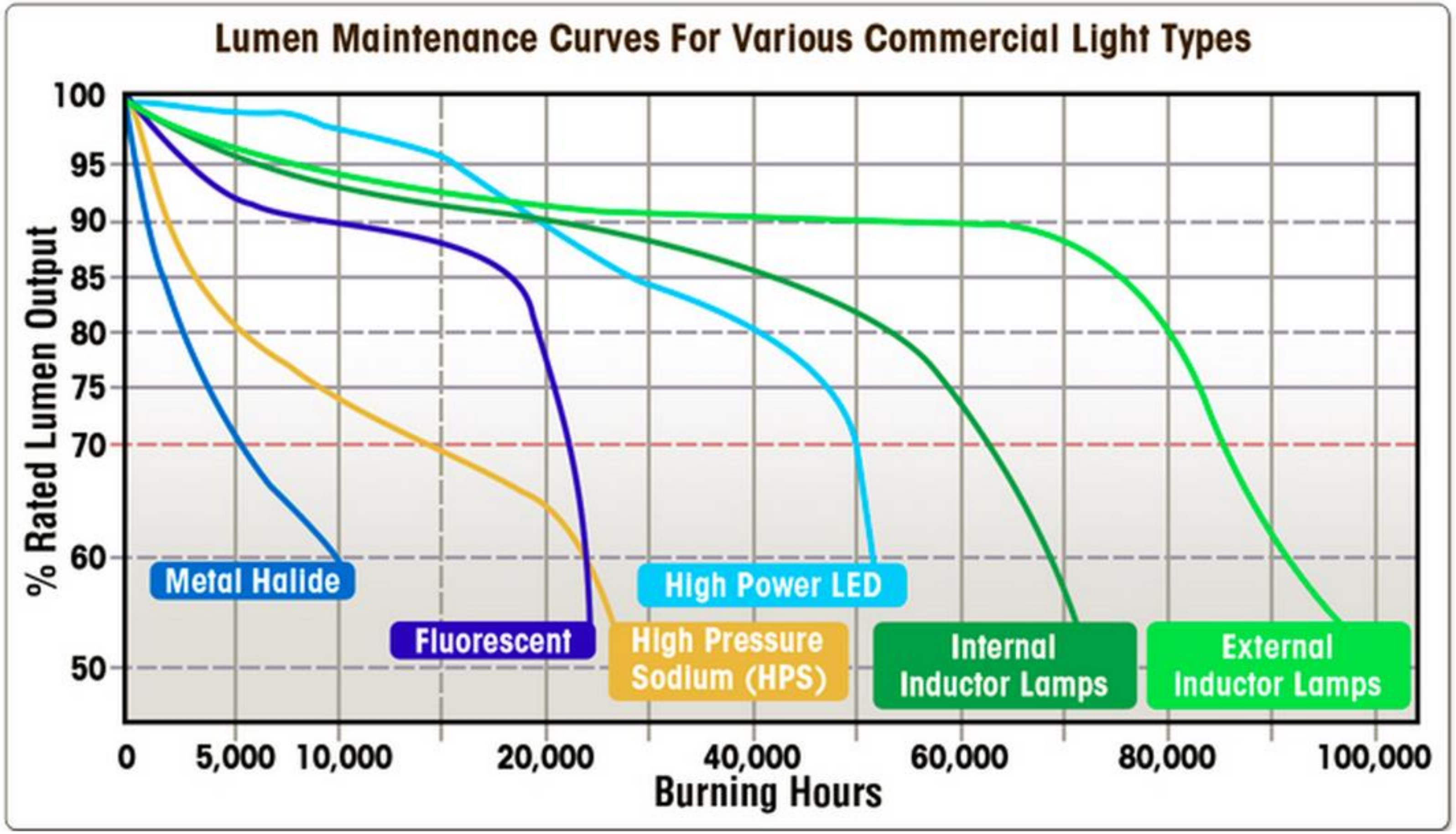
Lighting: Efficiency and types



Lighting: Typical lifespan



Lighting: Lumen maintenance



Lighting: Audit

- Lighting levels:
  - Use a light meter to check the current level of lighting in different zones (Lux)
  - Verify adequate lighting against best practices (e.g.: office = 350 lux)
  - Identify overlighted or underlighted zones
- Wattage per unit area:
  - A good indicator of efficiency
  - Benchmarking with reference values of W/m^2
  - For example, Classroom:
    - Existing: 19 W/m^2
    - Efficient retrofit: 8,6 W/m^2

Lighting: Audit

- Compare occupancy with actual hours of operation
  - Information from operator or from metering campaign
- Other factors to consider:
  - Ballast factors for fluorescents and High-intensity discharge lamps (HIDs)
    - IMPORTANT: Check power factor measured. Low power factors are common for low-quality ballasts
  - Burn-out fraction
  - Schedules – for various sections of the building
- Look at the fixture lenses
  - Discolored/deteriorated lenses retain a large portion of light
  - Can be replaced with transparent ones
- Look at the fixture itself
  - If yellowish reflective surfaces, new reflectors could be used to increase lumen output from the fixture
  - Opportunity to reduce the number of tubes while maintaining the same lighting level

Lighting: Rules of Thumb

- LEDs use 5 to 6 times less wattage than incandescent
- T12 and T8 fluorescents: can be replaced with 12 to 20 W LED
- Always consider ballast factor for fluorescents, not for LEDs
- Incandescent and fluorescent exit fixtures: can be replaced with LEDs
- Most lighting retrofit are now aiming for LEDs

