The SESEC Energy Saving Scheme (ESS)

A guide for companies

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1. About SESEC

Based on industry-driven ideas, SESEC is a cooperation project designed to support **Energy Efficiency** in the **European clothing** industry. Co-funded by the European Union through the IEE programme, SESEC develops and offers Energy Efficiency tools, information and training for companies to assess their consumption and implement corrective measures considering cost-effectiveness. Coordinated by EURATEX and run by a nine partners consortium, SESEC started in March 2012 and last thirty months. Periodic information on progresses and cooperation opportunities with organisation which are not member of the consortium are released through the SESEC website hosted in www.euratex.eu/SESEC.

2. About the Energy Saving Schemes (shortened in ESS)

The SESEC Energy Saving Scheme (ESS) is a working method with *resources* designed to support companies to assess their energy consumption, to benchmark the energy efficiency and to identify promising energy-saving potentials in the company.
The ESS key *resources* are three tools based on Microsoft Excel files namely the:

- the Energy Distribution Support Tool (EDST)
- the Energy Management and Benchmarking Tool (EMBT), and
- the Self-Assessment Tool (SAT)

Other resources include a web-based platform, the ESS Guide (this document) and training materials. To further help clothing companies in achieving Energy Efficiency, the SESEC project organises in 2014 several information events and training courses on how to apply the ESS across Europe, locations and dates are announced on the website.

3. About this document

This document is the Energy Saving Scheme (ESS) **Guide for companies to assess their energy management performance, the energy saving potential, and to identify**

energy saving measures. This Guide recommends a 4-steps approach (Plan-Do-Check-Act) and elaborates on the 3 Excel tools, a check list of measures is also provided.

4. Introduction

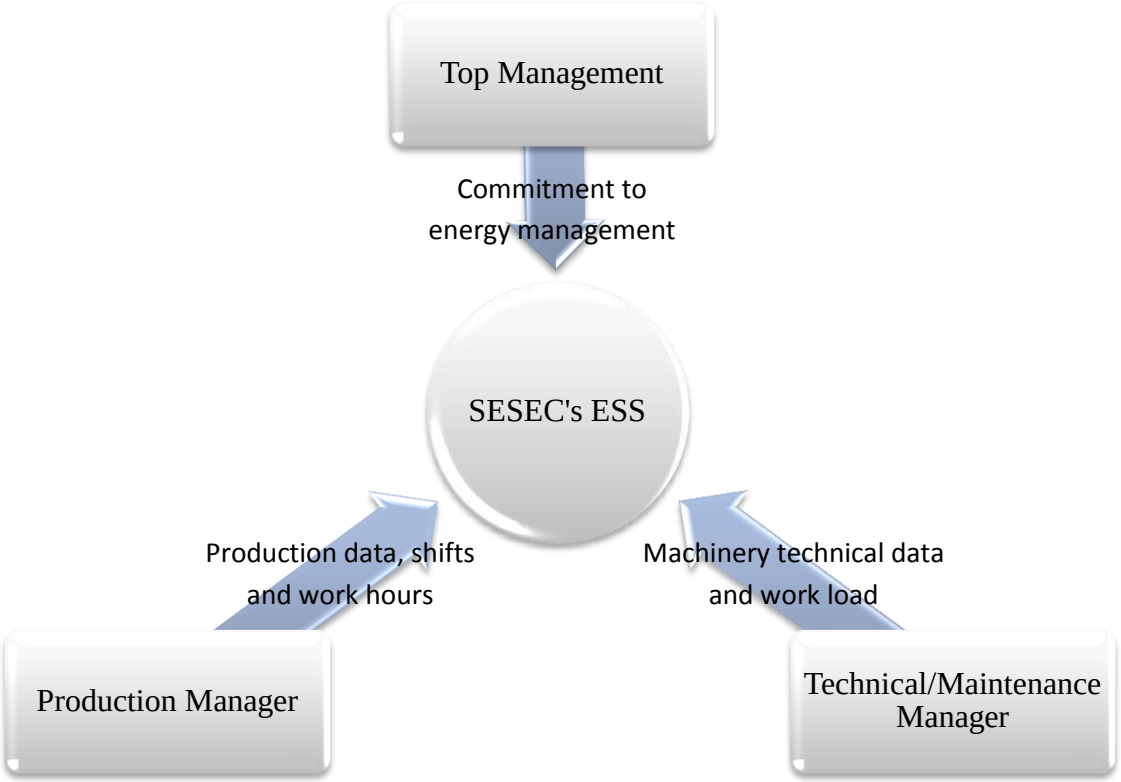
SESEC's Energy Saving Scheme (ESS) self-assessment tool implements a methodology that can be easily applied by the internal work force within the clothing industry. The addressed clothing industry segments include:

- T-shirts and related - knitted;
- Shirts and blouses - woven;
- Trousers and skirts (casual and denim) - woven;
- Suits & overall jackets - coats;
- Pullovers flat knitted;
- Underwear and bras; and
- Technical products.

