



ECONOLER

Sector-based Energy Efficiency

CTCN

Webinar

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THE CLIMATE TECHNOLOGY CENTRE AND NETWORK

- Operational arm of the UNFCCC Technology Mechanism
- Consortium of organizations from all regions + Network
- Mission to stimulate technology cooperation and enhance the development and deployment of technologies in developing countries
- Technologies include any equipment, technique, knowledge and skill needed for reducing greenhouse gas emissions and for adapting to climate change effects
- Core services include:
 - Technical assistance to developing countries
 - Knowledge platform on climate technologies
 - Support to collaboration and partnerships



CTCN TECHNICAL ASSISTANCE

Support to remove barriers to technology transfer (financial, technical, institutional)

- ✓ Identification of needs and prioritization of technology, depending on country context
- ✓ Technical recommendation for design and implementation of technology
- ✓ Feasibility analysis of deploying specific technologies
- ✓ Support to scale up use and identify funding for specific technologies
- ✓ Support legal and policy frameworks

Country-driven

- Any organization from developing countries can express need
- Request endorsed and submitted by the NDE

Fast and easy access to assistance

- User-friendly access: 4-pages submission, in all UN languages
- Appraisal of request within 1-2 weeks and response design within 2-8 weeks

CTCN selects and contracts relevant experts

- Assistance provided through Consortium and Network (value up to 250,000 US\$)
- Collaboration with financial organizations to trigger funding



NETWORKING AND COLLABORATION



Join our network!

Access commercial opportunities: respond to competitive bidding for delivery of CTCN technical assistance services

Create connection: network with national decision makers and other network members to expand your partnership opportunities and learn about emerging areas of practice

Increase visibility: broaden your organization or company's global reach, including within UNFCCC framework

Exchange knowledge: keep updated on the latest information and share via the CTCN's online technology portal

Examples of collaboration

Co-host climate related events

Twinning arrangements with research institutions

Engage in new technology projects

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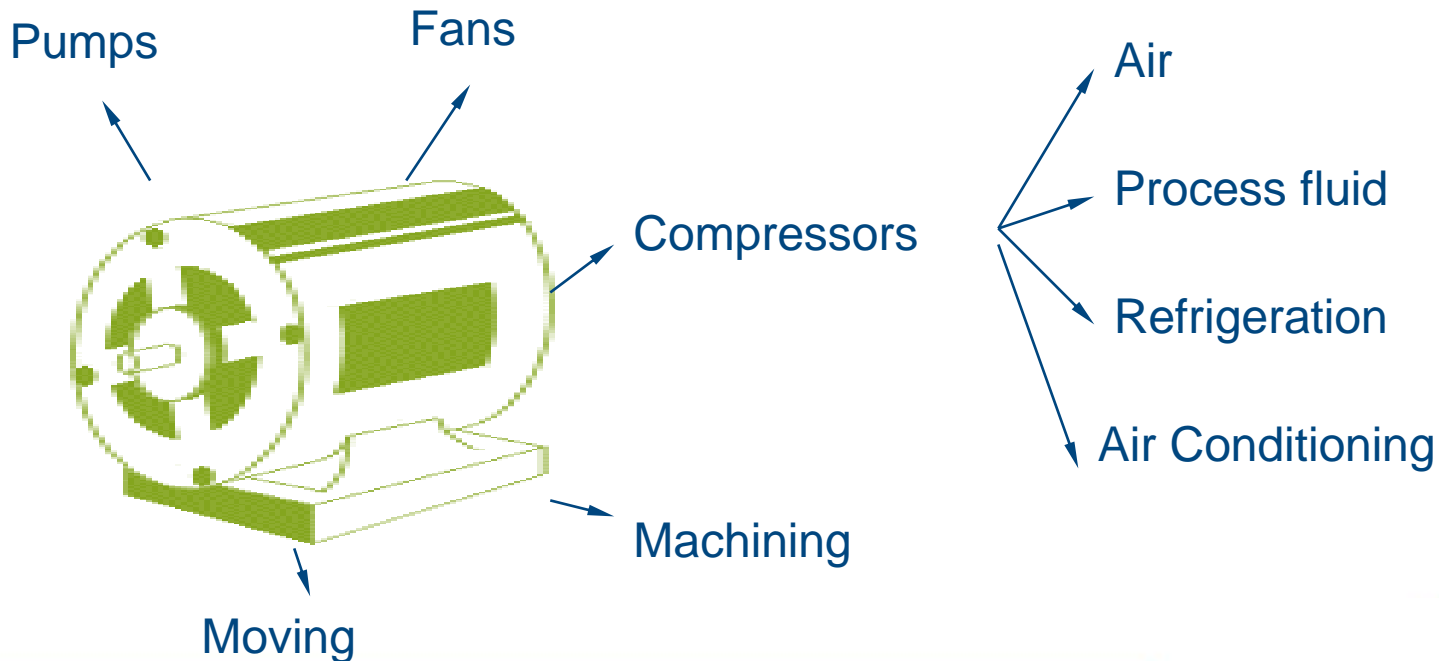
TOPICS

Most common EE measures by sector:

- › Industrial
- › Commercial and Institutional
- › Residential

INDUSTRIAL SECTOR MOTOR

- › Electric motors for industry use around 25% of the total electricity produced in industrialized economies.
- › They use 55%-65% of industrial electricity in most countries.

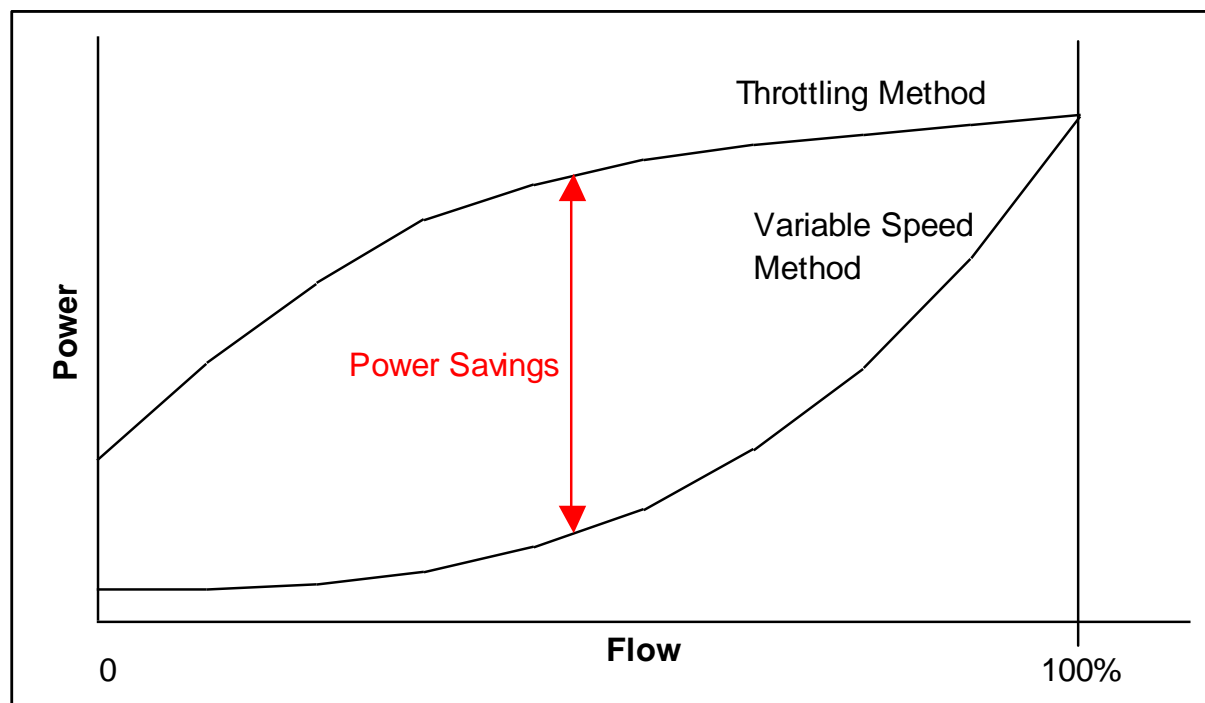


INDUSTRIAL SECTOR

VARIABLE SPEED DRIVE

For motor-driven variable loads, a variable frequency drive should be considered.