Lighting: Improvements

- Separate lighting levels: Provides the required lighting level only on the surface where a task is being performed. Common spaces where no specific activities are being carried out have a lower lighting level.
  - Lower energy consumption
  - Lower lamp wattage
  - Fewer fixtures
  - Improved lighting quality
- Controls: A central control system increases profitability and efficiency.
  - Switches off power in unoccupied zones
  - Optimizes of hours of operation
    - Central control system
    - Modify zones for fixtures, add controls
  - Timers, photocells, motion sensors
  - Addressable lighting control

Lighting: Improvements

- Profitability of various energy efficiency measures in existing buildings

Measure	PBP (years)
Use LED exit signs	< 5
Replace incandescent lighting with LEDs	2 to 4
Install low-consumption ballasts	1 to 2
Control through timers, photocells, motion sensors	< 1
Modulate luminous intensity as a function of natural daylight	5 to 6
Use table lamps and reduce overall lighting level	1 to 2

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4. **Air conditioning**
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Air Conditioning: Rooftops and split units

- Capacity: 1.5–130 tons
- Efficiency: 1.2 and 1.6 kW/ton
- Operation: Direct expansion
- Recommended for load less than 100 tons. For loads larger than 100 tons, it is recommended to install a chiller or VRF system for greater efficiency.
- Lifespan: 15 years

Air Conditioning: Heat pumps

- Measures of efficiency
  - Coefficient of performance (COP)
    - Usually ranges from 2.5 to 5.
  - $COP = \frac{\text{Refrigeration or heating capacity (kW)}}{\text{Energy input (kW)}}$
  - Other measures of efficiency: SCOP, EER, SEER, etc.
  - Be careful with indoor and outdoor temperatures used for peak efficiency and seasonal efficiency
- Can be used in central or decentralized systems
- Water loop heat pumps, geothermal heat pumps, variable refrigerant flow systems (VRF).

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Cooling: Chillers

- Same operating principle as the heat pump.
- Expansion valves
- Condensers

Cooling: Chiller types

1. Reciprocating compressor

- First compression system widely used
- Back and forth movement of a piston in a cylinder
- Open, semi-hermetic and hermetic
- Exists in practically all capacities
- Efficiency: 1.1 to 1.2 kW/ton
- More often air cooled: can be placed on roofs

2. Scroll compressor

- Relatively new on the market
- Not many mobile parts
- More resistant
- From 10% to 15% more efficient than the reciprocal type
- Tends to replace the reciprocal type for small capacities
- Efficiency: 0.80 to 0.95 kW/ton

Cooling: Chiller types

3. Screw compressor

- Have been used in air compression for a long time
- Mainly used for liquid chillers
- Efficiency closed to the centrifugal compressor’s (0.7 kW/ton)
- Capacities: about 50 to 250 tons
- Open and semi-hermetic

4. Centrifugal compressor

- Have been used for liquid chillers for a long time
- Equipment efficiency up to 0.52 kW/ton
- Available in open or semi-hermetic type
- Capacities: about 50 to 250 tons
- Water cooled (cooling tower)
- More difficult to use in humid climates

Cooling: Chiller condenser types

Air-cooled

- Air-cooled condensers cool down the cooling medium going back to the compressor.

Water-cooled

- Water-cooled condensers or cooling towers are used to cool down the cooling medium going back to the compressor.
- They are more efficient than air-cooled condensers.

Cooling: Chillers

- Simple measures for chillers
  - Chilled water temperature reset (Based on room thermostats, outdoor temperature and supply-demand differential temperature)
  - Condenser temperature control
  - Free cooling on chillers (when outdoor temperature is low enough)
- Warning: Always take into account dehumidification requirements.
- Is the peak demand very expensive?
  - Consider an ice storage system

Cooling: Cool storage

- This is an attractive option for large buildings where cooling requirements are present year-round and in countries where peak demand is costly.
- Solid ice storage (ice banks):
  - The system is based on a tank of water which contains a series of coils through which chilled refrigerant is circulated. Solid ice builds up around the coils until all the water is frozen.
  - Capacity: up to 200 ton-hours
- Water storage in tanks:
  - Can also be used for hot water storage (depending on the season)
- Cool storage can be full or partial.
  - Full storage: During off-peak periods, compressors generate a large quantity of ice or water; during peak periods the ice or water is used to fulfil cooling requirements.
  - Partial storage: The chiller operates continuously both to charge the storage at night and help meet cooling loads during peak periods.

Heating and cooling: Simple load calculations

- Two quick (easy) methods to calculate heat and cooling load:
  - Degree-Day Method: correlates the outside temperature with the energy required for heating based on the assumption that heating is required when the average daily temperature is less than 18°C (Balance temperature)
    - Use carefully as actual balance temperature might be different than 18 °C
    - A correction factor should be used to account for thermal mass of the building (which lowers the need for cooling and heating)
  - Bin Method: must be used when several parameters, such as efficiency of the HVAC system, vary with the outdoor temperature. A bin is then a temperature interval around which conditions are constant
    - More precise as efficiency can be adjusted according to outdoor temperature
    - RETScreen hourly weather data (Performance module) can be used to produce a BIN excel file.