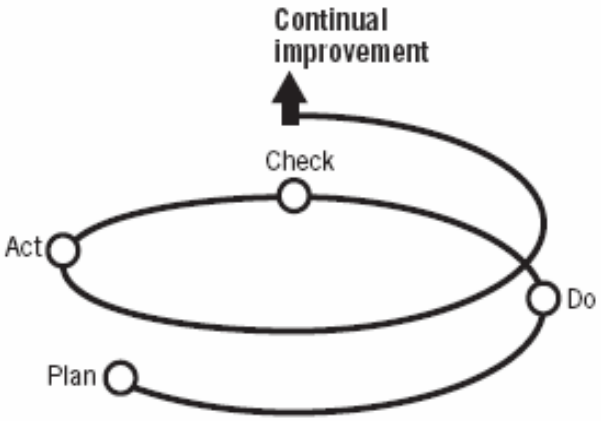
For each of these segments, the tool allows an analysis by process. The processes are:

- Weaving;
- Knitting;
- Spreading & Cutting;
- Embroidery;
- Printing;
- Sewing; and
- Finishing.

The tool is result oriented, simple to understand and based on the intrinsic technical and production knowledge of the company's work force. The methodology requires commitment to energy management by top management and an "energy team", which is composed by employees that embody the plant knowledge on production flows and the technical and operational data for production machines and its auxiliaries.



The methodology follows the widely used Plan-Do-Check-Act (PDCA) cycle and although standard based, this tool specifically focuses on technical analysis for energy consumption and on measure proposal for immediate implementation and savings. With a hands-on approach the tool avoids the often encountered feeling of over-analysis or over-study. In fact this methodology skips several steps of the standard approaches. Its use assumes that within the company, especially in the top management, the notion exists that energy has to be managed like any other resource and that there is an untapped energy potential to explore.



The SESEC's ESS is supported by three Excel based tools, which are:

- Energy Distribution Support Tool – EDST;
- Energy Management and Benchmark Tool – EMBT; and
- Self Assessment Tool – SAT.

This document presents the Plan-Do-Check-Act cycle in this order, however the implementation does not require the user to follow it strictly.

- PLAN stage includes an energy self assessment and the decomposition of the total energy use. This stage answers the following questions:
    - How does my company stand regarding energy management and where are the areas I can improve both in best practices and energy saving technology?
    - What cost effective energy saving measures should I implement?
    - What measures have priority?
    - How and where is energy being consumed?

- DO stage includes the specific implementation of the energy saving measures suggested in the PLAN stage.

- CHECK stage is to be used both as starting point and for continuous verification. In order for a company to know its state in terms of energy, indicator calculation and benchmarking are the first steps. For continuous verification, monitoring & targeting is to be added. This stage answers the following questions:
    - What is the energy content of my product?
    - What is the carbon footprint of my product?
    - How do I evaluate my consumption on a regular basis?

    - How is the company doing, energy wise, when compared with its counterparts?
- ACT stage represents the evaluation of implemented measures, application of corrective measures, continuous search for more measures to implement and new areas to find waste. This stage is an internal evaluation which compares actual achievements with the estimate in the PLAN stage. This stage answers the following questions:
    - Did I achieve my goals?
    - What more can I do?

5. Specific Outputs

After implementation, SESEC's ESS tools will provide the following outputs:

- List of energy saving measures with qualitative cost & payback data and implementation priority;
- Energy distribution by segment, both thermal and electrical;
- Energy distribution throughout the various production processes depending on segment, both thermal and electrical;
- Energy bookkeeping which collects and documents all energy relevant data systematically;
- Company's global and/or segment energy indicators on a monthly and annual basis. Indicators include the Specific Energy Consumption (SEC) and the Carbon intensity (CI) where:
    - SEC = Energy / Production; and
    - CI = Greenhouse Gases (CO_2) / Energy
- Company's global and/or segment graphical analysis of "Energy vs. Production" on a monthly and annual basis;
- Company's global and/or segment graphical analysis of "Greenhouse Gases (GHG) vs. Production" on a monthly and annual basis;
- Company's global and/or segment analytical calculation of energy consumption when production is 0, the calculation of energy required to produce one additional unit and calculation of the energy proportion that doesn't contribute to production;
- Benchmark position based on calculated indicators globally and by process in each segment.

4.1 Plan Stage

Picking up the previously stated questions regarding Plan stage;

Where does my company stand regarding energy management and what are the areas I can improve both in best practices and energy saving technology?

What cost effective energy saving measures should I implement?

What measures should I implement first?

One of the first activities to be undertaken when implementing an energy management system within a company is to check the existing level of the energy management in the company. The following checklist contains 7 key questions concerning internal procedures that help a company identify the main priorities regarding the implementation process. In terms of operationalization, the Self-Assessment Tool (SAT) completes the assessment started by the checklist and comprises of a questionnaire which can be used in the initial stage of implementing or improving the energy management system. As a result, a list containing proposed energy saving measures, its qualitative investment & payback and implementation priority is made available. Full list of energy saving measures can be found in annex.

Self evaluation check list.

This checklist is also available in an Excel file so it can be updated trough the process of energy management implementation, also comments can be inserted to aid in objectives achievement.

