Guidance on an Adapted Energy Management System (Mini EnMS)

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Executive Summary (November 2016)

The Adapted Energy Management System is the core part of the overall concept of a Stepwise on Energy Management System. This concept will also enable Small and Medium Size Enterprises (SME) to implement by in-house capacity a stepwise Energy Management System and, based on that, this could be extended subsequently to a full Energy Management System like ISO 50001 if this is needed.

It is important to involve SME into a broader scale implementation of Energy Management because of the energy saving potentials, cost savings for enterprises and also the reduction of GHG emissions due to measures of increased energy efficiency. Hereby the impact mitigation of climate change and the economic benefits will go hand in hand.

In order to encourage SME and other organizations wanting to implement a stepwise EnMS to do so, the entry barrier for implementing should be as low as possible and should not require specific expertise on Energy Management within the enterprise. Starting with the compilation of data about energy use over the statement of consumption as reported by the energy provider, the available specific consumption figures for the appliances up to measuring the energy consumption by commercially available flowmeter. Finally a cost/benefit consideration or assessment will be made for possible measures which are improving the energy performance. The Top Management will review these results and take a decision how to proceed. All these activities and subsequent steps need to be documented in a proper and comprehensive way.

Stepwise system

Existing tools and adapted methods should help to establish a comprehensive stepwise system which consists basically of three subsequent steps:

1. Energy Use Checklist

Before starting the Energy Management an Energy Use Checklist should help to identify the obvious main sources of energy consumption. For many sectors in

industry, commerce or small trade there are Checklists available focusing on typical and main sources of energy consumption. Applying such Checklists will provide a first estimate of main energy consumption and saving potentials. These Checklists could also be used later as a qualitative plausibility check for Energy Management.

2. Adapted Energy Management System

It is proposed that the Adapted Energy Management System (EnMS) should be used as a facilitated approach for Energy Management. This ‘Adapted EnMS is based on a methodology which has been described in the German legislation about financial incentives for SME when improving the energy performance. It is also covering the essentials of an Energy Audit as described within the European CEN Standard 16247 (also comparable to: ISO 50002 Energy Audit).

When using this Stepwise System for Energy Management, the access to and the implementation of an Energy Management System will be facilitated. The ‘Adapted Energy Management contains the core principles and elements of ‘real’ Energy Management Systems and can be easily extended to the cyclic PDCA (Plan/Do/Check/Act) review and continual improvement process.

These results can be used and applied as such to improve the Energy Performance through technical or organizational measures, furthermore as evidence for applying financial contribution from incentive programmes or regulations or for any other beneficial programme.

The main economic advantages are reduced energy consumptions and costs. This will become immediately effective, will cause the modernization of technologies and by that a higher economic performance of the enterprise, increased the competitiveness in national and international markets.

This Adapted Energy Management can also serve very well as the basic step of a full Energy Management System according to ISO 50001 or others. By that way, the efforts to implement ISO 50001 could be strongly reduced as the core principles and essential of an Energy management System are already in place if the Adapted EnMS has been implemented.

3. ISO 50001 Energy Management Systems

The next two steps of ISO 50001 would build on the Adapted Energy Management System, comprise, continue and operationalize the requirements of ISO 50001. This will result in a full functionality of ISO 50001 within the enterprise. It includes e.g. the training and professional qualifications of employees, adapting the organizational changes, assuring the comprehensive documentation and the implementation of technical measures.

The third and last step will comprise the review and check of the proper and correct functionality and operation. Gaps and necessities for improvement are to be identified; measures for improvement will be proposed and reported to the Top Management. The Top Management must take appropriate decisions.

This includes decisions on actions for continual improvement of the Energy Efficiency and setting further challenging objectives for higher Energy Efficiency over a specific period

A declaration of the Energy Policy such as measures taken, further objectives of energy consumption, the time frame and the Top Management's commitments will normally be drafted and documented.