Part B: Industry technologies

Applications in industry

Agenda – Part B: Industry technologies

1. Technologies commonly used in industrial applications

2. Refrigeration

3. Compressed Air

4. Motors and Drives

5. Boilers

6. Q&A

Industry technologies use in the region

	Common in ECOWAS region?	Perceived training needs
Diesel generators	Very common	Low training needs *(significant experience / medium complexity)*
Refrigeration	Common	High training needs *(low experience / medium complexity)*
Compressed air	Some industrial companies	High training needs *(low experience / medium complexity)*
Motors and drives	Common	Medium-high training needs *(some experience / high complexity)*
Steam	Some industrial companies	Medium training needs *(some experience / medium complexity)*
Boilers	Common	Low training needs *(low experience / low complexity)*
Heat Pumps	Not very common	Medium training needs *(low experience / medium complexity)*

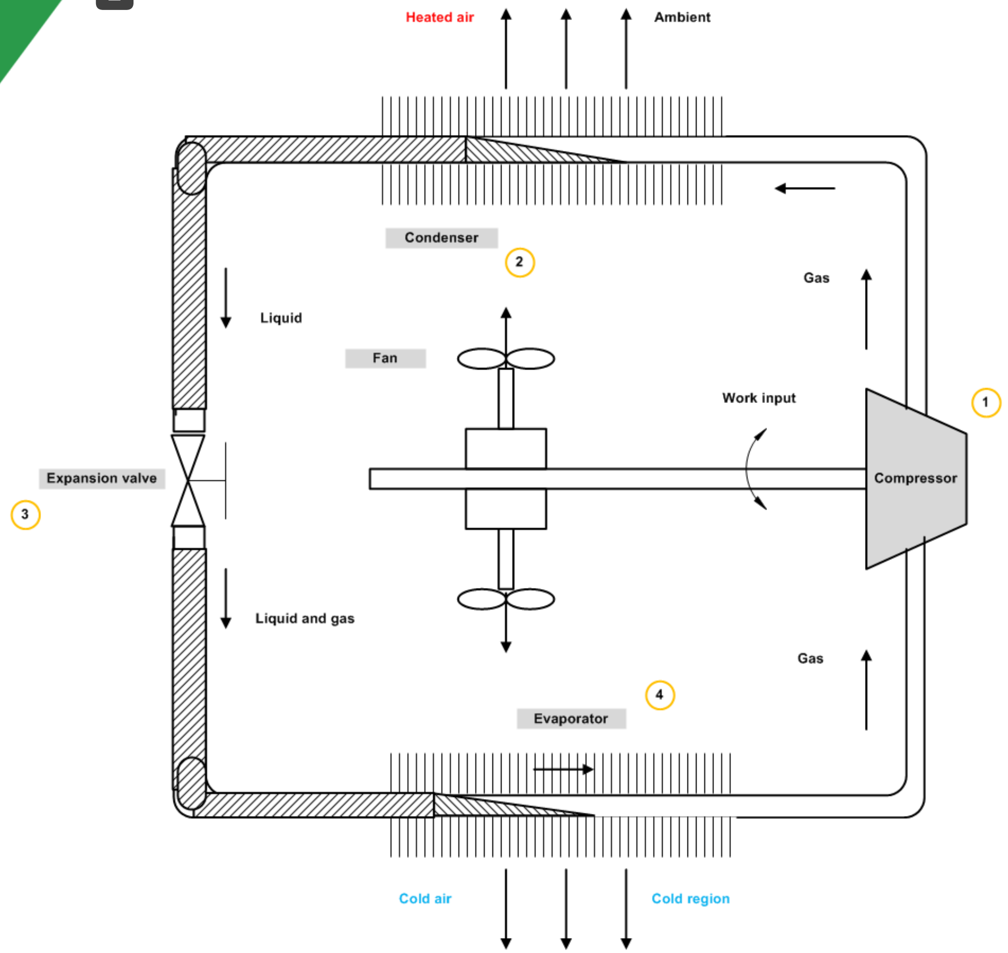
Refrigeration

1. Technologies commonly used in industrial applications
2. **Refrigeration**
3. Compressed Air
4. Motors and Drives
5. Boilers
6. Q&A

What are refrigeration systems

- Refrigeration systems are **energy intensive equipment** with significant environmental impacts.
- Refrigeration systems are heat engines which are designed to **convert electricity into heat (or coolth)** using a process.
- There are **many different types of refrigeration systems** since these are designed to suit the wide range of cooling needs in residential, commercial and industrial settings. Most popular ones are:
  - Vapour-compression refrigeration systems,
  - Absorption refrigeration systems,
  - Air-standard refrigeration systems,
  - Jet ejector refrigeration systems,
  - Thermoelectric refrigeration,
  - and thermo-acoustic refrigeration.
- The **most common equipment use the vapour-compression cycle** which has four basic components and a refrigerant

And the corresponding vapour-compression cycle 4 stages



The vapour compression cycle has four stages and these are as follows:

1. Compression
2. Condensation
3. Expansion/throttling
4. Evaporation

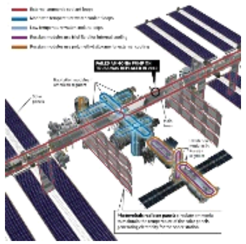
Where are they used

Grocery retail

Manufacturing

Data centres

Catering



Space science

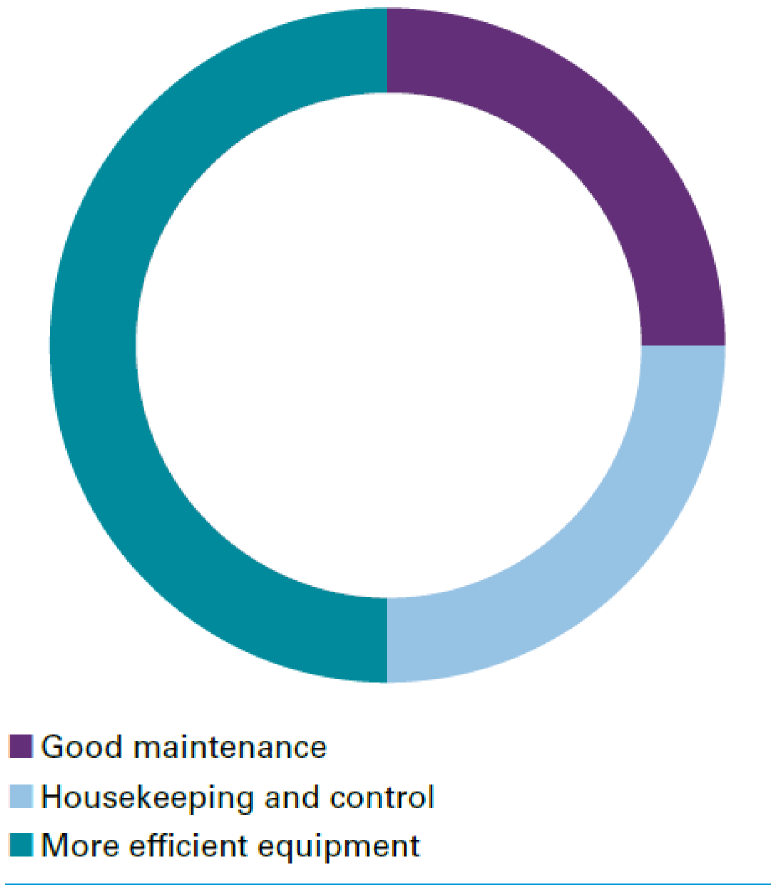
Transport

Residential comfort

Commercial comfort

Military

Low cost EE measures can bring significant savings



Measures that require **little or no investment** can lead to **savings of up to 20%** of running costs

Common areas for saving opportunities (1/2)

Display cabinets	High-efficiency cabinets can use up to 30% less of energy and usually have a payback of less than 2 years
Cold rooms	These should use air-tight stores with good door management, lighting and defrost control. Normal payback of less than 2 years
Compressors	Use of liquid pressure amplification can lead to savings up to 25% and have a payback of 3-5 years
Condensers	A good maintenance of the condensers (keeping them clean) can bring savings up to 10% with an immediate payback
Evaporators	Ensuring the evaporator only defrost when needed can lead to savings up to 9%. Intelligent defrost controls have a payback time of 2 years

Common areas for saving opportunities (2/2)

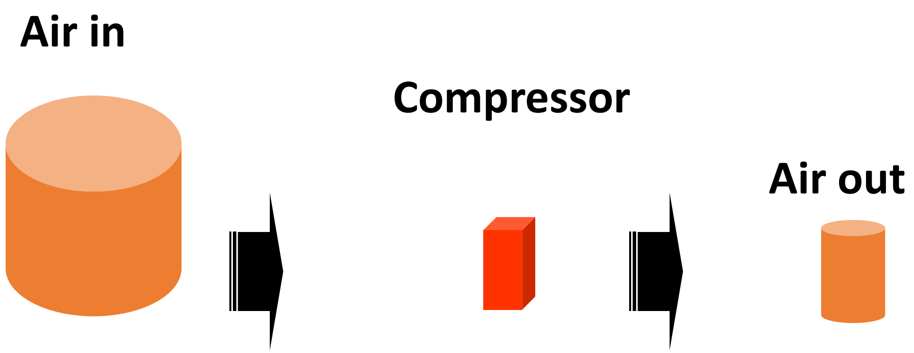
Heat recovery	Using the waste heat to heat water – this could be done with an installation of a “desuperheater” – which can bring savings of up to 30% in the boiler energy usage. Typical payback time is 3 to 5 years
Reducing refrigerant leaks	With refrigerant leaks reduced to almost zero, the savings can amount to 15% and payback can be as low as less than a year for a large refrigeration system
Pipe insulation	Ensuring that the pipe insulation is adequate (especially if pipes are outside) can bring reductions of up to 5%
Maintenance	Having a maintenance schedule (including some of the other measures listed) will ensure all procedures are running at their optimum. Payback time is almost immediate
Monitoring	A regularly monitoring of the key performance parameters of refrigeration systems can bring at least 5% savings with very low payback periods

Compressed air

1. Technologies commonly used in industrial applications
2. Refrigeration
3. **Compressed Air**
4. Motors and Drives
5. Boilers
6. Q&A