A	Basic information	Explanation of the question	Explanation answer if Yes
1	Has the company identified the primary energy aspects based on the energy consumption figures, and are they kept up to date?	The energy aspects that determine consumption within the processes are expected to be mapped. Both the primary and the secondary (e.g. compressed air equipment (primary energy consumption) and the use of compressed air, which also affects the consumption (secondary energy consumption)). This overview needs to be kept up-to-date when changes of e.g. processes occur.	Yes if a summary of the primary energy aspects is available that collectively represents three-quarters of the organization's total energy consumption.

B	Implementation and Operation	Explanation of the question	Explanation answer if Yes
2	Have tasks, responsibilities and authority been determined for all staff involved in energy management (energy team)	It is expected here that you have a list of employees with tasks, responsibilities and authority in the area of energy.	Yes if this is documented and conveyed within the company.
3	The primary energy consumers (energy aspects) are regularly measured, registered, analyzed and reported?	Measurement data of the major energy aspects (largest users) is expected to be available in sufficient detail. Sub-measurements are not always necessary, but are usually recommended, as is comparison of the data with key figures for the sector. Analysis provides insight into the progress being made and possible non-conformance.	Yes if measurement data are sufficiently specific to evidently contribute to management and improvement of the energy consumption, for example measures taken when non-conformance is identified.

C	Energy policy, planning and improvement	Explanation of the question	Explanation answer if Yes
4	Has the company management adopted an energy policy and has a plan of approach been compiled for improving the energy performance, in accordance with that policy and considering following matters?	A document (e.g. an Energy Conservation Plan (ECP) with detailed results based on the target energy saving output from SAT) is expected to be available. General requirements on the plan of approach are that it be Specific, Measurable, Achievable, Realistic and Timed (SMART).	Yes if this document is available.
4.1	Legal and other requirements?	Any permit requirements, construction regulations and requirements, e.g. on the parent company, are expected to be taken into account.	Yes if this is documented as being the case, e.g. in the ECP.
4.2	The primary energy aspects?	Energy objectives and tasks are expected to primarily focus on the (large) consumers, where the most improvement can be expected to be achieved.	Yes if this is documented as being the case, e.g. in the ECP.
4.3	The best techniques available (according to SAT list of measures, for example)?	An organization is expected to be aware of the best techniques available and to use these if possible. The organization can keep up to date, for example, by actively participating in sector consultation with reference to energy.	Yes if the organization can demonstrate that it structurally follows developments and determines whether new techniques can be implemented.
4.4	The time schedule within which these are to be achieved?	The points in time when implementation of objectives and tasks start and are to be concluded is expected to be clear. General requirements on the objectives are that they be Specific, Measurable, Achievable, Realistic and Timed (SMART).	Yes if this is documented as being the case and a time schedule is present.
4.5	Commitment from management?	The highest management of the company is expected to formally commit itself to a policy which confirms compliance by the company of relevant laws, regulations and other agreed rules and that the organization strives to continuously improve the energy performance and to prevent superfluous consumption of energy	Yes, if the authorized person of the management has formally approved the energy policy expressing the compliance and the ambition to continuously improve the energy performance and to avoid superfluous energy consumption

D	Documentation	Explanation of the question	Explanation answer if Yes
5	Have the commitment of the management to an energy policy and the way how energy management has been implemented, been documented (in writing or electronically)?	The energy management system is expected to be defined in a set of formal documents that is accessible to users. These documents indicate who bears responsibility for the documents and how energy measurement data in particular is registered. The energy management documents may comprise a separate system or can be part of another management system (e.g. ISO 9001 or 14001, or HACCP).	Yes if a documented system of coherent documents exists for achieving the energy policy and objectives.

E	Audits, measures and evaluation	Explanation of the question	Explanation answer if Yes
6	In the event of non-conformance, is the cause investigated and are corrective or preventative measures taken to prevent reoccurrence?	How non-conformance occurs is expected to be analyzed (monitoring registered data). Based on these occurrences, corrective and structural measures are taken to prevent them from reoccurring. Matters that will go wrong in the future if preventative measures are not taken are anticipated.	Yes this shown to be probable.
7	Is the evaluation of the energy management system performed at least once each year by the management based on the following information?	The entire package of energy management measures is expected to be discussed at least once each year in order to determine whether agreements are being satisfied and the desired results (policy) are being achieved.	Yes this shown to be probable.
7.1	Energy performance based on monitoring information.	The energy consumption is expected to be analyzed as a trend.	Yes if this has been documented.
7.2	The evaluation of conformance with legal and other requirements pertaining to energy.	The organization is expected to determine whether agreements and regulations have been satisfied in accordance with the policy statement.	Yes if this has been documented.

How and where is energy being consumed?

Understanding the organization's energy matters includes the trend quantification of current energy use. The best tool for this is an energy audit, which should be conducted by internal or external specialists by means of consulting. If an audit is not feasible, an internal approach can be made in order to access energy flows using the Energy Distribution Support Tool (EDST) The tool will ask to input technical and work load data and produces the electrical and thermal energy distribution.

