Steam, energy and management practices: how is industry doing? And what can we do to make them do better?

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Abstract

Experiences across Europe show that the potential for energy efficiency improvement in general, and steam system efficiency improvement in particular is not yet fully utilised. When talking about steam system efficiency this includes, in addition to steam generation, steam distribution and steam use. The main barrier in achieving the full potential seems to be the gap identified between the identification of measures from energy audits and implementation in practice.

The, EU-funded, Steam-Up project is aiming to close this gap. A first step to this is an industry-wide inventory carried out amongst 55 industrial companies and 45 energy auditors and energy consultants. The focus of the inventory was on energy efficiency with specific attention on steam use and efficiency, auditing and (energy-) management. The inventory was completed with a concise literature study on energy efficiency decision making and ways of influencing decision making. For the latter the focus was on non-energy-benefits and organisational- and behavioural change.

Based on this inventory the Steam-Up project is designing interventions to facilitate the uptake of energy (and specifically steam) efficiency in industry in general and in (piloted-) companies more specifically. These interventions may vary from interventions on an organisation level (e.g. by supporting energy management implementation) to interventions on all relevant (individual) levels of the organisation. These interventions will be designed using (proven) models for behavioural and organisational change.

This paper will focus on the main findings of the inventory and, based on that, will discus different intervention strategies that will be piloted in the framework of the project.

Introduction

The European Commission is aiming to stimulate the uptake of energy efficiency in industries by posing obligations on energy intensive industries to carry out energy audits on a regular basis as laid down in the EU-Directive 2012/27/EU. However no obligations are set when it comes to the implementation of identified measures as a result of an energy audit. Experiences across Europe show that carrying out an energy audit does not guarantee energy efficiency improvements. A very high percentage of the energy efficiency measures identified are, until now, not being implemented. The high potential in industrial energy efficiency savings, which is estimated to be 13 %[1] in energy consumption savings will therefore not be realised. Up to 75 % of this potential savings can be found in steam and electro motor systems.

In 2014 the European Commission supported a Consortium, led by the Netherlands, within the framework of the HORIZON 2020 programme in executing the Steam-Up project. The Steam-Up project is aiming to close the gap between the identification of measures from energy audits and the implementa-

1. http://www.isi.fraunhofer.de/isi-media/docs/e/de/publikationen/BMU_Policy_Paper_20121022.pdf

tion in practice. The main, but not exclusive, focus lies in the utilisation of the high potential in steam saving measures.

Based on their experiences, the Steam-Up Consortium, which mainly consists of national energy agencies and energy consultants, drew the following, provisional, conclusions concerning the barriers that contributed to the identified gap:

- There is no business case for steam saving measures for company decision makers;
- There is a lack of technical (steam) expertise of energy auditors and within enterprises generally;
- There is no formal organisational structure for dealing with energy efficiency (energy management).

This paper will elaborate on the 'barriers' identified that constitute the gap between the identification of energy efficiency, in for example energy audits, and its implementation in practice thus resulting in, verifiable, energy efficiency improvements. Based on that, a holistic approach of interventions will be presented that is expected to accommodate the uptake of energy efficiency in industrial organisations in general, and implementation of energy efficiency measures more specifically.

Survey: energy efficiency practices in industry

In order to get a more detailed view on how industry is acting when it comes to energy efficiency and steam use efficiency, a detailed survey was carried out. This inventory aims to identify steam, energy auditing and energy management practices in industrial organisations and find out what is hampering the uptake of energy efficiency measures. For a representative result questionnaires were sent to 55 industrial companies in 9 sectors in the 8 member countries (AU, CZ, D, DK, E, GC, I, NL) of the Consortium as well as from 45 energy auditors and consultants in the member countries. This extensive stack of information was completed with:

- General information on energy efficiency practices (legislation, regulations, support programmes, …) retrieved from the 8 consortium partners and energy agencies from 7 more EU countries;
- Information retrieved from a concise literature review on energy efficiency decision making behaviour and drivers for this behaviour.