If the ISO 50001 has been fully implemented and all required documentation is available a certification can be provided by an externally accredited certifying body. If the Energy Management is in compliance with ISO 50001, the organization or enterprise will get a certificate and a logo proving the successful implementation and can be used that for any business or communication purpose.

The certificates are issued for 3 years. After that time period a re-certification can be applied

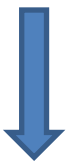
Figure 1:

Overview and Flow Scheme of the Stepwise System of Energy Management

Step 1: Apply Checklist of typical Energy Uses in SME

Results: First estimates of main energy consumptions

Can be used as qualitative plausibility Check



Step 2: Adapted Energy Management System

Adapted Energy Management System

(Superimposable with: Step I ISO 50001 Energy Management Systems

- Written Commitment of Top Management to implement 'mini' Energy Management System
- Energetic Assessment
- Compilation and Analysis of Fuel
- Compilation and Analysis of Energy Use
- Data compilation in forms of Excel spreadsheets
- Inventory of Energy Users
- Measurement and/or Estimating
- Analysis and Assessment (Energy Baseline / Energy Performance Indicators)
- Check on Plausibility and Error Analysis
- Assessment on Energy Saving Potentials
- Economic Assessment of Measures to use Reduction potentials
- Use of energy saving potentials
- Documentation
- Feedback to the Top Management
- Top Management: Decision about possible measures and documentation about it

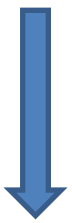
Results:

Decision Point for the Top Management:

- **Use the results of the adapted Energy Management as such and / or possibly apply for grants or other incentives**

Or

- **Continue to implement the full ISO 50001 Energy Management**



Step 3: Continue to Energy Management System ISO 50001

Energy Management System continue: ISO 50001
Step II Implementation and Operation

- Objectives to improve Energy Efficiency
- Energy Policy of the Organization
- Determining policy and targets for the Management System
- Implementation of Measures
- Documentation of the Implementation (e.g. Manual, Procedures)
- Organizational Structure
- Documentation System , Rules for Feed In and administrative Procedures
- Rules and criteria for Calls of Tenders, Purchase conditions, Life Cycle Costing
- Planning of Infrastructure
- Training of Employees
- Setting principles for communication and assuring proper communication
- Gathering and structuring proposals for improving the Energy and Economic Performance of the Organization
- Yearly Planning for Energy supply, consumption and tendering
- Planning for Energy supply, Measurement- and Assessment instruments

Energy Management System continue: ISO 50001
Step III Full Operation, Review and Control, Feed Back to Top Management and Continual Improvement

- Extensive and Full Operation of the Energy Management System (PDCA-Cycle) focused on continual improvement
- Updated plan for saving Energy (Plan)
- Records from the ongoing Energy Controlling (Do)
- Internal Energy Audit, Audit Plan and Report (Check)
- Analysis and Assessment of the Energy situation,
- Updating the Energy Goals and Documentation of Energy Reviews (Act)

Stepwise System of Energy Management Implementation

Step 1: Apply Checklist for typical Energy uses

This list provides an estimate about typical uses and energy consumptions in buildings and places of processing or offices.
It is an indication about saving potentials and beneficial measures.

Example:

Screening list/action plan (combined list)

No.	Description	Potential for savings		Invest-ment (Costs)	Pay-back time Years	Time schedule	Person in charge	Decisions
		kWh/ year	Price/ year					
1	Usually not in buildings – Use HCV	3,000	5,000	20,000	4	9/2014	PJ	Project late!
2	Turn off lighting on 1st floor evenings and weekends	2,500	3,500	0	0	3/2015	HN	Project accepted
3	Replace bulbs with energy saving light bulbs in offices	30	40	50	< 1	10/2015	HN	Project accepted
4	Put copying machines on a time switch	250	300	250	1	6/2015	HN	To be reconsidered

Step 2: Adapted Energy Management System

Decision for a systematic Energy Management

The commitment of the Top Management to implement and maintain an Energy Management is the most important prerequisite and decision to be taken at the beginning.
This should be communicated in writing in order to put emphasis on the execution of implementation.
Best it could be included into the enterprise policy, energy policy and continual improvement processes.
It must be documented in a written statement like the following phrasing:

'We as enterprise ……..confirm hereby our commitment to implement the 'Adapted Energy Management System' within 2016/2017 and operate it from 2017 in regular service. The necessary financial and human resources will be provided and the Top Management will review the system in defined intervals.'