What is compressed air

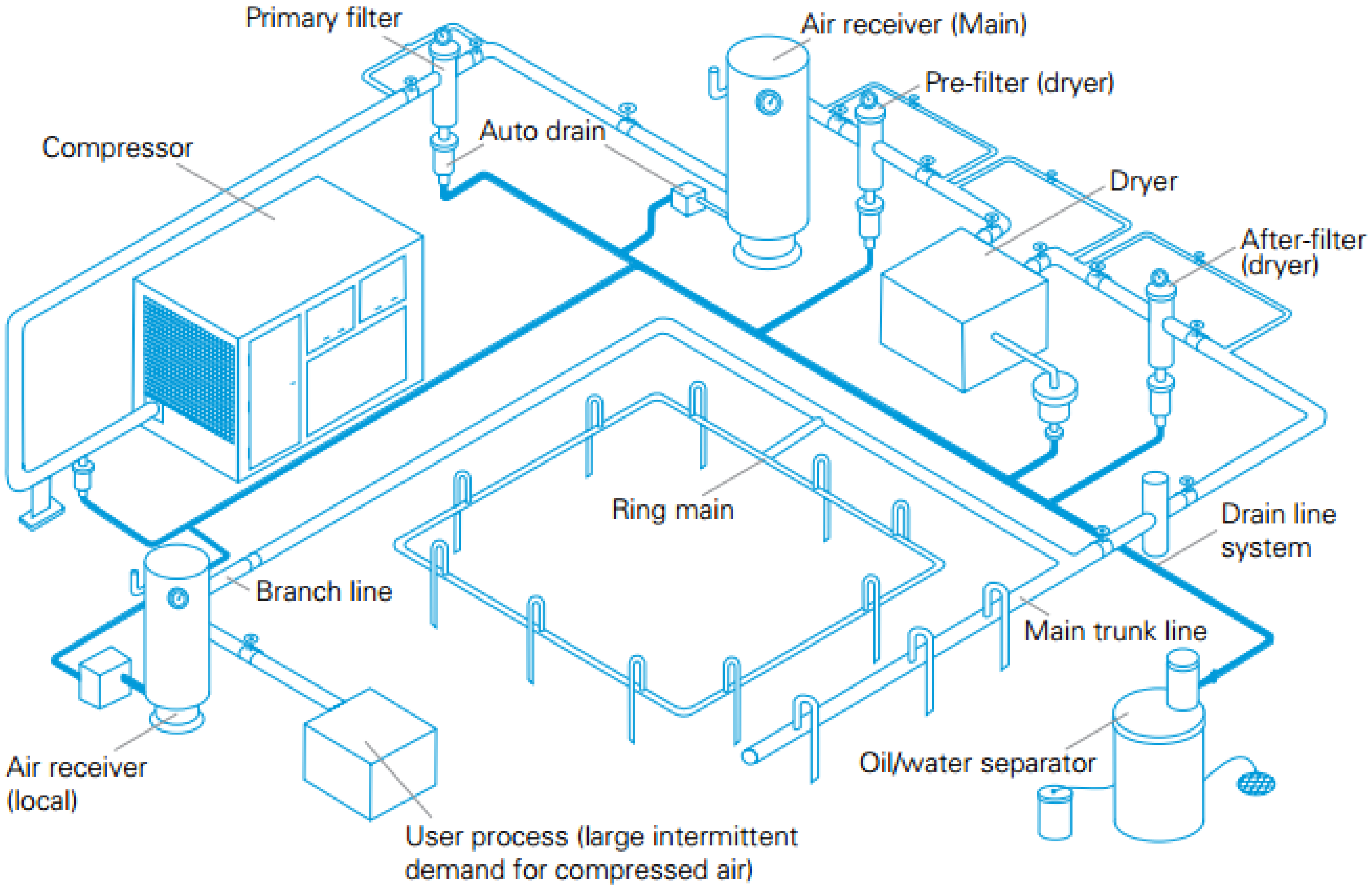
Compressed air - is air which is at a higher pressure than normal atmosphere.
It is used as a way of storing and transferring energy.



Ambient air
Pressure: 1 bar (absolute)
Volume: $8m^3$
Mass: 10 Kg

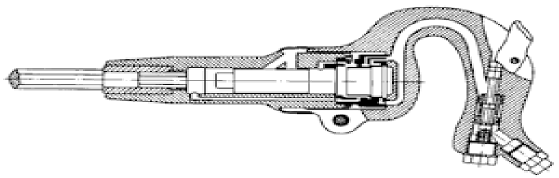
Compressed air
Pressure: 7 barg(gauge) (8 bar absolute)
Volume: $1m^3$
Mass: 10 Kg

Typical compressed air system

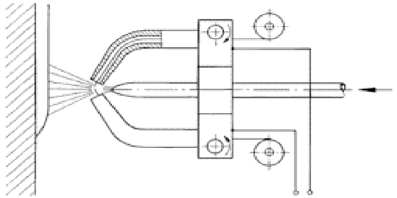


How compressed air is used

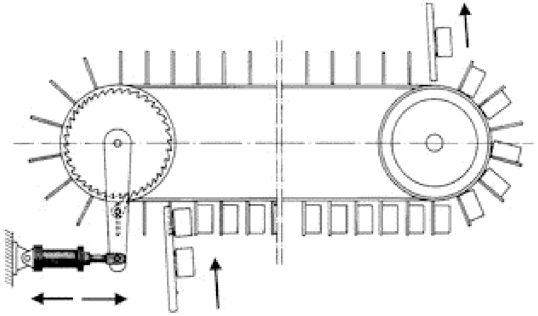
Compressed air - has many uses such as powering machinery, hand tools and for control systems.



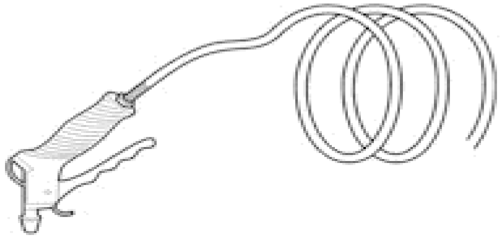
Pneumatic Drives
Example: Hammering compressed air tool
Picture: Valveless pneumatic jackhammer



Spraying
Example: Sandblasting, spray painting
Picture: Metal spraying arc unit



Materials Handling
Example: Conveyor units
Picture: Height bridging with a pneumatically driven elevator



Blowing
Example: Blowing out, cleaning
Picture: Blow-out gun with spiral hose

Image source : carbon trust 2014

Calculating running costs

- Quick estimate
  - Check motor rating – e.g. 75 kW
  - Check loading e.g. 50%
  - Power = 75 kW * 0.5 = 37.5 kW
  - Multiply by hours run and cost/kWh
    - 37.5 kW * 2000 hours * 0.1 USD = 7,500 USD per year
    - assumed cost of electricity is 0.1 USD /kWh
- More accurate method
  - Include no load power with the quick estimate method.