4.2 Do Stage

Do stage represents the implementation of all the selected energy saving measures, which were suggested by the Self-Assessment Tool (SAT). Based on the tool proposals the energy team, including the top management, should prepare a plan for implementation using the SAT results.

4.3 Check Stage

Picking up the previously stated questions regarding Check stage.

What is the energy content of my product?

What is the carbon footprint of my product?

How do I evaluate my consumption on a regular basis?

An efficient energy use requires implementation of an energy book-keeping system. Within an energy book-keeping system, all energy relevant data is being systematically

collected, documented and regularly up-dated. By matching the energy invoices and production data in the Energy Management and Benchmark Tool (EMBT), the energy use is centralized in the same place. As results one can calculate energy indicators and report on the evolution of consumption. In addition a regression analysis can estimate the energy content of one production unit, the baseline consumption (energy consumed if production is 0) and the amount of energy that doesn't contribute to production is made available.

Monitoring and targeting is also included here. After energy saving measures are implemented, the energy performance will improve, meaning lower Specific Energy Consumption (SEC) values, etc... This evolution is followed by continuing to use the EMBT month after month and verifying evolutions.

How is the company doing, energy wise, when compared with its counterparts?

Energy benchmarking comprises the collection, analysis and reporting of data to provide an industrial company with a context for assessing its energy efficiency in comparison to others in the same sector. It provides data on how energy is currently used within a particular industrial sector and process. Based on production and energy data collected in five countries, Bulgaria, Germany, Italy, Portugal and Romania, the EMBT provides the comparison results for each segment in lighting, compressed air, Steam/Hot water generation, total energy consumption and differentiated by process.

4.4 Act Stage

Picking up the previously stated questions regarding Act stage.

Did I achieve my goals?

What more can I do?

The ultimate goal is the sustainable reduction of the energy performance indicators, basically "use less to produce more". Expected savings are set as the objective to be achieved in the Do stage and after implementation the energy performance indicators evolution should be followed. If reduction is not as expected reasons should be procured, analyzed and, if possible, corrected.

Even when everything is on schedule and the measures are working, things must continue to pass through the circle. In order to at least maintain the current level, regular checks are needed to ensure that everything is still functioning optimally and make any necessary modifications. Inevitably, new possibilities for improving energy efficiency must be assessed, so select more energy saving measures from the SAT (or other sources) and add them to the implementation plan.

6. Possible implementation sequence

As stated in the introduction, the cycle order has no strict sequence, nevertheless one logical sequence is presented in the following flowchart:

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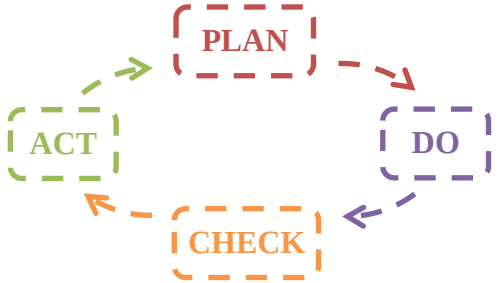
SESEC
Sustainable Energy Saving for the European Clothing Industry



Use SAT to assess level of energy management/technology

Answer yes/no questions, and check/select boxes regarding energy usage

Output

List of energy saving measures with qualitative cost & payback data and implementation priority

Use list to plan energy saving measures implementation

Use EDST to estimate energy distribution within the company

Input machine/equipment technical data, work load and production flow

Output

Energy distribution, both thermal and electrical, by segment and distribution throughout the various production processes depending on

Use data for benchmarking

Correct and

Use EMBT to manage energy and benchmark indicators

Input production and consumption data trough energy invoices

Output

- Energy bookkeeping

- Company's global and/or segment energy indicators on a monthly and annual basis. Indicators include the Specific Energy Consumption (SEC) and the Carbon intensity (CI)

- Company's global and/or segment graphical analysis of "Energy vs. Production" and "Greenhouse Gases (GHG) vs. Production" on a monthly and annual basis

- Company's global and/or segment analytical calculation of energy consumption for pull production

Implement measures

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Annex – Energy saving measure list

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Organization	Build up a system, as detailed and exact as possible, for monitoring of the energy consumption/energy costs and create statistics. Insert energy measuring devices in all relevant installations. Assign a person responsible to initiate actions in the field of energy efficiency.	Medium/High	Process and auxiliary equipment	Reduction of electric and of combustible consumption	Variable (It is function of the initial condition, basically savings increase proportionally to the difference between real use conditions and nominal conditions in which machines or plants run	Cost reduction and Emission reduction because of reduction of electric consumption and in use of combustibles	Variable	5
Organization	Make linear the relation between growth of consumption and growth of production. Check the relation between growth of consumption and growth of the production. If this would result more than linear, divide the utilities into compartments	Slight	Process and auxiliary equipment	Reduction of electric and of combustible consumption	Variable (It is function of the initial condition. They could reach 30% of specific consumption in cases in which there was a strong not linearity in the previous relation)	Cost reduction and Emission reduction because of reduction of electric consumption and in use of combustibles	Variable	3

