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D 2.5 - BENCHMARK ANALYSIS REPORT ON BEST PERFORMING AVAILABLE TECHNOLOGIES

	Most commont current technology	Description	Application	Best available technology	Description	approx max % EE improvement	Comments
Lighting							
	Incandescent bulbs	wire resistance	indoor lighting, signaling	LED	Ligh emiting diode	90%	from 10-15 Lm/W to 90-120 Lm/W
	Halogen bulbs	wire resistance	indoor lighting	LED	Ligh emiting diode	80%	from 10-25 Lm/W to 90-120 Lm/W
	Fluorescent High efficiency	Domestic Discharge lamps and high efficiency	indoor lighting	LED	Ligh emiting diode	30%	from 60-93 Lm/W to 90-120 Lm/W
	Hg vapour	Discharge lamps with Mercury vapour	Outdoor lighting	NA vapour	High pressure sodium vapour lamps.	60%	from 30-60 Lm/W to 90-120 Lm/W
	Metal Halide	Discharge lamps with metal halides	Outdoor lighting	NA vapour	High pressure sodium vapour lamps.	20%	from 70-96 Lm/W to 90-120 Lm/W
	magnetic ballast primers	magnetic tension controllers for discharge lamps	Start up and tension control for discharge lamps	electronic ballast primers	electronic tension controllers for discharge lamps	10% - 20%	Depending on the light power
HVAC							
	air conditioning split	individual air conditioning systems split into 2 parts: evaporator inside and condenser outside	Indoor air cooling	Heat pumps with inverter technology	reversible thermodynamic cycle powered with electricity.	35%	
	air conditioning split	individual air conditioning systems split into 2 parts: evaporator inside and condenser outside	Indoor air cooling	Heat absortion cycles by solar thermal panels	Combined fluid thermodynamic cycle with heat absortion from solar thermal panels	80% - 100%	Depends on the fluid cooling system
	Direct ventilation	Window opening for ventilation	Ventilation	Free cooling	2 way ventilation with heat exchange: Inlet fresh air gets pre-heated by the exiting foul air.	30%	Depends on the heat exchange dimensions and air temperature.
	Combustion boiler	heat produced by a fuel combustion in a boiler	Indoor air heating	Low temperature boilers	Boilers with heat recovery system	10%	Depends on the maintenance of the old boiler.
	Combustion boiler	heat produced by a fuel combustion in a boiler	Indoor air heating	Condensation boilers	Boilers that use the heat stored in the steam	25%	Depends on the maintenance of the old boiler.
	electric water heaters	generation and storage of hot water by electricity resistance	hot water for domestic purposes	solar thermal panels	panels to capture solar irradiation and transfer it to domestic hot water	80% - 100%	Depends on the coverage ratio
Heating							
	water radiator	heat transfer is done by means of water radiators.	heat transfer for indoor heating	radiant floor	heat transfer is done by means of thin water pipes under the floor.	50%	
	fan coils	heating is provided by an electrical resistance and a fan	heating	radiant floor	heat transfer is done by means of thin water pipes under the floor.	60% - 75%	
Electric engines							
	IE1 motors	Poor efficiency motors	electrical motors at constant load	IE3 motors	High efficiency motors	50%	Depends on the type, age and maintenance of the replaced motor
	IE2 motors	Standard efficiency motors	electrical motors at constant load	IE3 motors	High efficiency motors	15%	Depends on the type, age and maintenance of the replaced motor
	Fixed power	Electric motor at fixed power.	electrical motors at variable load	Speed drive systems	system to adapt the motor power to the load.	25%	Depends on load factor
Cooling							
	traditional fridge/freezer	Compressor runs to a target pressure.	Cooling	fridge / freezer with inverter	Fridge with a tension drive to adapt the compressor pressure to the needs	40%	
	traditional fridge/freezer	Compressor runs to a target pressure.	Cooling	fridge / freezer with no frost system	Air circulation system to prevent frost building.	5%	Depends on the external air humidity
Furnaces							
	Electric furnace	Furnace that uses electricity	Melting, cooking and Curing	Gas Natural furnace	Furnace that uses natural gas	40%	Savings with respect to primary energy
	Gasoil furnace	furnace that uses gasoil	Melting, cooking and Curing	Gas Natural furnace	Furnace that uses natural gas	25%	Savings with respect to primary energy
	Coal furnace	furnace that uses coal	Melting, cooking and Curing	Gas Natural furnace	Furnace that uses natural gas	35%	Savings with respect to primary energy
	Batch furnace	Furnaces with batch feeding	Batch production	Continuous furnaces	Furnaces with continuous feeding	50%	depending on idling times