**FAN AND PUMP LAWS:
ADVANTAGE OF VSD FOR
VARIABLE FLOWS**



DOE study 2002: 18-25% of motor energy in manufacturing sector can benefit from VSD

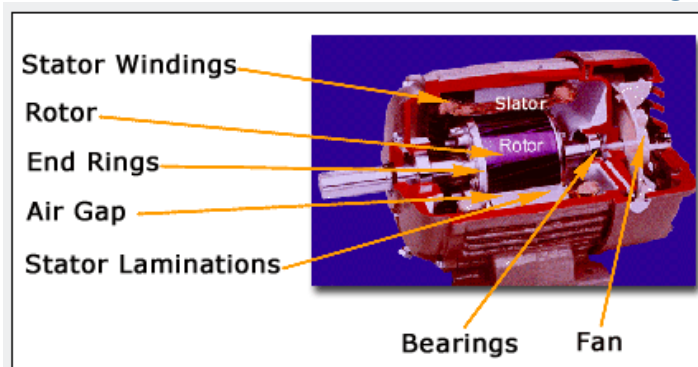
Source: Dollars to Sense, NRCan

INDUSTRIAL SECTOR

IMPROVING MOTOR PERFORMANCE

Premium Efficiency (IE3) : Outperform energy-efficient and standard motors

- › Initial cost is 20%-30% more. Energy cost can be up to 97% of total life cycle cost.
- › Better materials and design: Longer core, use of steel with better magnetic properties, reduced thickness of the stator lamination, reduced/optimized rotor and stator gap, larger-sized conductors, better insulating materials, high quality bearings and better lubricant.
- › More efficient ventilators, bearing and cooling systems.

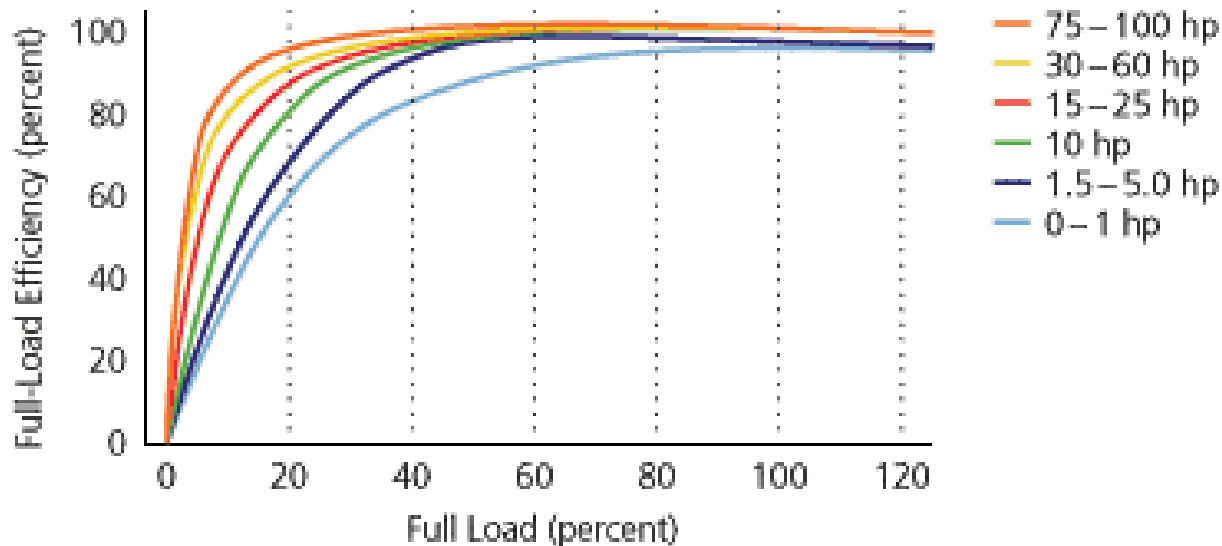


Copper development association

High efficiency motors consume generally 1% to 4% less electricity than standard motors and are more reliable, last longer, and their use results in lower transformer load.

COMMERCIAL AND INSTITUTIONAL EE MEASURE – ELECTRICAL SYSTEMS

- › Actual efficiency depends on motor loading and nominal (full loading) efficiency



Reference: Office of Energy Efficiency, Natural Resources Canada

INDUSTRIAL SECTOR

IMPROVING MOTOR PERFORMANCE

RETScreen Case Study

RETScreen

Motors 1 2 3 4 5

Description motor application

Method 1 2

		Base case	Proposed case	
		Standard efficiency	Premium efficiency	
Type				
Capacity	kW	100	100	
Efficiency - full load	%	93.6	95.9	
Load factor	%	75	75.0	
Speed - full load	rpm	1,800	1,800	
Load type		Standard		
Efficiency - operating conditions	%	92.8	95.1	
Motor shaft power load	kW	75.0	75.0	
Operating hours	h/d	12	12	
Incremental initial costs	\$		1,000	
Incremental O&M savings	\$			
Number of motors		1	1	
Electricity	MWh	351	343	2.4%

INDUSTRIAL SECTOR

IMPROVING MOTOR PERFORMANCE

- › Avoid oversizing (inefficient) and undersizing (overheats): target is 60%-80% load factor
 - Motor management program
- › Up to 2% in efficiency reduction after non optimum rewinding: ~1% reduction with best practices
- › Keep motor cool
 - Clean air vents
 - Balance three-phase voltages
 - Power factor correction (capacitors on the motor side of distribution system)

INDUSTRIAL SECTOR

COMPRESSED AIR SYSTEMS

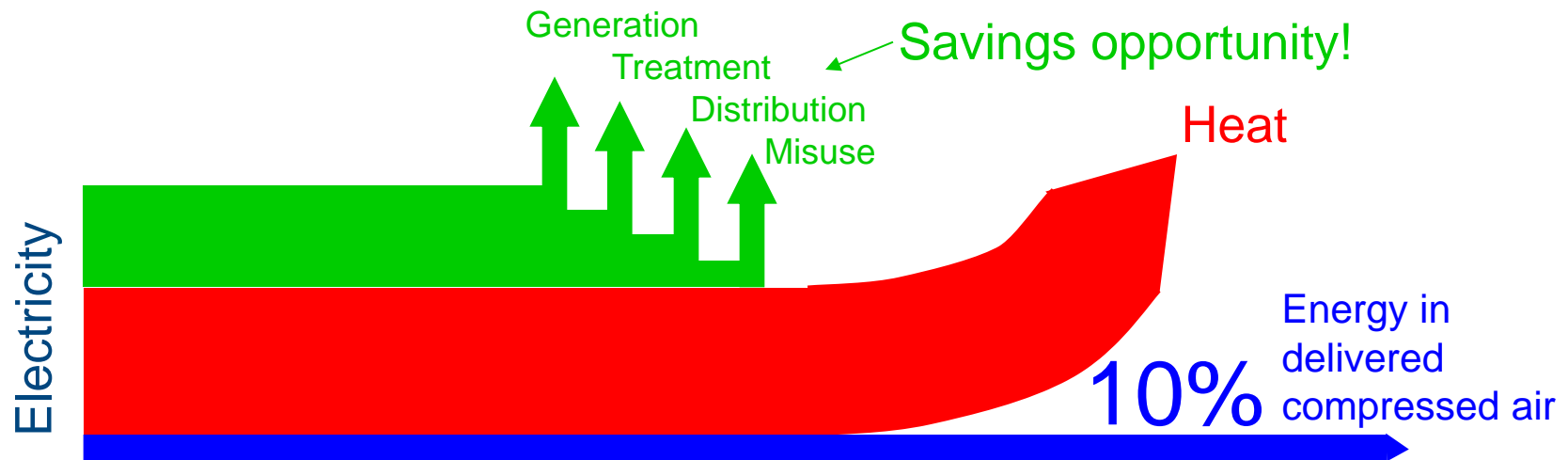
Consume large quantities of energy (expensive).