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Organization	Imbue saving awareness in all workers. Train all staff to operate manual controls, to watch for energy saving opportunities, use posters, “switch-off” and “save-it” stickers as a tool of good housekeeping.	Low/Medium	Process and auxiliary equipment	Reduction of electric and of combustible consumption	up to 2%	Cost reduction and Emission reduction because of reduction of electric consumption and in use of combustibles	Short	3
Process	Use modern, energy-efficient spinning, knitting and weaving equipment. Use light-weight spindles that are powered separately. The production speed of weaving equipment has increased significantly, including by means of improved grab lines, and especially by the introduction of air weaving systems that make production more energy efficient. Note: part of saving effect is negated with air weaving systems due to the energy used to generate the necessary compressed air.	High/ Very high	Process equipment	Reduction of electric consumption	Variable (depends on the original machine but savings up to 5% can be considered)	Cost reduction and Emission reduction because of electric consumption reduction	Long	7

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Process	Use conveyors for product transport in-line. Reduces labour costs related to sorting operations and the average number of garments waiting to be grouped together, consequently saving space and optimizing stock flow. Can be used for different types of sorting operations and reduces human error. Reduces labour costs related to sorting operations and the average number of garments waiting to be grouped together, consequently saving space and optimizing stock flow. Can be used for different types of sorting operations and reduces human error.	High	Process equipment	Reduction of electric and thermal consumptions	Variable (savings with this measure are intimately related to production flows, energy reduction is a byproduct of the improved production flow efficiency)	Cost reduction and Emission reduction because of electric consumption reduction	Variable	7
Process	Reduce excess combustion air to minimum by CO_2/O_2 measurement	Low	Thermal equipment within the heat production plant	Reduction of combustible consumption for thermal use	usually up to 3%	Cost reduction and Emission reduction because of reduction in the use of combustibles	Short	2

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Process	Maximize completeness of combustion by Soot/CO measurement	Low	Thermal equipment within the heat production plant	Reduction of combustible consumption for thermal use	usually up to 1%	Cost reduction and Emission reduction because of reduction in the use of combustibles	Short	2
Process	Maximize combustion air temperature by drawing air from highest point in boilerhouse.	Low	Thermal equipment within the heat production plant	Reduction of combustible consumption for thermal use	usually up to 0,5%	Cost reduction and Emission reduction because of reduction in the use of combustibles	Short	3
Process	Maintain boiler cleanliness (soot/scale) by monitor for rise in flue gas temperature	Low	Thermal equipment within the heat production plant	Reduction of combustible consumption for thermal use	usually up to 1%	Cost reduction and Emission reduction because of reduction in the use of combustibles	Short	2
Process	Change controls to “modulating-Low-Off”	Variable	Thermal equipment within the plant	Reduction of combustible consumption for thermal use	Thermal up to 2%, Electrical up to 15%	Cost reduction and Emission reduction because of reduction in the use of combustibles	Medium	4

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Process	Repair (replace) boiler insulation	Low/Medium	Thermal equipment within the heat production plant	Reduction of combustible consumption for thermal use	up to 85% (insulated VS uninsulated)	Cost reduction and Emission reduction because of reduction in the use of combustibles	Short	2
Process	Insulate feedwater tank – cover tank	Low	Thermal equipment within the heat production plant	Reduction of combustible consumption for thermal use	up to 85% (insulated VS uninsulated)	Cost reduction and Emission reduction because of reduction in the use of combustibles	Short	2
Building organization	Set thermostats to minimum for comfort (20ºC in winter and 25ºC in summer)	Null	Heating / Air Conditioning Plant	Reduction of electric and thermal consumptions	Variable (depends on startup temperature, and insulation quality)	Cost reduction and Emission reduction because of reduction of electric consumption and in use of combustibles	immediate	1
Building organization	Minimize loss of hot/cold air. Guarantee closed passages between acclimatized and non acclimatized areas	Slight	Heating / Air Conditioning Plant	Reduction of electric and thermal consumptions	Variable (each interior machine is designed for that specific area, if more area is added it keeps working and unable to heat/cool to comfort)	Cost reduction and Emission reduction because of reduction of electric consumption and in use of combustibles	immediate	1

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Building organization	Use heat/cooling only when area is occupied. Applies for comfort areas, technical areas such as server rooms, display rooms, etc. should be analyzed separately	Null	Heating / Air Conditioning Plant	Reduction of electric and thermal consumptions	Variable (this measure usually applies to the night time, in this conditions saving may rise up to 25% if turned off)	Cost reduction and Emission reduction because of reduction of electric consumption and in use of combustibles	immediate	1
Building organization	Install more efficient thermostats with a weather dependent control to regulate the acclimatization in relation to the outside temperature.	Slight	Heating / Air Conditioning Plant	Reduction of electric and thermal consumptions	Variable (adaptative control can produce savings up to 20%)	Cost reduction and Emission reduction because of reduction of electric consumption and in use of combustibles	Medium	5
Building organization	Use air curtains when passages from acclimatized and non acclimatized areas are usually and inevitably open	Low	Heating / Air Conditioning Plant	Reduction of electric and thermal consumptions	Variable (depends on the size of the passage and the temperature on the non acclimatized room)	Cost reduction and Emission reduction because of reduction of electric consumption and in use of combustibles	Medium/Long	5