Any flow during no load hrs indicates a leak in the system

Areas for potential improvement opportunities

Usage policy, train staff & encourage awareness

- Because compressed air is so convenient and easy to use, it is often misused. People perceive air as being free and are not aware of the cost.

Switch off policy

- When not in use at tea breaks etc. or implement automatic control – an idling compressor can still use up to 20-70% of it's full load when not in use!

Investigate if compressed air is even needed at all

- For example, compressed air is often used for pick and place applications, where a vacuum pump would use ~50 – 60% less energy
- Many hand tools such as angle grinders use compressed air but electronic tools can use up to 70% less energy

Regulate air pressure

A 1bar drop in pressure will result in 6-7% savings

- Inspect end use application requirements and reduce pressure where possible. Operating at too high a pressure wastes energy but can also result in increased wear and lead to leaks. Very common to see pressure higher than necessary (sometimes this is to compensate for leaks). Also try to minimise pressure fluctuation

Regular & Preventative Maintenance

- Up to 10% savings

Leak reduction is a crucial area

Reducing leaks is the single most important energy saving action for most sites

- All systems will have leaks (even new ones).
- A leakage target of 5-10% should be the aim for a well maintained system, but leakage rates on a poorly maintained systems could be as high as 50%.
- System pressure has a big impact on the leakage rate (higher pressure = high leakage)
- High levels of leakage also result in reduced performance, increased maintenance and shorter life

Common areas of leakage

- Leaking Valves – either left open or failed
- Leaking hoses, pipes, flanges and pipe joints
- Leaking pressure regulators
- Air using equipment left in operation when not required

Fact:

Have an ongoing test and repair programme for leaks. Leaks reappear and a 3mm hole could cost over £1,000/year in wasted energy, enough to cover the cost of buying an ultrasonic leak detector.

How to check for leaks

- **Listen:** Turn off end users, run the compressor and listen for hissing/rasping sounds
- **Look:** Turn off end users, run the compressor, add soapy water to pipework and look for bubbles
- **Detect:** Hire or purchase an ultrasonic leakage detector - most effective method

The system should always be depressurised before repairing leaks

Equipment for leak detection

Very effective even in high background noise areas

Waste heat recovery

The compression process generates **large amounts of heat** (temperature of the air exiting the compression stage is 80–170ºC). This air must be cooled which is normally achieved by air or water cooling. The **extracted heat is often wasted!**

You can recover most of this heat. In most cases**, 25–80% of the electrical energy supplied to a compressor can be recovered and used for:**

- Space heating for an adjacent building
- Domestic hot water heating
- Preheating boiler feed water
- Process heating or preheating
- Producing warm air to keep product and packing materials dry
- Providing heat to regenerate desiccant dryers.

Motors and drive

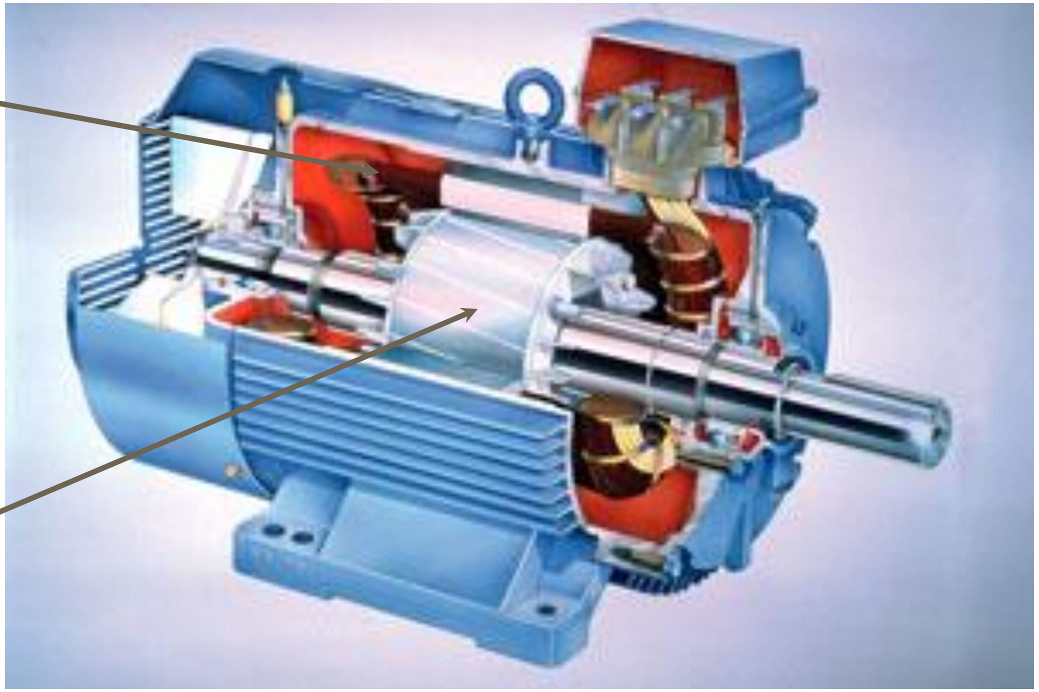
1. Technologies commonly used in industrial applications
2. Refrigeration
3. Compressed Air
4. **Motors and Drives**
5. Boilers
6. Q&A

What are they

- An electric motor **converts electrical energy into rotating mechanical energy** to drive devices such as pumps, fans or conveyors
- The mechanical output **power delivered** by the motor **is measured in kW** and is a **function of the speed** (rpm) **and the torque** (turning force)
- By far the **most commonly used motor is the AC induction motor** which uses a conventional alternating current to induce torque on its rotor causing it to rotate
- Motors form **part of larger systems** such as pipes and ductwork HVAC systems so they **need to be understood within the context of the system in which the operate**; simply concentrating on the motor itself can mean energy saving opportunities are missed.