	production furnace	furnace used at glass industry	for productions between 20 and 40 tns in glass industry	heat recovery furnace	furnaces with heat recovery systems	35%	Depends on the exhaust gas temperature
	production furnace	furnace used at glass industry	for productions larger than 40 tns in glass industry	regenerative furnace	furnaces with regenerative systems	35%	from combustion air preheating
Compressed air							
	traditional compressor		compressed air supply	speed drive compressor	compressors adapted to variable loads	30%	depends on load conditions, number of compressors, etc
	traditional compressor		compressed air supply	air compression with heat recovery	Air compression system with a heat exchanger to provide heat for other purpose.	90%	Up to 94% of the energy is thermal and only 6% is pressure. Only useful if heat recovered can be reused.
	Alternative compressor		compressed air supply	Screw compressor	More efficient and quieter equipment	15%	
	traditional compressor		compressed air supply	high efficiency compressor	compressed air systems with a high efficiency electric motor	40%	Depends on the type, age and maintenance of the replaced motor
Pumps							
	traditional pumps		fluid motion	speed drive pumps	pumps adatped to variable loads	30%	depending on range of operating conditions.
	traditional pumps		fluid motion	high efficiency pump	pump driven by a high efficiency electric motor	40%	Depends on the type, age and maintenance of the replaced motor
Fans / extractors							
	traditional fan		air current motion	speed drive fans	fans adapted to variable loads	30%	Depends on the load factor.
	traditional fan		air current motion	high efficiency fan	fan driven by a high efficiency electric motor	40%	Depends on the type, age and maintenance of the replaced motor
Boilers							
	Electric boiler	Boiler that uses electricity	Production of Steam	Gas Natural boiler	Boiler that uses natural gas	40%	Savings with respect to primary energy
	Gasoil boiler	Boiler that uses gasoil	Production of Steam	Gas Natural boiler	Boiler that uses natural gas	25%	Savings with respect to primary energy
	Coal boiler	Boiler that uses coal	Production of Steam	Gas Natural boiler	Boiler that uses natural gas	35%	Savings with respect to primary energy
	traditional boiler		Heating and heat processes	Low temperature boilers	Boilers with heat recovery system	10%	Depends on the exhaust gas temperature
	traditional boiler		Heating and heat processes	Condensation boilers	Boilers that use the heat stored in the steam	25%	or condensing economiser
	traditional boiler		Production of hot water	boiler with economizer	System to reuse exhaust gas energy to pre-heat process water	10%	depending on steam temperature
	traditional boiler		Heating and heat processes	boiler with pre-heater	System to reuse exhaust gas energy to pre-heat incoming combustion air.	10%	depending on steam temperature
Dryers	Electric or gas dryers	Hot air current to dry up processes	Drying and curing processes	speed control of feeding belt	Dryer with speed control to optimize the dwelling time.	30%	In case the dryer has no automatic feeding system
	Electric or gas dryers	Hot air current to dry up processes	Drying and curing processes	humidity control on exhaust	Dryer with humidity control to avoid too much humidity in the drying air current.	30%	Energy is wasted to get rid of the humidity
	Electric or gas dryers	Hot air current to dry up processes	Drying and curing processes	Biomass dryer	Dryer run by biomass	0%	No Energy savings but replacement of no renewable sources by renewable and cheaper sources
	Electric or gas dryers	Hot air current to dry up processes	Drying and curing processes	dryer with preheater	Dryer fitted with an equipment to reuse exhaust gas energy to preheat inlet air	15%	Depends on the exhaust gas temperature
Other							

Important note % of savings are always approximate ranges and are submitted to important variations. The real savings will greatly vary depending on the age, maintenance and the working conditions of the replaced equipment. For precise saving estimations a case to case analysis should be done.

Source Aranda A, Barrio F, Zabalza I, Díaz de Garallo, S; "Técnicas para la elaboración de auditorías energéticas en el sector industrial". Prensas Universitarias de Zaragoza, 2010
Aranda A., Zabalza I., Díaz de Garallo, S., Llera, E.; "Eficiencia energética en instalaciones y equipamiento de edificios". Prensas Universitarias de Zaragoza, 2010