- › Energy : 80% of the life-cycle cost of compressed air system

Compressing gas causes its temperature to rise.

- › Heat must be removed (wasted energy)

10% of the input electricity effective to provide air.



INDUSTRIAL SECTOR

EE IN COMPRESSED AIR SYSTEMS

- › Reduction of air losses – very often 20%-30% of total production
 - 1/4" (6.4 mm) leak at 100 psig (700 kPa gauge) consumes as much electricity as 300 x 60-watt bulbs
- › Distribution System Modifications
- › Optimization of Distribution Pressure
- › Compressor Control
- › Compressor Efficiency
- › Multiple-Stage Compressors

INDUSTRIAL SECTOR EE IN COMPRESSED AIR SYSTEMS

- › Draining System Optimization
- › Air Dryer Optimization (especially desiccant)
- › Replacement of the following usages:
 - Cleaning
 - Cooling
 - Air knife
 - Dust removal
- › Venturi nozzles to reduce air flow



Photo: DV Systems

INDUSTRIAL SECTOR

EE TRANSFORMERS

EE in transformers:

- › Operating in the high efficiency zone

Two types of losses

1. Joule losses or copper losses

- › Function of the winding resistance and current passing through them: $P_{\text{copper}} = R \times I^2$

2. Magnetic losses or iron losses

- › Function of frequency and voltage
- › Losses by Eddy current
- › Hysteresis losses



INDUSTRIAL SECTOR EE TRANSFORMERS

- › Amorphous steel transformer
 - › Larger winding
 - › Better tolerances
 - Generate a few percent savings
 - Generally difficult to justify its use in a retrofit project
 - Existing transformer still good
- › Should be considered if a transformer has to be replaced or for new units
 - Incremental cost vs. savings



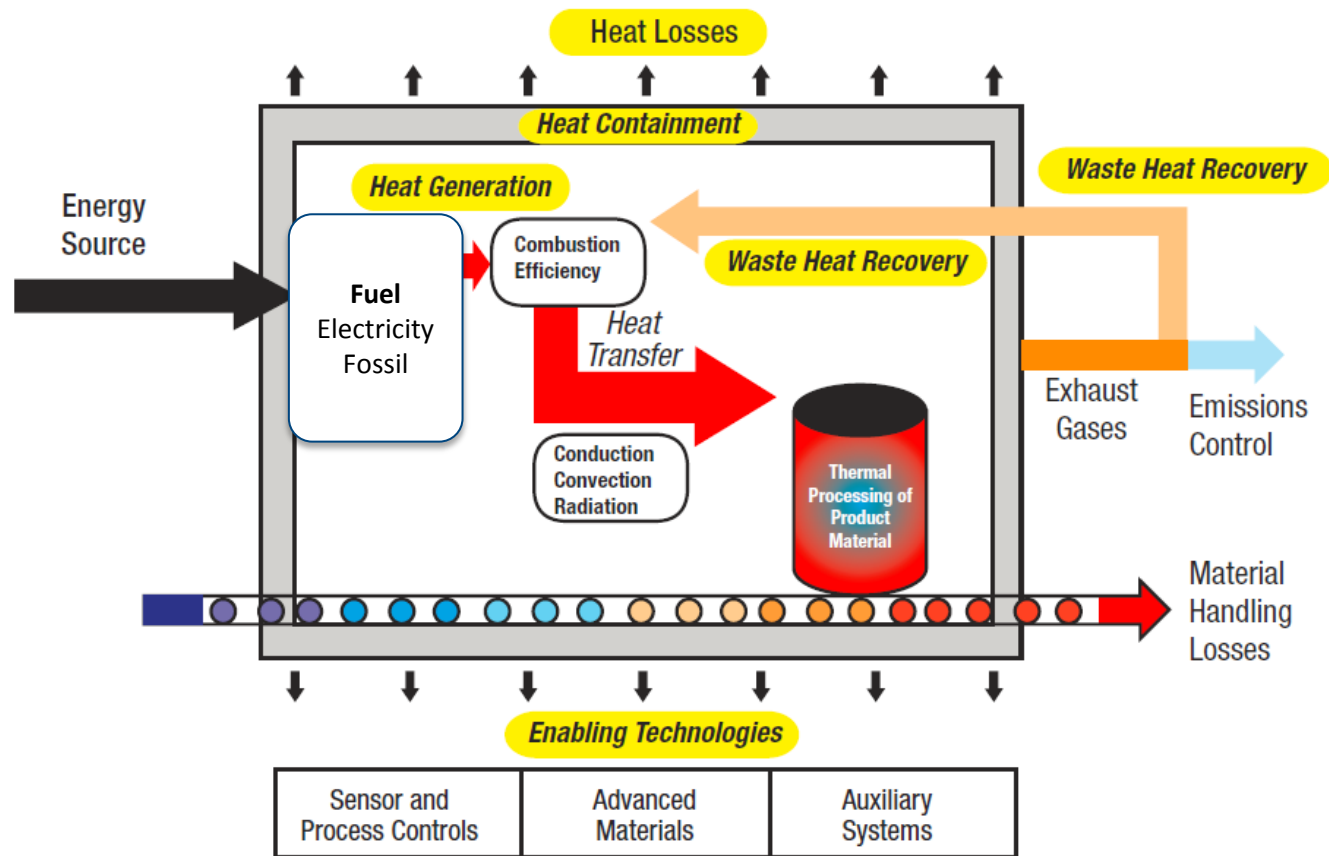
INDUSTRIAL SECTOR ELECTRICITY DISTRIBUTION

- › Average electricity losses in non-residential buildings : Around 2%
- › Upsizing the electric cable size : Limiting losses to 0.7%
- › Potential EU region: 20 TWh/year (industry and tertiary sectors)