Motor design: basic elements

Stator
Encloses the rotor, typically wound and provides the electromagnetic field which creates the rotational motion



Source: AEEMA

Rotor
The rotating 'shaft' of the motor – which is either has energised copper windings, permanent magnets or in simply ferrous material.

Common sources of inefficiency

Bad Practice	Good Practice
Motors are left running when not needed	A systems approach is taken to managing motors and drives
No active management of the organisation's motor inventory	Procedures and controls are in place to minimise motor running
A lack of understanding of the benefits of Higher Efficiency Motors (HEMs) and Variable Speed Drives VSDs	There is planned maintenance of all motor and drive systems
A lack of maintenance of motor and drive systems	Higher Efficiency Motors (HEMs) are specified as standard for all new equipment.
HEMs are not specified for new equipment	Procedures are in place to assess the repair/replace option for failed motors
Failed motors are always repaired – the option to replace is not reviewed	Motor installation and replacement includes laser alignment of the drive system
Motor and drive systems are not correctly aligned	Belt driven systems are reviewed for options of changing the belt type
Where belt drives are used they are not correctly tensioned	The motor inventory has been reviewed to identify oversized motors and systems where Variable Speed Drives (VSDs) or soft starters could be used
Oversized motors are used	The organisation is aware of developments in motor and drive technology and reviews these for potential application
The options for soft starters have not been explored	

Energy Savings Opportunities

Motor Management Policy

- A structured approach to repair and maintenance to help realise savings and achieve additional benefits like reduced down time
- Should include:
  - Schedule and procedure for motor maintenance
  - A plan for purchasing new and more efficient motors
  - A plan for dealing with failed motors - lifecycle costing to compare repair or replace
  - A method of tracking the number of times a motor has been rewound

High Efficiency Motors (HEMs)

- Replacing motors with high efficiency versions saves energy
- HEMs will cost more but are likely to use 2-5% less energy and so should be considered in purchasing decision
- Adapted versions of AC induction motors using permanent magnets and reluctance motors are now offering the high efficiencies
- Other Benefits include:
  - Higher power density resulting in smaller unit sizes
  - Wider speed ranges
  - Increased starting torque

Speed Control

- Speed reduction/control can make significant energy savings when applied to fans, pumps and compressors
- Speed control should be applied where existing flow rates are excessive (e.g. ventilation, heating and/or chilled water pumps) and where flow control is currently being provided by ‘energy inefficient’ means (e.g. throttling valves/dampers, pressure relief/spill-back loops)
- Automatic speed control:
  - Need to determine control parameter (e.g. pressure, temperature differential or air quality)
  - Need sensor and controller
  - New controls may not be necessary where replacing existing motorised valve/damper control

Motors: High-Efficiency Motors

- Typical Efficiency of Electrical Motors

Efficiency of Electric Motors		
Power	Standard	High Efficiency (average value)
150 kW (200 HP)	92,5	95.4
75 kW (100 HP)	91,7	95.0
37,3 kW (50 HP)	91,4	94.1
18,7 kW (25 HP)	89,6	93.0
11,2 kW (15 HP)	88,4	92.4
7,5 kW (10 HP)	87,3	89.4
3,7 kW (5 HP)	84,6	89.5
1,5 kW (2 HP)	79,9	85.5
1,1 kW (1.5 HP)	78,0	85.5
0,7 kW (1 HP)	74,8	84.0