Barriers to implementation of energy efficiency measures

The concept of barriers is not always considered as being best suited to indicate what is hampering the uptake of energy efficiency[2]. In general, it is a mixture of techno-social factors that determines whether energy efficiency measures are taken or not. This includes organisational processes, procedures, individual habits, norms etc. It is this mixture of factors, which might be better described as 'system', that is hampering the uptake. This means that removing a barrier is no guarantee for improved energy efficiency since the system as a whole might respond differently than we expect based on our linear way of thinking. For ease of discussion we will however stick to the concept of barriers. Based on the identified barriers a holistic, systematic, approach is needed to overcome the existing barriers that are inherent to the existing system.

BARRIER 1: LOW LEVEL OF STEAM SYSTEM EXPERTISE AND KNOWLEDGE

Where in earlier days a steam attendant was a well-known phenomenon in industries where steam was used, nowadays this specific function seems to be extinct. Responsibilities for operation and maintenance are often laid down at maintenance or facility staff and/or are a part-time function. The task is also often outsourced to external parties. Together with this, the technical knowledge of operational and engineering personnel is vanishing which forms a major barrier to energy efficiency improvements. The following observation might be illustrative to this. When asked for where to turn to, to get information on steam saving options only 1 company (2 %) in our survey brings up his own personnel.

Only a few 'hard core' steam experts can still be found amongst energy auditors and consultants. Since they are the ones companies rely on (70 % of the companies in our survey said that energy consultants are their main source of information for steam saving options) for advice on energy efficiency optimisations it seems likely that not all potential steam efficiency measures are being assessed or being assessed as feasible. Often with arguments that can only be countered by real in-depth experts that know what is feasible, without harming your steam system, and what not. Without that knowledge and based on ignorance people tend to remain on the (too) safe side leading to over-dimensioning and setting of for example levels for conductivity control that are way out of range.

BARRIER 2: LACK OF INVOLVEMENT AND COMMITMENT OF SENIOR MANAGEMENT

Involvement and commitment from senior management in energy efficiency improvement is key to reach the full potential of efficiency options. Our survey shows that management is considered to have the highest influence on energy efficiency, 63 % of the companies state that management is one of the key influencers. Their involvement in energy efficiency actions is confirmed for 58 % of the companies but mainly in the decision, evaluation and reporting phase. When asked for their involvement in the energy auditing process only 38 % of the companies explicitly stated their involvement and then again mainly in the end, or decision making phase, of the process. This seems rather low since a majority of the companies stated that decisions on implementation of energy efficiency measures are made at top management or owner level.

The best way of assessing the commitment of senior management to energy efficiency is in identifying whether resources like time, capacity, money, are allocated for energy efficiency activities. Our survey showed that in only 27 % of the companies this is the case. Lack of resources is by far the most mentioned barrier (in 43 % of the companies) for following up on energy audit results. Budget constraints are also mentioned by 41 % of the companies as one of the main reasons for not have taken viable (with a SPP < 2 years) measures one year after identification.

2. Centre of Sustainable Energy and the Environmental Change Institute, University of Oxford (2012), What are the factors influencing energy behaviours and decision-making in the non-domestic sector?, United Kingdom.

In literature[3] the allocation of energy responsibilities to senior management is considered to be essential for energy being salient to this senior management. However a survey, carried out in 48 US companies, shows that in only 38 % of the companies, senior management bears energy responsibilities.

BARRIER 3: LACK OF INVOLVEMENT OF RELEVANT (INTERNAL) STAKEHOLDERS

From an energy management perspective the people in an organisation who have an influence on energy use or efficiency should in one way or another be involved in the process of energy efficiency. In our survey companies were asked which people were thought to have a (direct or indirect) influence on energy use and efficiency. In almost 40 % of the answers (more answers per company were allowed), representing 63 % of the companies, management was mentioned as an influencer, see Figure 1.

What stands out is that employees who are considered to have a direct influence, from the perspective of operation and maintenance like people from production, maintenance or boiler staff, are less often mentioned (respectively in 22, 15 and 10 % of the companies). Also striking is that employees from other departments like e.g. procurement or finances are considered to have no influence on energy efficiency even though procurement of (energy efficient) equipment is a responsibility of the procurement department.