Employees need to be informed and involved into the whole process.
Provide them as well with information about the mission statement and the energy policy of the enterprise and the strategic goals to be achieved.

Assignment of Responsibilities and Resources

The assignment of the responsible Energy Manager and his/her rights and duties have to be recorded and documented in writing.
Energy Efficiency is not a self-running process. Normally there is a leading Energy Manager i or an Energy Team, depending on the size of the enterprise, who implement the Energy Management.
The Energy Manager should be motivated for his/her tasks, knowing the organization and course of action and operation within the enterprise. There should be confidence from staff and management in the responsibilities and tasks of the Energy Manager.
The assignment could read as follows:
'The main responsibility for the coordination of the implementation of the Energy Management will be Mrs. / Mr. Energy Manager. The necessary financial and human resources are assigned to him and rights and duties as well to enforce the implementation'.
It might be necessary to assign support staff and their resources to him / her in order to comply with his/ her tasks.

Documentation

It is recommended to install a system of documentation where the necessary data and assessments are stored and to be retrieved by all involved co-workers being involved in the implementation process. An Excel tool and spreadsheet could support a concise collection, analysis and assessment of data.

Energy Review

The Energy Review should collect or measure the use and consumption of energy within the organization. It is the objective to identify systematically saving potentials over a longer period of time.

Recording and Analysis of the used Energy

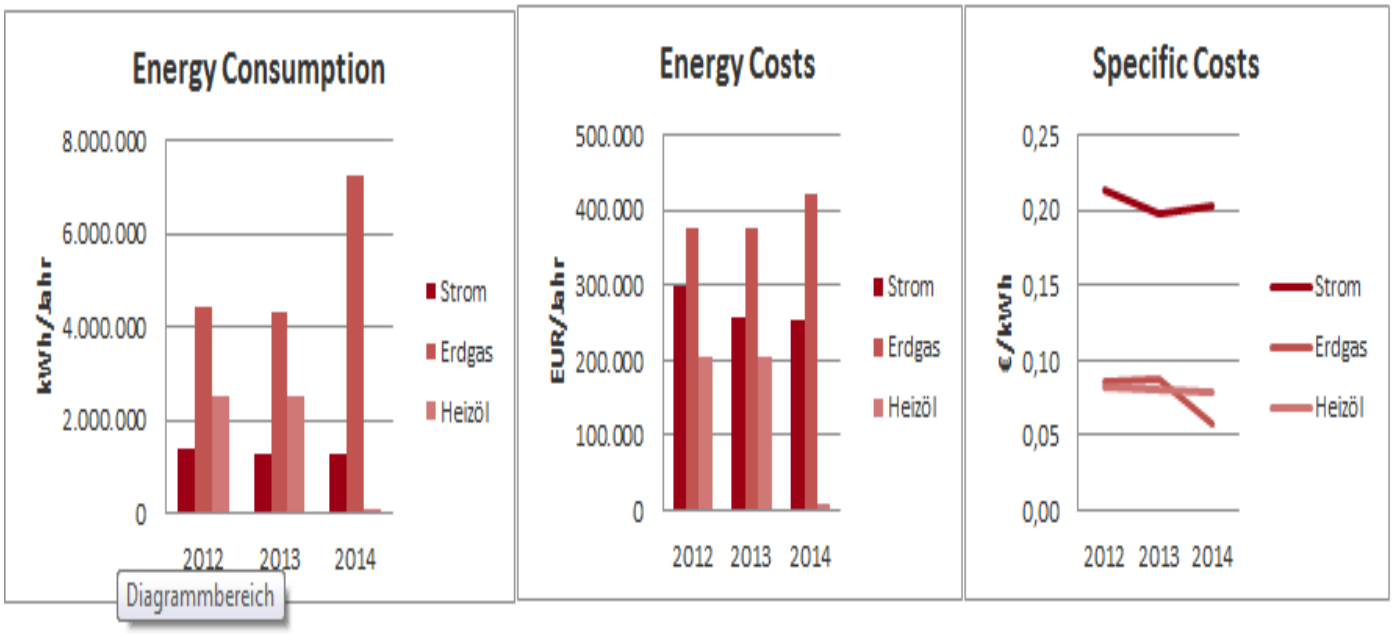
There should be documentation about the actual energies used and the consumption of energy covering a time period of 12 months as a minimum and a completeness statement by the Top Management.
These data could be originated from administrative book keeping or meter reading.