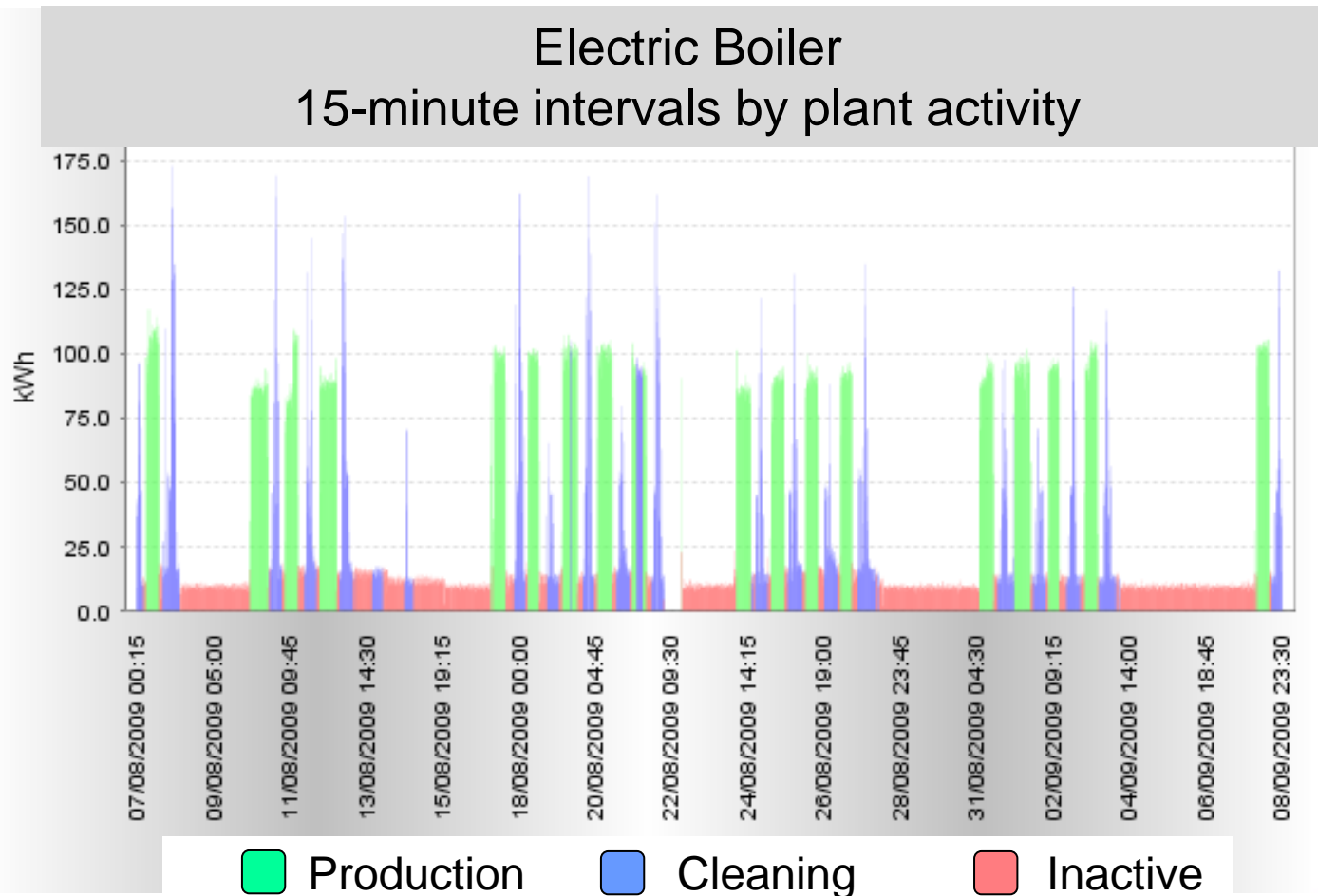
Source: Copper Alliance

INDUSTRIAL SECTOR TECHNOLOGY FOR PROCESS IMPROVEMENT

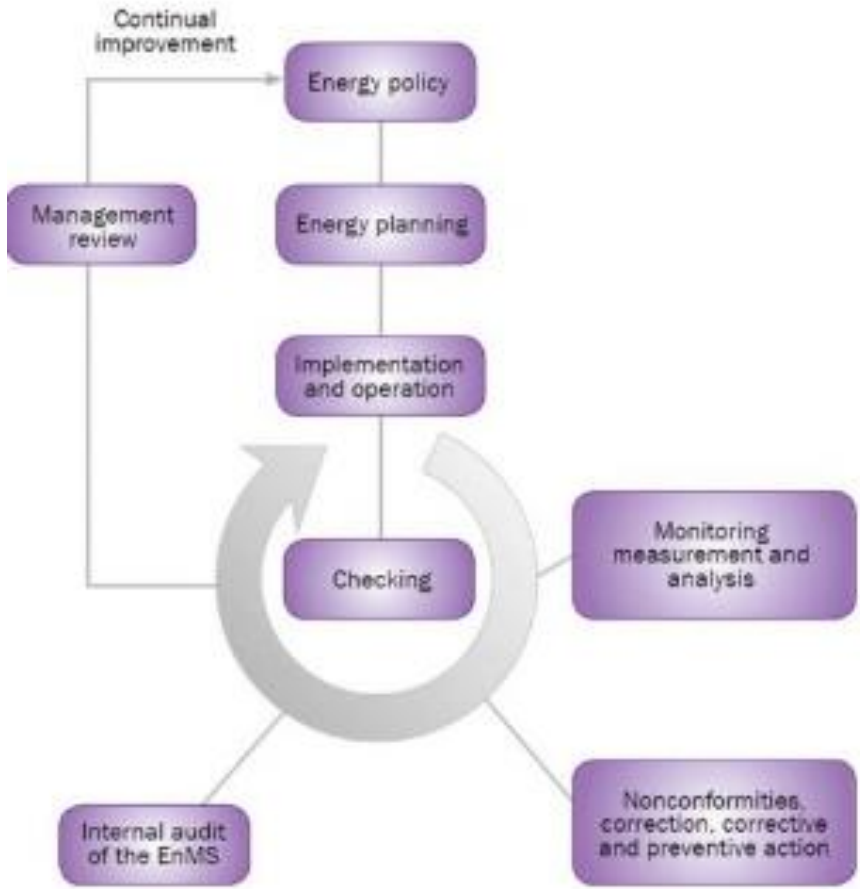
Improving Process Heating System Performance