The involvement of mentioned groups of disciplines is more or less proportional to their considered influence, which is shown by a similar graph presenting the involvement of the different employers groups in the audit process.

This 'limited' involvement of stakeholders will have an influence on the effectiveness of energy efficiency actions since the 'not' or 'less' involved groups of employees almost all (can) have an influence on energy use and efficiency. A workshop that was executed within the framework of the Steam-Up project resulted in an extensive list of employees (from the boiler staff up to the CEO) that have an influence on or are affected by, in this specific workshop case, steam, its use and efficiency.

Involvement of a (broad) group of stakeholders can be desirable for several reasons, since this people:

- Can offer opportunities for energy efficiency measures because they are related to the subject;
- Can offer insight in the non-energy benefits of energy efficiency measures (increased production, better working conditions, safety, less maintenance, …);
- Will be less averse to the implemented energy efficiency measures because of their active involvement in the process.

BARRIER 4: LACK OF (PERCEPTION) OF STRATEGIC VALUE OF ENERGY EFFICIENCY

Energy efficiency projects are not (often) seen as having strategic value for the business of the company. They therefore have to compete with other projects that do have (or are considered to have) a strategic value. Strategic in this sense could mean how it contributes to companies' competitiveness, legitimacy or social

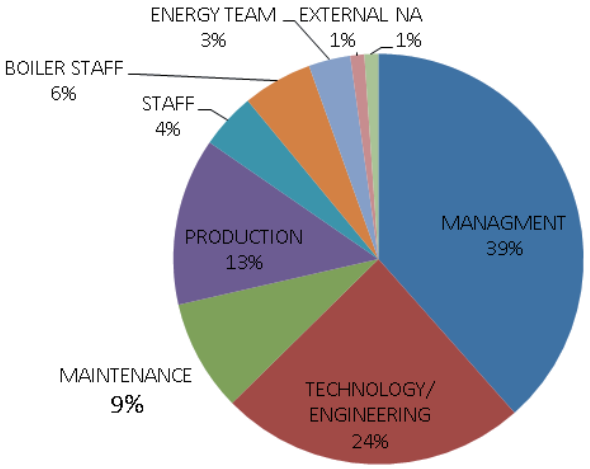

Figure 1. Share of influence of different groups of employees on energy use and energy efficiency.

responsibility image. Literature[4] shows that unprofitable energy efficiency measures – unprofitable from an energy cost saving perspective – are nevertheless taken when they are considered to be of strategic importance. Also in our survey some indirect evidence is found for this assumption. When energy auditors were asked about the implementation rate of measures identified, 63 % of the auditors stated that measures although not considered 'profitable' (with a SPP > 2 years) still are taken. In comparison only 44 % of the auditors state that measures considered profitable (SPP < 2 years) are taking one year after identification.

An example of an energy efficiency measure with strategic value is the following. A chemical plant was considering the reuse of heat from a product stream to heat the feed stream. Based on energy cost savings and the companies' criterion to assess the profitability this energy project would not have been approved. However through the exchange of the 'waste heat' a bottleneck in the capacity of the furnace, that heats the feed stream, could be eliminated thus giving room for the increase of production throughput.

Non-energy benefits

The strategic value of energy efficiency projects can be increased when in the assessment of these projects the non-energy benefits (NEBs) are also accounted for. Including quantifiable NEBs in the evaluation process can increase the priority level for energy efficiency investments. NEBs that are hard to quantify, especially those of a strategic character, can serve as an extra arguments at a later step in the decision-making process to select between similar investment opportunities.

Based on[5] the conclusion can be drawn that inclusions of NEB's in the decision making process should be as early as possible. The referred author(s) state "… building up knowledge on NEBs may have large contributions in the future for measures that may not even "survive" the first step".

3. Centre of Sustainable Energy and the Environmental Change Institute, University of Oxford (2012), What are the factors influencing energy behaviours and decision-making in the non-domestic sector?, United Kingdom.

4. Centre of Sustainable Energy and the Environmental Change Institute, University of Oxford (2012), What are the factors influencing energy behaviours and decision-making in the non-domestic sector?, United Kingdom.