The Energy Review should collect or measure the use and consumption of energy s within the organization. It is the objective to identify systematically saving potentials over a longer period of time.

Year	Used energy/ Energy source	Consumption (kWh/year)	Proportion of total Energy Consumption in %	Costs in EUR	Portion of Costs in %	Measurement System	Accuracy/ Calibration

Example: Recording and Analysis of the Energies

Fruit Juice Production



Fuel	Unit	Accounting from	to (date)	Fuel Use	Unit/Duration	total Cost	Specific Cost		Fuel uses kWh	Anual Cost
Electric power		01.01.2014	31.12.2014	1.254.911	/364 Tage	253.297 €	0,20	€/	1.254.911	253.993,13 €
Natural gas		01.01.2014	31.12.2014	7.228.347	#NV	420.956 €	0,06	#NV	7.228.347	422.112,55 €
Fuel oil		01.01.2014	31.12.2014	103.340	/364 Tage	8.092 €	0,08	€/	103.340	8.113,96 €

Fuel	Unit	Accounting from	to (date)	Fuel Use	Unit/Duration	total Cost	Specific Cost		Fuel uses kWh	Anual Cost
Electric power		01.01.2013	31.12.2013	1.299.663	#NV	257.068 €	0,20	€/	1.299.663	257.774,62 €
Natural gas		01.05.2013	31.12.2013	4.298.964	/244 Tage	252.280 €	0,06	#NV	4.298.964	377.385,56 €
Fuel oil		01.01.2013	31.12.2013	2.536.710	/364 Tage	205.765 €	0,08	€/	2.536.710	206.330,76 €

Fuel	Unit	Accounting from	to (date)	Fuel Use	Unit/Duration	total Cost	Specific Cost		Fuel uses kWh	Anual Cost
Electric power		01.01.2012	31.12.2012	1.400.000	/365 Tage	300.000 €	0,21	#NV	1.400.000	300.000,00 €
Natural gas		01.05.2012	31.12.2012	4.400.000	/244 Tage	252.280 €	0,06	€/	4.400.000	377.385,56 €
Fuel oil		01.01.2012	31.12.2012	2.500.000	/365 Tage	205.765 €	0,08	€/	2.500.000	205.765,47 €

Recording and Analysis of Energy consuming Systems and Equipment

Analysis of energy consumption and distribution of energy sources per user
Recording of performance and consumption data of production plants and infra-structure.
Usual equipment such as compressors, pumps, ventilation, motors, heat and chilling devices and office equipment and lighting could be measured or calculated from load and utilization. There must be comprehensive projection about operating and load characteristics available. Energy consumption for Lighting and office equipment can be estimated.