INDUSTRIAL SECTOR MONITORING AND TARGETING

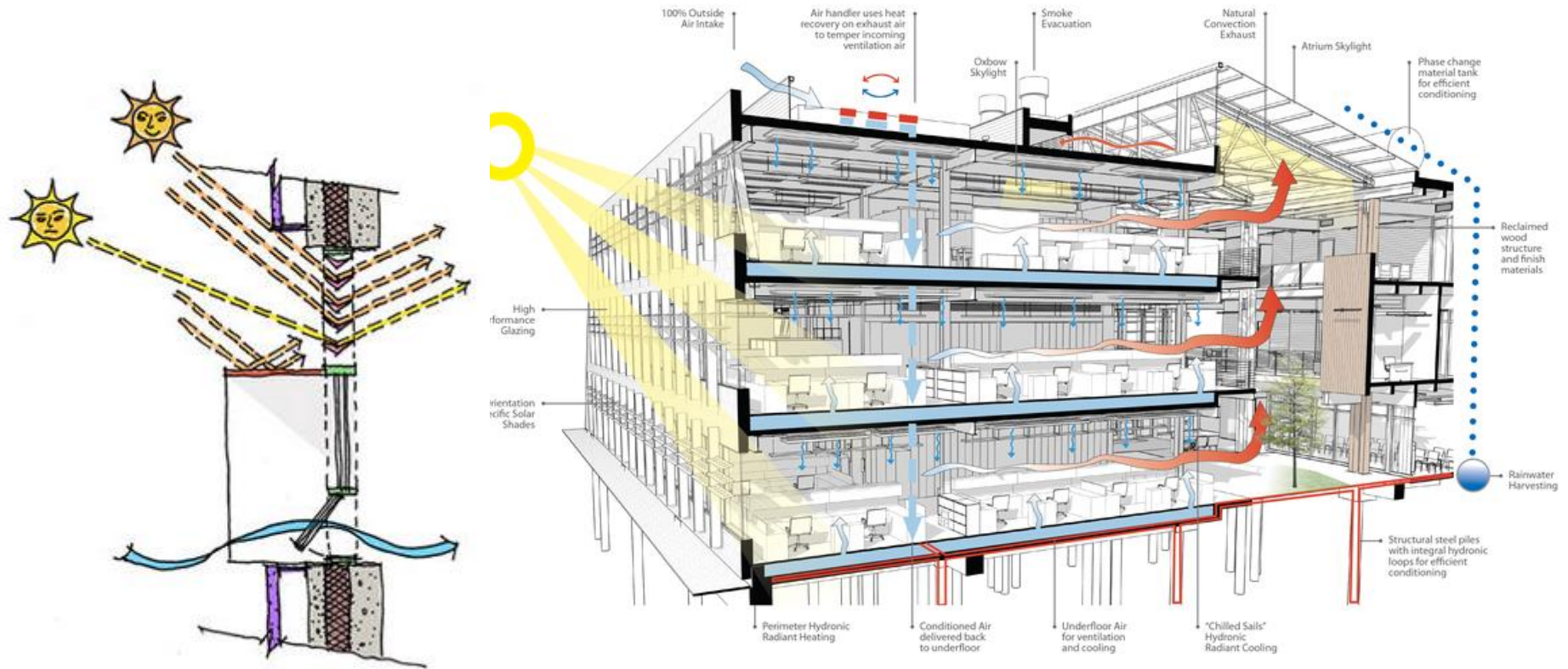


INDUSTRIAL SECTOR ISO 50001



COMMERCIAL AND INSTITUTIONAL EE MEASURE

Building envelope and bioclimatic architecture



Research Support Facility at the NREL

Federal Center South Building 1202

COMMERCIAL AND INSTITUTIONAL EE MEASURE

Zero-energy Building - Singapore

Light pipe



Shading vs. natural lighting

Individual diffusers



Renewable



COMMERCIAL AND INSTITUTIONAL EE MEASURE - HVAC

Cooling

- › Controls
 - Temperature set-up
 - Distribution temperature
- › Thermal storage
(water, ice, eutectic salts)
- › Evaporative coolers
- › Absorption units
- › Geothermal
- › Free cooling
- › Heat pump

Heating

- › Controls
 - Temperature reset on hot water
 - Night set back
 - Other controls
- › Heat recovery
- › Energy type replacement
- › Radiant heating
- › Off-peak energy optimization
 - mass or fluid heat storage

COMMERCIAL AND INSTITUTIONAL EE MEASURE - HVAC

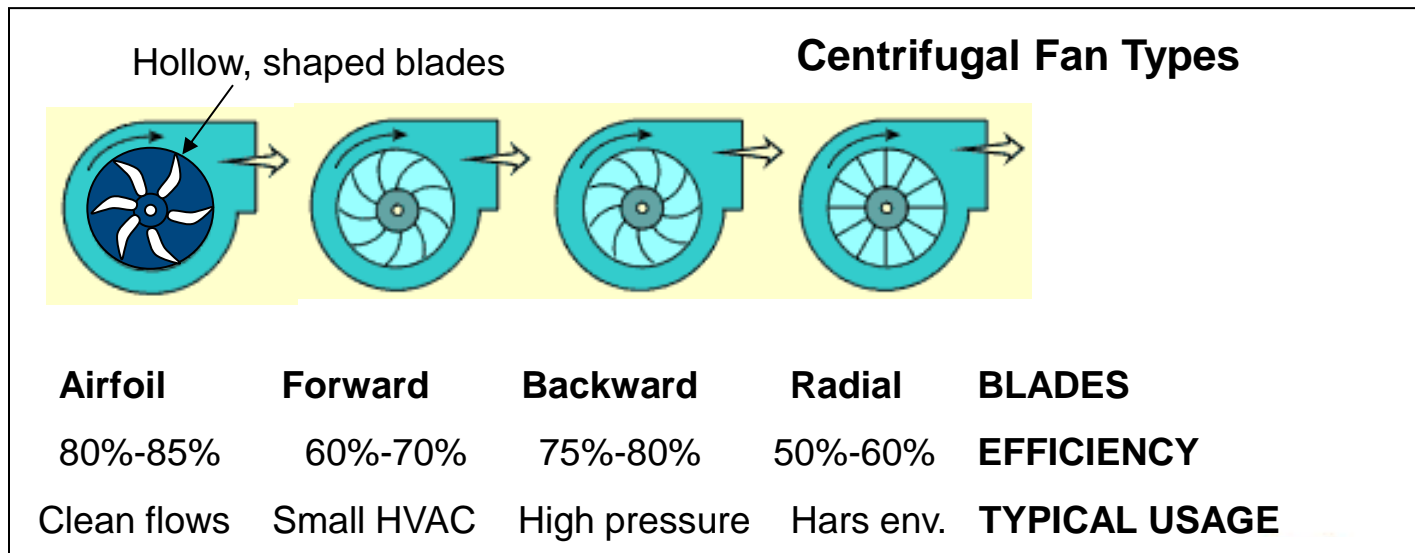
Heat Recovery

	Run around	Heat pipe	Heat wheel	Plate
Typical Effectiveness	Sensible 55% to 65%	Sensible 45% to 65%	Sensible 55% to 65% Total 55% to 85%	Sensible 50% to 80%
Range (cfm)	100 CFM 47 l/s and up	100 CFM 47 l/s and up	50 to 70,000 CFM 23 to 33000 l/s	50 CFM 23 l/s and up
Advantages	Exhaust airstream can be separated from supply air; fan location not critical	No moving part except fan; location not critical; allowable ΔP up to 60-inch WC	Latent transfer Compact large sizes Low pressure drop	No moving part Low pressure drop Easily cleaned

COMMERCIAL AND INSTITUTIONAL EE MEASURE - HVAC

Four Energy Efficiency Strategies : Centrifugal equipment

- › Fan or pump efficiency
- › Reduction of hours of operation
- › Flow reduction
- › Pressure reduction

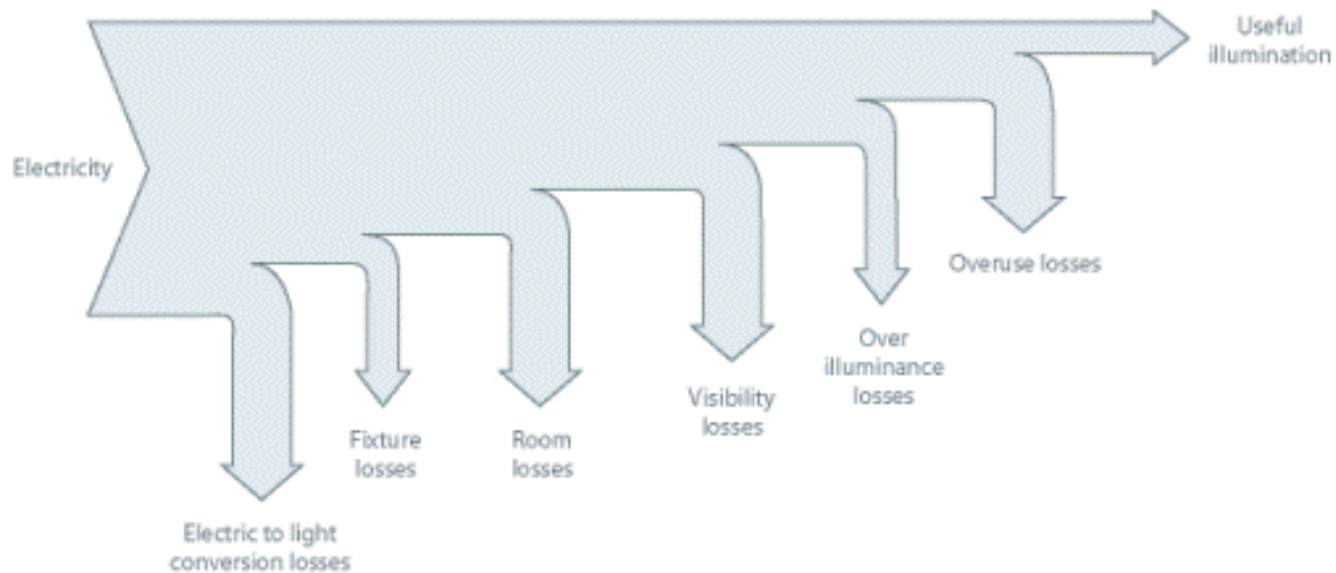


COMMERCIAL AND INSTITUTIONAL EE MEASURE – LIGHTING

Artificial lighting : 20% to 40% of total energy consumption

Artificial lighting is inefficient and generates heat

- › Add cooling load and reduce heating requirements.