5. Nehler, Thollander, Ottosson, Dahlgen (2014), Including non-energy benefits in investment calculations in industry – empirical findings from Sweden, ECEEE 2014 Industrial Summer Study, July 2014, Papendal, the Netherlands.

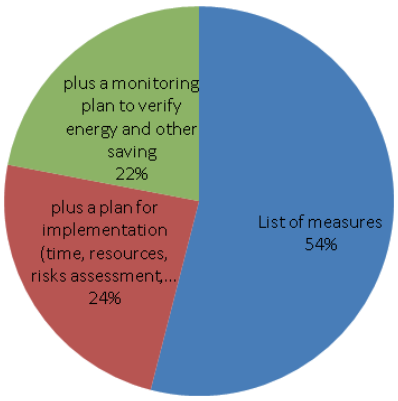

Figure 2. Reporting modalities as a result of energy audits.

Investment decision-making can be considered a 3 step process[6]: 1. noticing the opportunity , 2. creating a list of options and 3. choosing between options using financial and other relevant metrics. In general most of the attention is dedicated to the last step in this process. The above implies that more attention should be paid to the first step, with involvement of multiple stakeholders, which even might imply the involvement of a management representative to assess the strategic value of the energy efficiency investment in an early stage.

BARRIER 5: AUDIT REPORTS: NOT MANAGEMENT GRADE AND NO FOCUS ON IMPLEMENTATION

The objective of carrying out energy audits is the final realisation of energy efficiency improvements. However practices from across Europe show that carrying out an energy audit does not guarantee any energy efficiency improvements. The main causes for that seem to be:

- Audit reports are not management grade i.e. they do not present a clear business case (opportunities (including NEB's to assess opportunities for business and strategy), risks, etc.) for decision makers;
- There is no focus on the process of implementation of the identified energy efficiency projects and measures.

The first item i.e. formulation of a clear business case is said to be a main driver (#2) for energy efficiency investments as stated by industrial companies (ranging from SME to large energy intensive companies)[7].

The second is clearly shown based on our survey where we ask energy consultants about what is reported to the company as a result of the energy audit. For only less than half (46 %) of the consultants the main product of the audits seems to be list of measures, including financial evaluation, accompanied with a plan for implementation and/or a plan for monitoring and verification. See also Figure 2.

BARRIER 6: ENERGY EFFICIENCY HAS TO BECOME COMPANY CULTURE, WHICH PROMOTES CHANGE

When you want to bring energy efficiency into an organisation you have to take note of its existing culture, and the individuals and their behaviour, that constitute organisational culture. How this works can best be illustrated by a model based on McClelland's Iceberg[8] for individual behaviour. This model is transformed by the author of this paper to be applicable for organisations, see Figure 3[9].

The iceberg for organisational behaviour

Behaviour in general and more specifically for organisations can be illustrated by the iceberg model of McClelland. What we see is above the water surface. These are, visible and verifiable actions, or in short BEHAVIOUR. In the ideal world behaviour is directly steered by our desires or what we WANT. For organisations this wanting is laid down in policies and strategies. In order to make these policies and strategies work the organisations designs all kinds of processes, procedures, guidelines and instructions that helps in translating policies and strategies into actions. This set of procedures, norms and protocols can be considered as the memory of the organisation or in this model it is what the organisation THINKS.

While bringing in new energy efficiency policies and/or strategies into an existing organisation one should take note of the existing culture (or THINKING) of that organisation. Try to answer the question "How could existing sets of processes, procedures and norms interact with the newly to be designed sets of processes, procedures and norms that aim to enable energy efficient behaviour". The existing culture might be helping to serve your energy efficiency strategy and policies, but might as well be obstructing. Quite often this is the case, in most cases, without the organisation being aware of this.

This can be illustrated with the following example. You wish to build a (new) energy efficiency culture based on your energy efficiency policies and you want all employees to conform with that policy. The (existing) evaluation processes where employees are judged on and awarded for production outputs is very likely to interfere, or worse come into conflict, with the (new) desired energy efficient operation of production. This will be reinforced as long as employees are not judged and/or rewarded for acting energy efficiently.