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Building organization	Use free-cooling whenever possible. Available when the outside temperature is lower than the inside and cooling is required, ex. cooling production plant in winter.	Variable	Heating / Air Conditioning Plant	Reduction of electric and thermal consumptions	Up to 40% (higher in very cold climates)	Cost reduction and Emission reduction because of reduction of electric consumption and in use of combustibles	Medium	5
Building organization	Use free heating whenever possible. Available from steam/condensate system, compressors, vacuum turbines.	Variable	Heating / Air Conditioning Plant	Reduction of electric and thermal consumptions	10-15%	Cost reduction and Emission reduction because of reduction of electric consumption and in use of combustibles	Medium	5
Organization	Reduce the amount of ventilation by control optimization with a timer switch and/or occupancy sensor	Low	Ventilation central and pipe network	Reduction of electric consumption	Variable (depends on the amount of hours the area is occupied/unoccupied)	Cost reduction and Emission reduction because of electric consumption reduction	Medium	5
Service fluids	Repair leaks in hot fluid pipework.	Low	Thermal fluid distribution system	Reduction of combustible consumption for thermal use	Variable (depends on the size of the leak and fluid temperature and pressure)	Cost reduction and Emission reduction because of reduction in the use of combustibles	Short	1

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Service fluids	Repair leaks in ventilation pipework	Low	Ventilation central and pipe network	Reduction of electric consumption	Variable (depends on leak size)	Cost reduction and Emission reduction because of electric consumption reduction	Short	1
Service fluids	Replace steam traps with sensor controlled magnetic valves (Condensate output on demand with minimum loss of fresh steam)	Medium	Thermal fluid distribution system	Reduction of combustible consumption for thermal use	25-35%	Cost reduction and Emission reduction because of reduction in the use of combustibles	Medium	4
Service fluids	Install low-cost solenoid valves on air supply lines to individual machines. Switch off compressed air supply as soon as machine is switched off.	Low	Compressors and pipe network	Reduction of electric consumption	Variable (depending on the machine type savings and amount of pneumatic valves and plastic connectors)	Cost reduction and Emission reduction because of electric consumption reduction	Short	3
Service fluids	Insert valves to isolate “periodic-use” items in system.	Low/Medium	Thermal fluid distribution system	Reduction of combustible consumption for thermal use	up to 5%	Cost reduction and Emission reduction because of reduction in the use of combustibles	Medium	4

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Service fluids	Remove/isolate “dead-legs” and redundant Pipework	Low/Medium	Thermal fluid distribution system	Reduction of combustible consumption for thermal use	100% (active VS inactive)	Cost reduction and Emission reduction because of reduction in the use of combustibles	Medium	4
Service fluids	Repair leaks in vacuum pipework	Low	Vacuum central and pipe network	Reduction of electric consumption	Variable (depends on leak size)	Cost reduction and Emission reduction because of electric consumption reduction	Short	1
Building	Maintain lamps and fixtures clear of light-blocking dust and dirt.	Slight	Illumination plant	Reduction of electric consumption	Variable (illumination improvement up to 30% but can be higher depending on amount of dirt and reflector type)	Cost reduction and Emission reduction because of electric consumption reduction	immediate	1
Organization	Switch off lights where lighting is not needed.	Null	Illumination plant	Reduction of electric consumption	Variable	Cost reduction and Emission reduction because of electric consumption reduction	immediate	1

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Building	Make the best use of daylight.	Variable	Illumination plant	Reduction of electric consumption	Variable (optimization may provide 1-2 hours natural light in winter-summer)	Cost reduction and Emission reduction because of electric consumption reduction	Short/Medium	3
Building	Avoid the absorption of light by the surroundings (light-colored wall, ceilings, and floors).	Low	Illumination plant	Reduction of electric consumption	Variable	Cost reduction and Emission reduction because of electric consumption reduction	Short	3
Process	Install soft-starters in detriment of star-triangle and direct starters in medium/high power motors with multiple starts	Medium	Electric equipment	Reduction of electric consumption	up to 15%	Cost reduction and Emission reduction because of electric consumption reduction	Short	3
Process	Replace, don't repair, motors up to 11 kW	Low/Medium	Electric equipment	Reduction of electric consumption	Variable (depends on the current efficiency but replacing also avoids heat damage to stator core, wrong wire size or turn count, higher friction bearings/seals and bad re-design of winding pattern	Cost reduction and Emission reduction because of electric consumption reduction	Medium	3