Incandescent: 95% or more of the energy converted to heat

COMMERCIAL AND INSTITUTIONAL EE MEASURE – LIGHTING

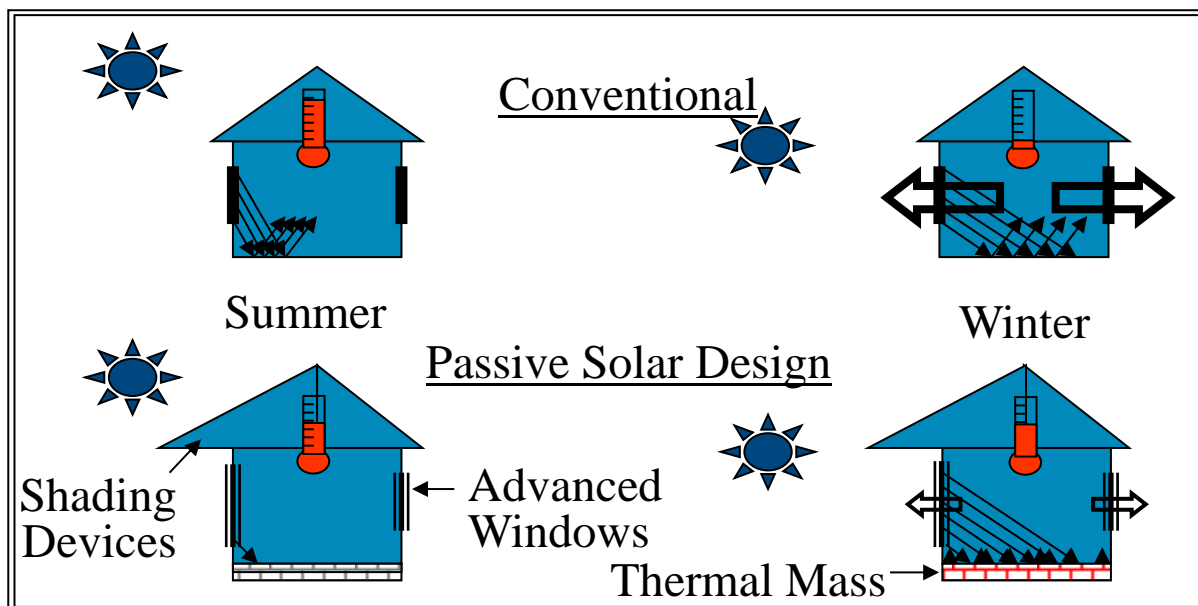
Lighting Opportunities

- › Use more efficient fixtures (lamps, ballasts, reflectors, lenses)
- › Use timers, automatic dimming & occupancy sensors
- › Favour natural daylight
- › Task lighting and lower general lighting levels
- › Reduce excess lighting by delamping
- › Raise occupants' awareness (i.e., turning off lights)
- › Maintain/clean regularly (improves light loss factor)
- › Select interior surfaces and colours for diffuse reflection

RESIDENTIAL SECTOR

EE MEASURE – BUILDING ENVELOPE

- › Minimize infiltration - Ventilation- Heat Exchanger
- › Add insulation
- › Equator-facing: High efficiency windows (2-3 panes, low-e, argon, thermal break)
 - Shaded by overhangs, trees – reduce summer gain
- › East-West-facing windows; natural lighting, less heat gain

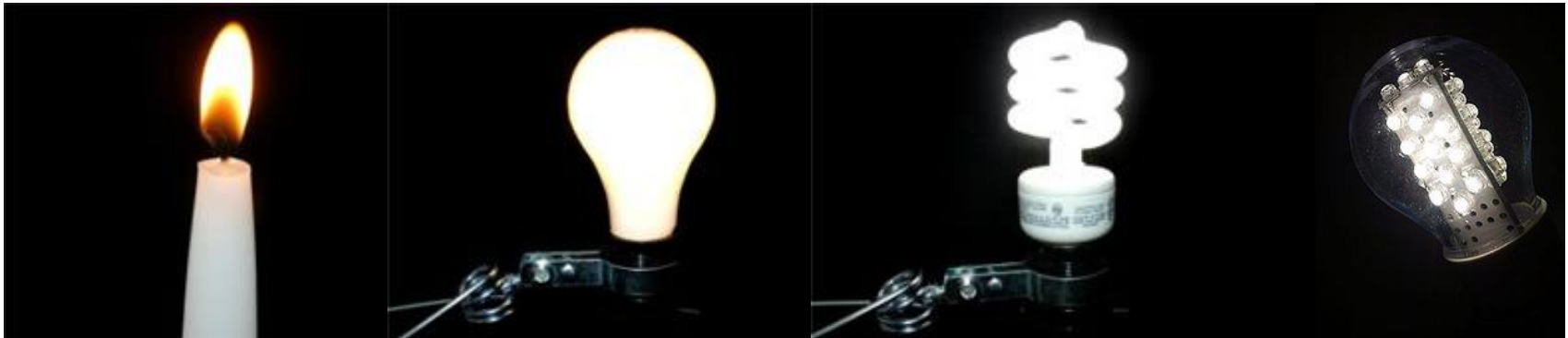


RESIDENTIAL SECTOR

EE MEASURE – LIGHTING

Efficiency (lm/W): Ratio of light visible to the human eye (in lumens) to input electrical power (in watts)

<u>Type</u>	<u>Efficiency</u>	<u>Typical Lifetime</u>	<u>Colour Rendering</u>
Incandescent	10-18 lm/W	1,000 hr	Excellent
Halogen	14-18	2,000 hr	Excellent
Compact fluorescent	70-90	10,000 hr	Excellent
Exposed LED lamp	70-100	100,000 hr	Variable



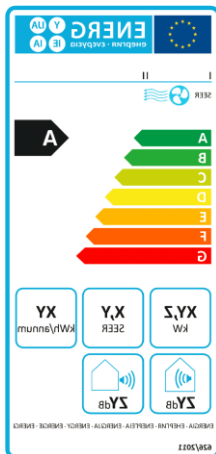
Several dimming opportunities exist in the residential sector.