The following table could be used as template:

Energy User				**Used Energy (kWh) und Energy source**	**Waste Heat (Temperature range)**	**Measurement system / Measurement mode or mode of recording**	**Degree of Accuracy/ Calibration**
No.	**Facility / Part**	**Age**	**Capacity**				

Example:
Recording and Analysis of Energy consuming Systems and Equipment

Building	Heater		2001		
Energy Supply	Compressed Air Supply 1		2006		22,00 kW
Energy Supply	Compressed Air Supply 2		1999		22,00 kW
Energy Supply	Compressed Air Supply 3		1999		15,00 kW
Energy Supply	Board Heat Exchanger		1999/2002		28,00 kW
Energy Supply	Steam Boiler 1		2013		20,33 kW
Energy Supply	Steam Boiler 2		1996		28,00 kW
Energy Supply	Steam Boiler 1		2013		
Energy Supply	Steam Boiler 2		1996		
Extraction	Juicer 1		1978		20,00 kW
Extraction	Juicer 2		1995		30,00 kW
Extraction	Separator		2014		56,00 kW
Processing	Concentrator		1977		40,00 kW
Processing	Aseptic Facility		2010		19,00 kW
Processing	Separator		1995		56,00 kW
Storage	Mash Tanks		1978/2011		45,00 kW
Storage	Cold Store 1		1993		
Storage	Cold Store 2		2002		
Storage	Cold Store 3		2011		

Energy Performance Indicators

It is important to determine the actual Energy Performance within the organization. In order to estimate the future energy consumption you need to define the Energy Performance. Changes in the amount of production / products or the external conditions like climate could influence the energy consumption.
Energy Performance Indicators (ENPI) should provide an assessment of the Energetic Performance. The Energy use per amount of production or the percentage of changes will express the Performance Indicators.

Some examples for Energy Performance Indicators (ENPI)

ENPI	Description	Unit
Specific Energy Consumption related to amount of production	Energy Consumption (total) / Amount of production (total)	kWh/PE, kWh/EUR
Specific Energy Consumption related to area	Useful for heating energy for lighting. Energy consumption /area	kWh/m²
Changes of ENPI	Provides information how the specific consumption of energy will change over a longer period of time	%

Plausibility and error checking

Make a readjustment of all recorded data and eliminate obvious errors by a check of plausibility
The check can be performed:

- By comparison of energy delivery and measured/determined consumption
- Benchmarking for building heating / chilling efforts per square meter
- Benchmarks for industry sectors e.g. in sources like ‘Climate and Energy Foundations’
- Review by second person

If there are significant gaps or inconsistencies, find out the reasons and correct it.

Identification and assessment of Energy Saving Potentials

This will comprise the identification for energy saving potentials. The energetic optimization of technical equipment and systems and the improvement of energy efficiency of specific installations or products.

Furthermore the following tools may be applied:

- Assessment of the reduction potentials of energy consumption considering economic criteria
- Determine the energetic saving potentials in energy units and monetary units
- Provide a list of measures to reduce the energy consumptions e.g. in terms of investments
- Assessment of economic criteria for measures (cost/benefit), internal interest rate, profitability, return of investment (ROI)

General Issues				Internal Interest rate	Static Return of Investment
Investment/ Measure	**Investment**	**Cost Saving / year**	**Technical Use time (Lifetime)**	**Profitbility of investment per year**	**Cashflow**
	€	**[€/year]**	**[years]**	**[%]**	**[years]**

Example: Saving Potentials and Economic Assessment

Beverage Industry

Pressurized Air Compressor-System

Description of Project:	Measures:	Assessment:
Process- und Zirculationspumps of the Re-cooling system > 250 Employees Analysis: Flow-through high-pressure side, throttled, Operation at low power efficiency, driven by nominal and not load-dependent operation conditions	Deletion of Throttling Use of High Efficiency Motors und Motorvalves Rotational speed control related to load demand Replacement or deletion of low -/non-used volume meters Standards: DIN EN 809/A1, DIN EN 12162/A1, DIN EN 13951/A1 ISO 4409 ISO 8426 ISO 17559	Considerable Reduction of Costs in Operation Sustainable use of Materials