The model of Green and Kreuter for individual behaviour

In addition to organisational behaviour one should also take note of individual behaviour. A well-known and validated model for building an intervention strategy on human behaviour is that of Green & Kreuter[10]. This model starts at the end by determining the desired results in our case energy efficiency improvement. Based on that (step 1) the relevant changes in behaviour and environment (to reach the determined result) have to be diagnosed. In step 2 the determinants for the behavioural change are assessed. These are the following factors:

6. Centre of Sustainable Energy and the Environmental Change Institute, University of Oxford (2012), What are the factors influencing energy behaviours and decision-making in the non-domestic sector?, United Kingdom.

7. Energy Efficiency Financial Institutions Group (2015), Energy Efficiency – the first fuel for the EU Economy: How to drive new finance for energy efficiency investments.

8. D.C. McClelland (1961), The Achieving Society, D. van Nostrand Publisher, Princeton NJ, US.

9. D.C. McClelland (1961), The Achieving Society, D. van Nostrand Publisher, Princeton NJ, US.

10. Green L, Kreuter M. (1999), Health promotion planning: An educational and ecological approach, 3rd edition. Mountain View, CA: Mayfield Publishing Company.

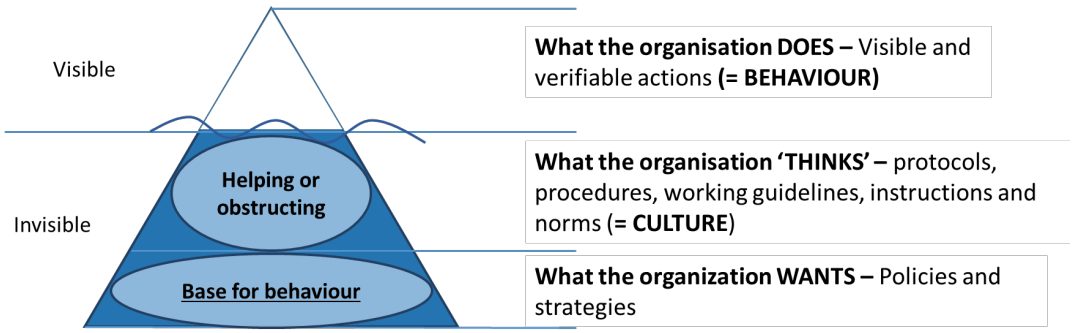

Figure 3. Iceberg model for organisational behaviour inspired by McClelland's model for individual behaviour.

- Factor 1: **Motivation:** The behavioural change (or new behaviour) must be wanted: people must have a motivation for the new behaviour;
- Factor 2: **Enabling**: The behaviour must be facilitated: people must be facilitated to perform the new behaviour.

Factors 1 and 2 induce the behavioural change, but a third factor is needed to maintain behavioural change:

- Factor 3: **Reinforcement**: The behaviour must be 'automated'.

Examples
Examples of the different factors are:

- Motivating factors: Knowledge (people have to be aware), Attitude (weighing of pro's and con's), Social pressure (norm) (do what others do);
- Enabling factors: Financial resources, Technical resources, Organisational resources, New skills;
- Reinforcing factors: Feedback of peers, Advice of experts, Feedback of authorities.

A successful integral intervention should include above mentioned elements. To give an example: energy management is considered to be a good intervention for an organisation to become energy efficient. Practice shows that 'real' implementation of energy management, i.e. that it becomes into the 'nerves' of the organisation, seems quite difficult to achieve. Looking at ISO 50001 through the 'eyes' of Green and Kreuter one will discover that this standard has its main focus in enabling the organisation, and its individuals, to become energy efficient, using the instrument of training. Motivation for the desired behaviour and reinforcement is paid less or no attention to in ISO 50001. This will therefore have to be taken care of separately.

A simple example of how this can be done is to include the issue of energy efficiency in the job description of the employee. This enables the organisation to discuss energy efficiency action of employees during their periodic job evaluation. This will build motivation, since people will be judged and rewarded for the energy efficiency actions, and reinforcement since the attention for energy efficiency actions is recurring. From that perspective it is illustrative that from the companies in our survey only 27 % checks the fulfilment of roles, tasks and responsibilities (related to energy efficiency) and that only one (1) reported to have energy efficiency being included in the formal job description of the employees.