RESIDENTIAL SECTOR

EE MEASURE – APPLIANCES

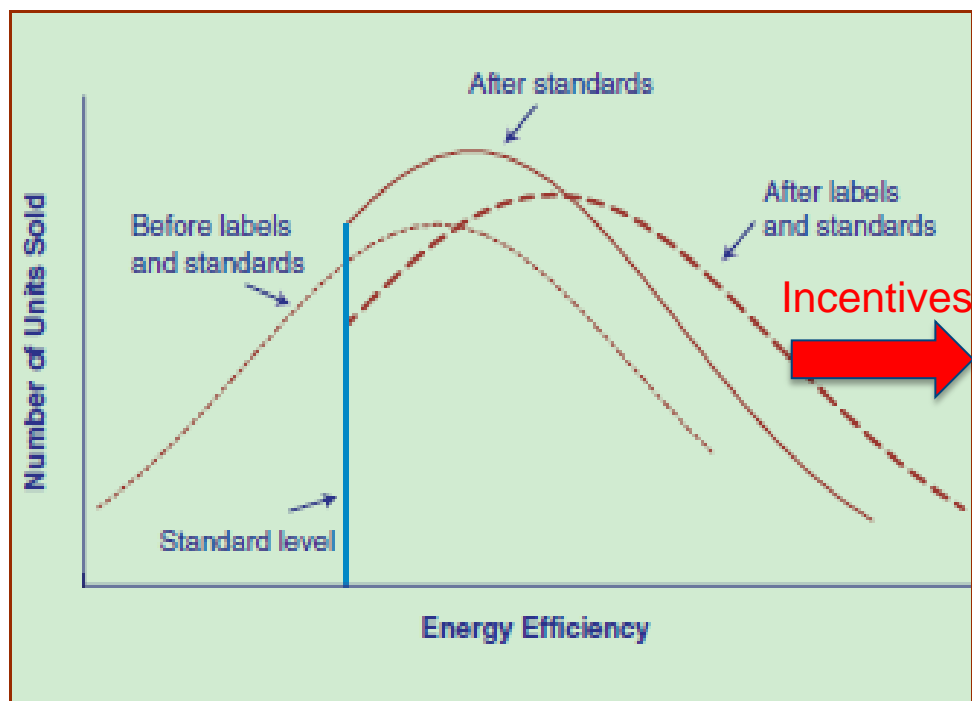
Energy performance standard and label:

- › Energy Star
- › European Union



Appliances:

- › Air conditioning fan
- › Refrigerator, freezer
- › TV
- › Dishwasher
- › Washing machine
- › Dryer
- › Electronic equipment

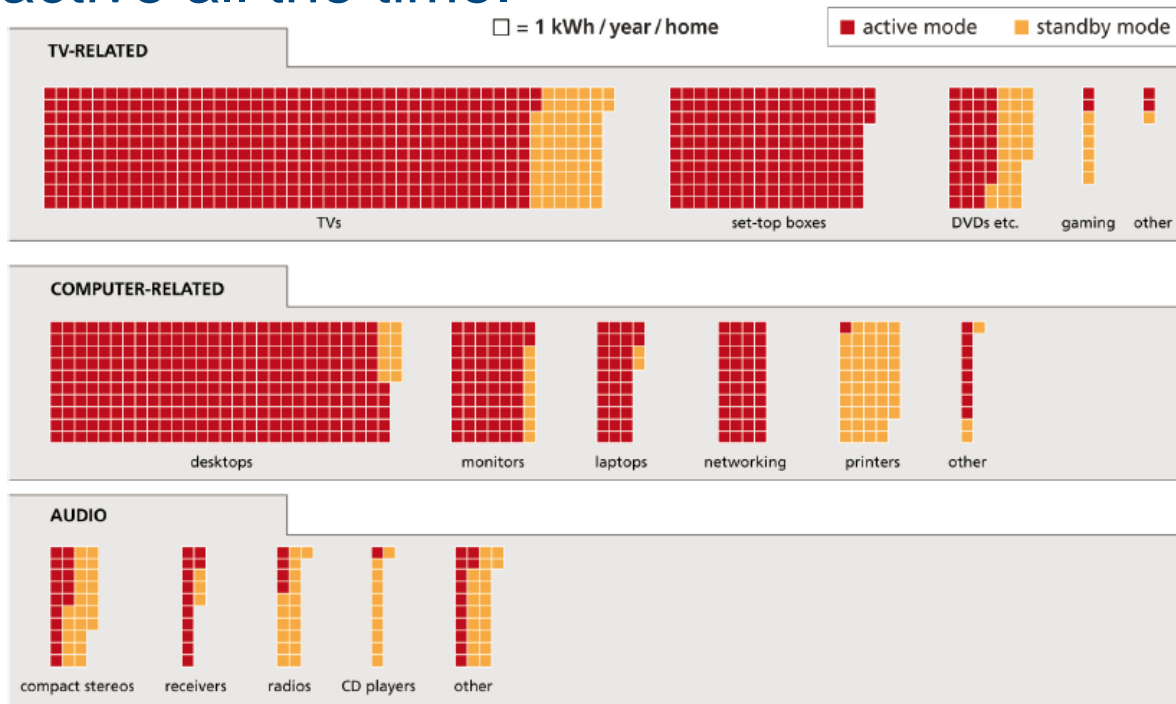


Source: Clasp handbook

RESIDENTIAL SECTOR

EE MEASURE – STAND-BY POWER

Field research in the U.S. : Standby mode dominates total energy use in a few products. Power in some products stays active all the time.



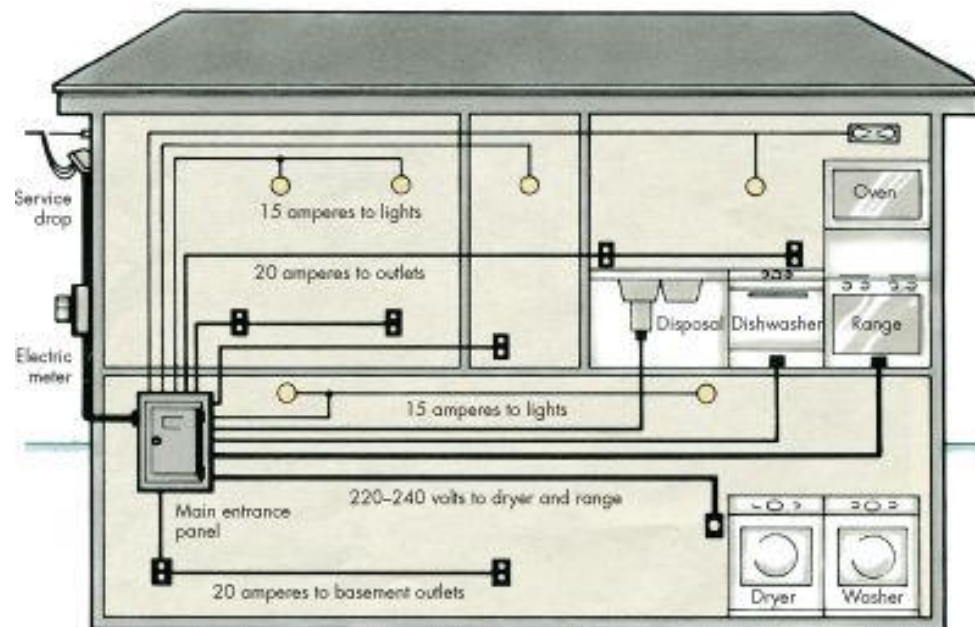
Source: Scott Pigg. "Energy Savings Opportunities for Home Electronics: Insights from a Minnesota Field Study." *Energy Center of Wisconsin*, October 2010

RESIDENTIAL SECTOR

EE MEASURE – ELECTRICITY DISTRIBUTION

Electric cables are hidden consumers of electric energy. Studies demonstrated that significant savings could be made by optimizing cable and wire diameters (in new buildings).