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Organization	Use a central vacuum system with variable speed and pressostatic control and with several delivery points equipped with dampers	Medium/High	Vacuum central and pipe network	Reduction of electric consumption	up to 50%	Cost reduction and Emission reduction because of electric consumption reduction	Medium/Long	4
Organization	Use dedicated vacuum systems in machines with low work regime or geographically offset from central system. Applies to machines with frequent changes, variable workhours and/or far from centralized system. If all machines suffer from such variance, dedicated systems are more efficient than centralized ones.	Variable	Vacuum central and pipe network	Reduction of electric consumption	Variable (depends on pipe distance from central system and work regimes of selected machines)	Cost reduction and Emission reduction because of electric consumption reduction	Variable	4
Process	Eliminate uneconomic “hot standby” periods, maintain heat supply only if absolutely necessary.	Slight	Thermal equipment within the plant	Reduction of combustible consumption for thermal use	Variable (depends on the power and time the machine is on)	Cost reduction and Emission reduction because of reduction in the use of combustibles	Short	1

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Service fluids	Clean and effective heaters/coolers. Verify dirt deposition in all heat transfer surfaces	Negligible	Heating / Air Conditioning Plant	Reduction of electric and thermal consumptions	Variable (depends on dirt deposition, if totally dirty systems might not even work properly and just shut down)	Cost reduction and Emission reduction because of reduction of electric consumption and in use of combustibles	immediate	1
Service fluids	Use lowest air intake temperature possible in compressors. Duct air intake to ensure coolest possible and/or pre-cool it	Low/Medium	Compressors and pipe network	Reduction of electric consumption	3% for every 10ºC	Cost reduction and Emission reduction because of electric consumption reduction	Variable	2
Service fluids	Check on correct pressure setting regularly.	Null	Compressors and pipe network	Reduction of electric consumption	6-7% per each bar reduced	Cost reduction and Emission reduction because of electric consumption reduction	immediate	1
Process	Replace pneumatic tools by electrical tools	Low/Medium	Compressors and pipe network	Reduction of electric consumption	up to 50%	Cost reduction and Emission reduction because of electric consumption reduction	Short	3

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Organization	Do not use compressed air for cleaning operations. Use of vacuum cleaner instead of compressed air	Negligible	Compressors and pipe network	Reduction of electric consumption	Variable	Cost reduction and Emission reduction because of electric consumption reduction	immediate	1
Organization	Reconsideration of electric supply contract	Negligible	All the electric equipment	Reduction of electric energy cost	Low - Low/Medium - Medium	/	Immediate	1
Organization	Reconsideration of thermal supply contract / cost of used combustibles	Negligible	All the thermal equipment	Reduction of thermal energy cost	Low - Low/Medium - Medium	/	Immediate	1
Organization	Shifting of energivorous processes towards lower price time slots	Slight	Equipment dedicated to this process	Reduction of electric energy cost	Low - Low/Medium	/	Immediate	1
Organization	Shifting of partial charging of batteries of forklift trucks towards lower price time slots	Slight	Forklift truck	Reduction of electric energy cost	Low	/	Immediate	1
Service fluids	Adoption of proximity sensors for not permanently used places	Slight	Illumination plant	Reduction of electric consumption	Slight	Cost reduction and Emission reduction because of electric consumption reduction	Immediate	1

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Service fluids	Removal of covering / impediments from heating appliances and air conditioners	Slight	Heating / Air Conditioning Plant	Reduction of electric and of combustible consumption	Low - Low/Medium - Medium	Cost reduction and Emission reduction because of reduction of electric consumption and in use of combustibles	Short - Short/Medium - Medium	1
Organization	Use of work-shifts	Low/Medium	Process equipment	Reduction of electric energy cost	Variable	/	Immediate	2
Service fluids	Reduction of compressed air production pressure	Null	Compressors and pipe network	Reduction of electric consumption	Low - Low/Medium	Cost reduction and Emission reduction because of electric consumption reduction	Immediate	1
Service fluids	Reduction of steam production pressure	Null	Steam generators	Reduction of combustible consumption for thermal use	Low - Low/Medium	Cost reduction and Emission reduction because of reduction in use of combustibles	Immediate	1
Organization	Use of machines at full load	Slight	Process equipment	Reduction of electric and thermal consumptions	Low - Low/Medium	Cost reduction and Emission reduction because of electric and thermal consumption reduction	Immediate	1

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Organization	Avoiding of on / off running of machines	Slight	Process equipment	Reduction of electric and thermal consumptions	Low - Low/Medium	Cost reduction and Emission reduction because of electric and thermal consumption reduction	Immediate	1
Service fluids	Reduction of losses in compressed air plant	Low	Compressors and pipe network	Reduction of electric consumption	Low - Low/Medium	Cost reduction and Emission reduction because of electric consumption reduction	Short - Short/Medium	2
Process	Replacement of Flat-belt and V-belt transmissions with toothed belt	Low	All the electric equipment	Reduction of electric consumption	Low	Cost reduction and Emission reduction because of electric consumption reduction	Variable	2
Service fluids	Adoption of solar thermal collector	Low	All the thermal equipment	Reduction of combustible consumption for thermal use	Low	Cost reduction and Emission reduction because of reduction in use of combustibles	Short	3