Saving of Energy	In KWh per Year- before	Electricity	2.470.000
	In KWh per Year- after retrofitting	Electricity	1.545.000
	Savings in KWh and (%)	Electricity	925.000 / (37%)
Savings of Costs	Euro/Jahr	Electricity	74.000,- Euro/Year

Total Savings of Costs per Year	74.500,- Euro /Year
Investment in Euro	295.000
Pay Back time in Years	4 Years
Return Rate in %	21,4 %

Review by and feedback to the Top Management

The Top Management must review the progress of the action plan and energy performance at a minimum of one time per year but better in a continuous way.
The must take decisions how to further continue with appropriate measure to improve the energy efficiency.
First they might decide and take the most simple and lowest cost measures.
The decisions of the top management must be documented.
The adopted measures should be incorporated in action plans and timelines which goals have to be achieved and which time.

The Adapted Energy Management has been finalized now.

The Top Management of the organization can decide about the following steps:

Decision Point for the Top Management:

- **Use the results of the adapted Energy Management as such and / or possibly apply for grants or other incentives**

And / Or

- **Continue to implement the full ISO 50001 Energy Management**

Step 3: Continue to Energy Management System ISO 50001

Energy Management System

continue: ISO 50001

Step II Implementation and Operation

- **Objectives to improve Energy Efficiency**
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Energy Management System

continue: ISO 50001

Step III Full Operation, Review and Control, Feed Back to Top Management and Continual Improvement

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Energy Policy and Continual improvement

At any stage of Energy Management it is recommended to define and declare the Energy policy of the organization as well as further objectives and energy targets. This helps to keep on track, to record progress and achieve further reduction of energy use, costs and emissions. So this is contributing essentially to climate protection

How do we develop our energy policy, energy objectives and energy targets?

Suggestions for an energy policy, energy objectives and energy targets are given below.

There are no restrictions on how detailed the energy policy, energy objectives and energy targets have to be, but there has to be an increasing degree of detail from the energy policy through energy objectives to energy targets.

Energy policy (some suggestions may be applied in their present form, others will require further elaboration)

- Throughout the entire company, employees are to be aware of using energy sparingly.
- Efficient use and reuse of energy, natural resources and materials throughout the entire company.
- We will make an active effort to reduce the consumption of energy and thereby contribute to reducing the consumption of scarce resources such as coal, oil, natural gas and to reducing the emission of greenhouse gases (CO2).
- We will be a pioneer company in energy efficiency .

Objectives

- We purchase energy efficient products.
- We apply energy efficient design of new buildings.
- We will choose the most energy efficient equipment from our suppliers whenever possible.
- We will make sure that all employees are conscious of saving energy.
- We will make sure that all employees are conscious of the energy consumption of the company – and that new devices

purchased are among the least energy consuming devices on the market.

- Energy management is to become a natural part of the daily work of all employees.
- We will go through all installations with the purpose of identifying opportunities for reducing the energy consumption.
- Every year we are to launch a communication campaign focusing on behaviour to ensure that employees are updated on energy issues.

Targets

- We wish to number among the 10 most energy efficient municipalities/ministries/universities/companies.
- We will reduce our CO2 emission by an annual 3% over 10 years.
- We will be certified to ISO 50001 in 2017.
- We will reduce the relative electricity consumption of our administration by 10% in 201X.
- By the end of 20XX, 80% of our ventilation systems are to be heat recovery systems.
- All offices are to be provided with energy-saving power strips by the end of 201X.
- Reduce electricity consumption in 20XX by 1% compared with 2010.
- By 1 July 20XX, mapping of opportunities for savings are to be carried out in consultation with an energy consultant, and a prioritized action plan for completing relevant actions has been made.
- By the end of 20XX, we have elaborated energy-saving procedures and manuals for all fields of activity and ensured that they are known and are applied by all.