Boilers

1. Technologies commonly used in industrial applications

2. Refrigeration

3. Compressed Air

4. Motors and Drives

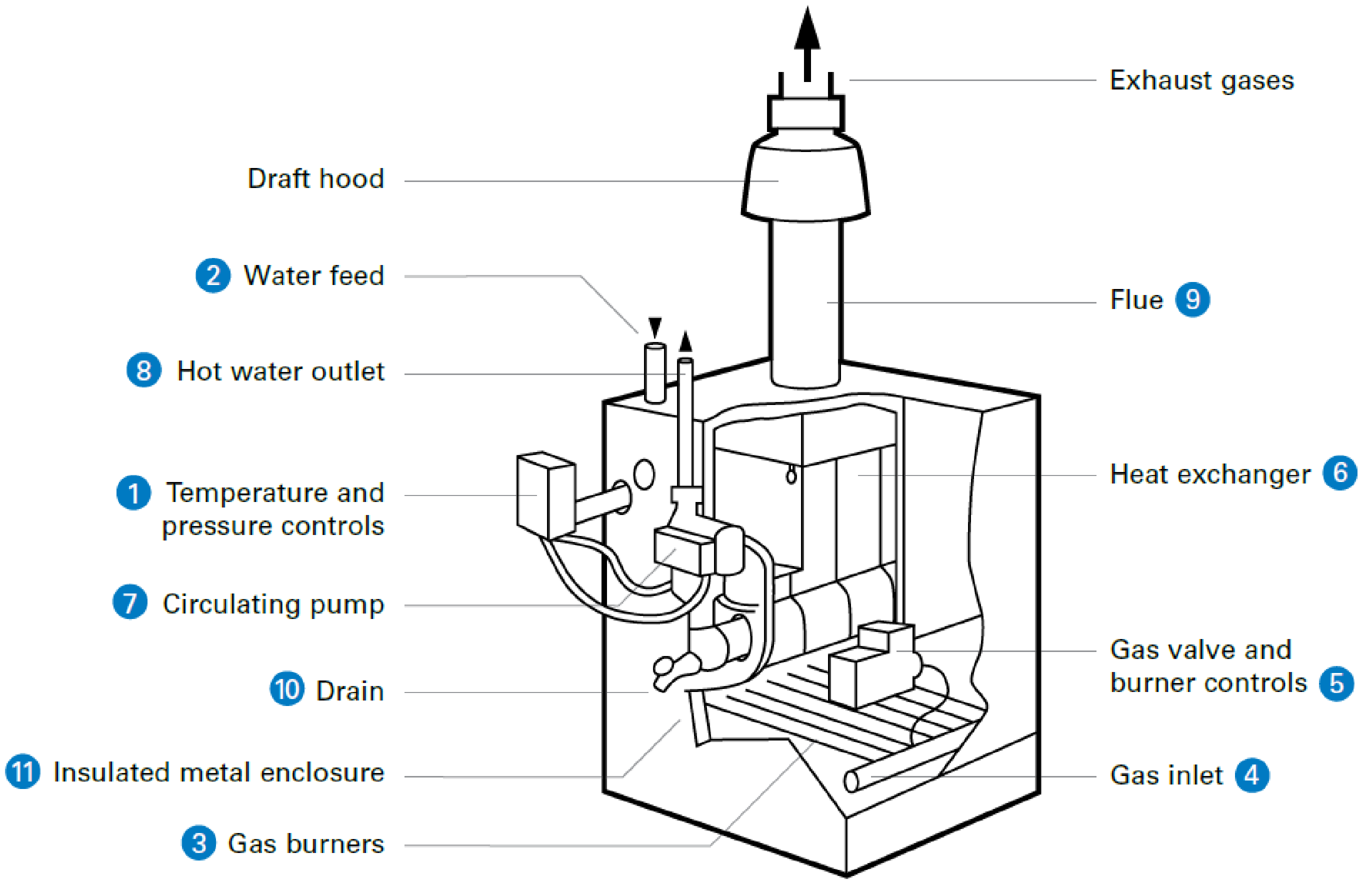
5. Boilers

6. Q&A

Main characteristic of boilers

- **Low temperature hot water (LTHHW) boilers produce hot water at around 90ºC** and are the type most commonly found in houses and commercial premises. The hot water produced is distributed via pipework to ‘wet’ heating systems and hot water storage tanks
- They can use a **variety of fuels** such as natural gas, oil, LPF or biomass. Some are designed to operate as a dual fuel boiler
- Types of boilers
    - **Conventional boiler** most old boilers are of this type which are designed to operate with an average water temperature of 60 to 70°C; these are also larger than modern design boilers
    - **High-efficiency boiler** standard and low temperature boilers that meet the minimum EU efficiency requirements of the current regulations
    - **Condensing boiler** have extra heat exchanger surfaces to extract much of the waste heat and return it to the system which makes them the most efficient on the market
    - **Modular boiler system** is where a series of boilers are linked together to meet a variety of heating demands. Modular boiler systems are best suited to buildings or processes with a significant, variable heat demand.

A further look into the technology



Common opportunities for efficiency gains

Improvements to existing boilers	Boiler controls	Maintenance	Boiler replacement
▪ Insulate all equipment ▪ Fit flue dampers ▪ Install variable speed drives and pumps ▪ Recover heat from exhaust gases	▪ Burner control ▪ Boiler interlock ▪ Sequence control ▪ Optimised start/stop control ▪ Direct weather compensation control ▪ Check controls	▪ Regular servicing ▪ Analyse flue gas ▪ Soot removal ▪ Limescale minimization	▪ Understand the building's heating requirements ▪ Location and Flue outlet ▪ Financial and environmental considerations

A reduction in fan speed of 10% can reduce up to 20% of energy

1mm layer of soot can cause a 10% increase in energy usage by the boiler

Energy Efficiency Support Programme: 2nd Phase – Technical assistance as part of an audit

Phase 1 - Web based training

- 19 companies were selected

Phase 2 - One on one support

- Only the first 10 entrepreneurs that are able to secure an Energy audit contract
- After the company has been able to sign the contract with the Client, it will have to send a letter of request to Carbon Trust or Econoler including details on the service to be provided (name of client, address, financial arrangements, etc.)
- If the request has a favorable response, a Letter of Agreement will be signed between Carbon Trust or Econoler and the company detailing the scope of the assistance to be provided.
- Econoler and Carbon Trust will support selected companies on a rolling basis and it will not be liaising directly with the Client.
- Therefore the company is responsible for providing all the required information to enable the support.
- The payments from the Client will go entirely to the company providing the energy audit services.
- Carbon Trust or Econoler will accompany the company in the audit process and provide ad-hoc advice when required through emails and phone-calls. It will also review the final report and ensure quality control.

Q&A Session

OPEN TO QUESTIONS!

(Now or later)

Thank you for your attention

- **Contacts for the next phase of the programme**

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