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Building	Adoption of high efficiency window frames	Low/Medium	Heating / Air Conditioning Plant	Reduction of electric and thermal consumptions	Low - Low/Medium	Cost reduction and Emission reduction because of electric and thermal consumption reduction	Medium	3
Building	Substitution of mercury-vapor lamps with fluorescent tubes in low buildings	Low - Low/Medium - Medium	large-scale electric equipment	Reduction of electric consumption	Variable	Cost reduction and Emission reduction because of electric consumption reduction	Short	3
Service fluids	Installation of compressed air accumulation tanks	Low - Low/Medium	Compressors and pipe network	Reduction of electric consumption	Low - Low/Medium	Cost reduction and Emission reduction because of electric consumption reduction	Short - Short/Medium	3
Service fluids	Installation of steam accumulation tanks	Low - Low/Medium	Steam generators	Reduction of combustible consumption for thermal use	Low - Low/Medium	Cost reduction and Emission reduction because of reduction in use of combustibles	Immediate	3
Service fluids	Replacement of fossil fuels with renewable fuels	Variable	Hot water / steam generation plant	Reduction in fossil combustibles use	Variable	Emission reduction because of reduction in use of fossil combustibles	Variable	3

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Building	Adoption of sunbreakers / curtains	Low	Air Conditioning Plant	Reduction of electric consumption	Low	Cost reduction and Emission reduction because of electric consumption reduction	Short/Medium	4
Service fluids	Heat recovery from the boiler / steam generator smokes	Low - Low/Medium	Thermal equipment within the heat production plant	Reduction of combustible consumption for thermal use	Low - Low/Medium	Cost reduction and Emission reduction because of reduction in use of combustibles	Medium	4
Process	Recovery of process heat	Variable	All the thermal equipment	Reduction of combustible consumption for thermal use	Variable	Cost reduction and Emission reduction because of reduction in use of combustibles	Variable	4
Process	Improvement of insulation of water / steam pipes	Variable	All the thermal equipment	Reduction of combustible consumption for thermal use	Variable	Cost reduction and Emission reduction because of reduction in use of combustibles	Variable	4
Service fluids	Use of high efficiency pump for sewages	Variable	Sewage disposal	Reduction of electric consumption	Variable	Cost reduction and Emission reduction because of electric consumption reduction	Variable	4

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Process	Adoption of inverters for big size electric engine	Medium	Large-scale electric equipment	Reduction of electric consumption	Medium	Cost reduction and Emission reduction because of electric consumption reduction	Medium	5
Building	Adoption of LED Lamps	Medium - Medium/High	Illumination plant	Reduction of electric consumption	Medium	Cost reduction and Emission reduction because of electric consumption reduction	Medium	5
Service fluids	Recovery of heat from compressors	Medium	Compressors and heat production plant (for process and heating)	Reduction of combustible consumption for thermal use	Slight	Cost reduction and Emission reduction because of reduction in use of combustibles	Short	5
Process	Adoption of high efficiency electric engine	High	All the electric equipment	Reduction of electric consumption	Medium - Medium/High	Cost reduction and Emission reduction because of electric consumption reduction	Medium - Medium/Long	5

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Building	External wall insulation	Medium/High	Heating / Air Conditioning Plant	Reduction of electric and thermal consumptions	Medium	Cost reduction and Emission reduction because of electric and thermal consumption reduction	Medium - Medium/Long	6
Process	Adoption of high efficiency boilers / steam generators	Medium/High	Thermal equipment within the heat production plant	Reduction of combustible consumption for thermal use	Low/Medium	Cost reduction and Emission reduction because of reduction in use of combustibles	Medium	6
Building Organization	Limitation of heated / conditioned volumes (it can be sufficient to spread a nylon sheet)	Low - Low/Medium	Heating / Air Conditioning Plant	Reduction of electric and thermal consumptions	Low - Low/Medium	Cost reduction and Emission reduction because of electric and thermal consumption reduction	Medium - Variable	6
Service fluids	Condensates Recovery	Variable	Process thermal equipment	Reduction of combustible consumption for thermal use	Low	Cost reduction and Emission reduction because of electric consumption reduction	Short	6

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Process	Replacement of electrical heater with fire heater	Variable	Process thermal equipment	Reduction of electric consumption	Variable	Cost reduction because reduction of electric consumption and cost increase because increase in use of fuels. Emissions have to be evaluated.	Variable	6
Energy production	Installation of Cogeneration plants	High	Thermal equipment within the heat production plant	Reduction of electric energy cost	Medium/High/Very High	Cost reduction because reduction of electric consumption and cost increase because increase in use of fuels. Emissions have to be evaluated.	Medium/Long	7
Energy production	Installation of Trigeneration plants	High	Process thermal equipment	Reduction of electric consumption for air conditioning	Variable	/	Long	9

Category	Action	Cost	Involved uses	Effects on consumptions	Savings	Consequences	Pay back	Priority
Building	Low ceilings and lamps	Variable	Illumination plant	Reduction of electric consumption	Variable	Cost reduction and Emission reduction because of electric consumption reduction	Variable	6
Organization	Work shifts on the weekend	Low - Low/Medium	Process equipment	Reduction of electric energy cost	Variable	/	Immediate	6
Organization	Turn off machines and lights during lunch	Negligible	All the electric equipment	Reduction of electric consumption	Variable	Cost reduction and Emission reduction because of electric consumption reduction	Immediate	1