Copperalliance

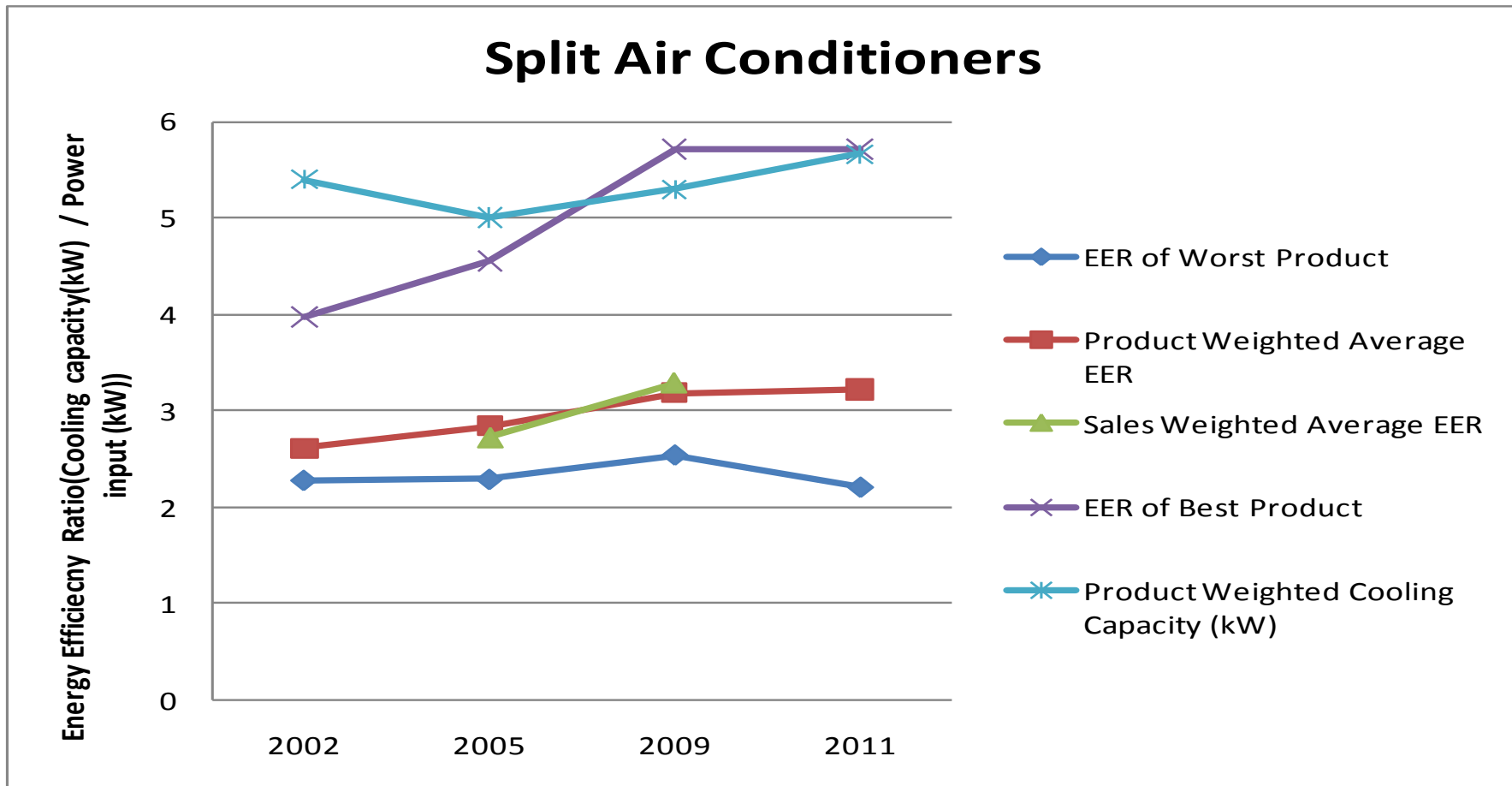


How does it work?

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EE MEASURE – HVAC

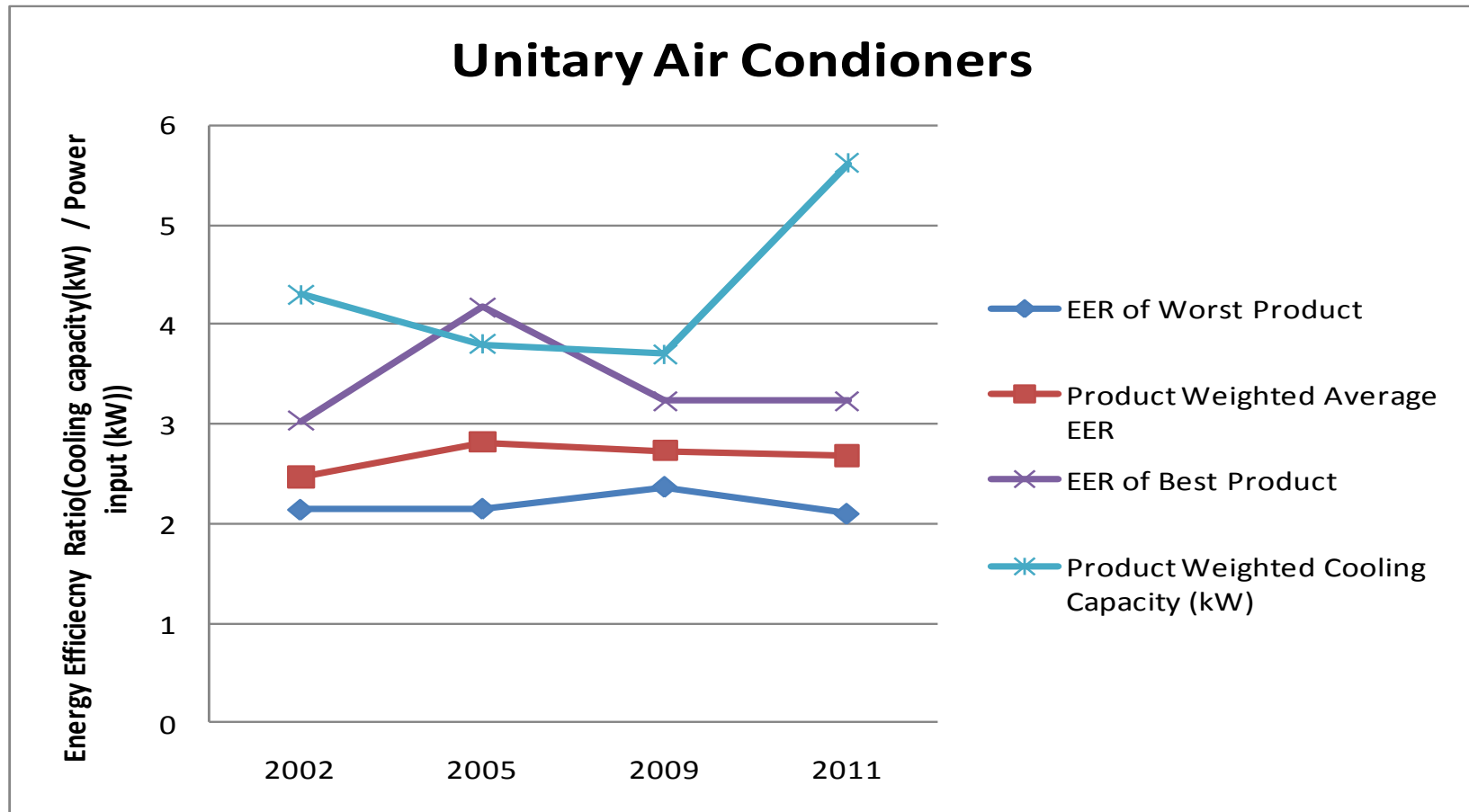
Product Offer-Weighted Trends in European Union



RESIDENTIAL SECTOR

EE MEASURE – HVAC

Product Offer-Weighted Trends in European Union



CONCLUSION

- › Many technology oriented EE measures exists in different sectors:
- › EE potential can not only be achieved through the use of technologies. Energy management is also key achieving potential
- › No need for R&D to achieve great potential. Technologies exist!!!

THANK YOU

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