BARRIER 7: LACK OF ENERGY MANAGEMENT PRACTICE

Although ISO 50001 is celebrating its fifth anniversary this year, the uptake across Europe is still quite moderate. Based on an ISO survey, until the end of 2014, app. 5,500 certificates were issued. More than 60 % of the certificates are being issued in Germany, where certification is a prerequisite for energy tax exemption. Compared with the number of ISO 14001 and ISO 9001 certifications the numbers are quite low. The numbers of ISO 50001 certificates only represent 1 % of the numbers of ISO 9001 certificates. In our survey 14 % of the companies said to be certified for ISO 50001 another 13 % stated to have energy management as part of another management system (mainly ISO 14001). This is the case while almost 50 % of the companies state that the reduction of energy use is a management priority.

The existence of an energy management practices in the companies surveyed was also assessed by checking the basic principle of energy management: Plan-Do-Check-Act.

Plan phase

- *Steam and energy use:* 80 % of the companies in our survey knew their steam use 'exactly'. Asking for the share of steam use in the overall energy use 7 % does not know and more than 30 % did not gave an answer. Knowing your energy use is an important driver for energy efficiency;
- *Energy auditing:* Energy audits are carried out in 73 % of the companies on a regular basis. In this audits in 86 % the steam system was included. The main focus for the steam system was on production (97 %), followed by distribution (92 %) and use in processes (79 %). From a systems approach perspective this is remarkable. Because what you do not use you do not have to produce moreover savings in steam use effect savings in steam production to a great extent because of the efficiency losses over the chain of production-distribution-use;
- *Assignment of roles, tasks and responsibilities:* An important issue in energy management is to identify people that have an influence on energy use and efficiency and to assign their roles, tasks and responsibilities. Our survey shows that fulfilment of these assignments is only checked in 27 % of the companies.

Do-phase

- *Operational control:* The survey results show a low attention for operational control. When asked for taken measures taken in 18 % of the companies operational control measures (settings, good housekeeping and maintenance) are mentioned. It is well known that especially energy management is capable in accommodating the identification of these type of measures.

Check-phase

- *Energy Performance Indicators (EnPI's):* Only 48 % of the companies identified EnPI's in order to monitor and evaluate the progress of its energy efficiency efforts. From the perspective of getting management buy-in for energy efficiency this figure seems quite low. Without this KPI's on energy efficiency it is very hard to manage your energy efficiency improvements and to be able to show the real gains;
- *Type of EnPI's:* When EnPI's are being defined this is in 73 % based on use per unit e.g. Mj/ton. This kind of EnPI's rarely represent the real picture. Energy use is influenced by more than saving measures alone, think of production volumes, weather conditions, occupancy, etc. These influences are not accounted for using this simple kind of equations and therefore this simple metrics will give a false impression of the energy efficiency development;
- *Verification:* Energy measures taken are verified in 46 % of the companies and this is mainly done by monitoring, measuring or metering (41 %). Without verification of measures it is difficult or even impossible to show the real gains of the energy efficiency measures to management.

Act-phase

- No questions were asked referring to this phase of the management system.

Based on the above it can be concluded that the management of energy using a formal structure is not yet common practice. About 25 % of the companies who took part in our survey have a certified energy management system in place. Doing a spot check on energy management in the companies it turns out that from the basic required elements only 30 % (role assignment) to up to 80 % (insight in energy use) is complied with.

Steam-Up: Interventions for an energy efficient industry

In the Steam-Up project a set of interventions is currently being developed. Below an overview of the main interventions is described.

IN-DEPTH STEAM-UP AUDIT

The main intervention, that is also aiming at accomplishing energy efficiency in European Industry in the course of the project, is an in-depth Steam-Up audit. This audit contains the following components:

- *Technical Steam-Audit:* In-depth steam-audit linked to internationally available expert-tools with involvement of or consultation with 'hard core' steam experts;
- *Management and multi stakeholder involvement:* Guiding for engaging top-management and internal stakeholders before and in the course of the audit process;
- *Business assessment:* Guiding for getting to know the business of the company and thus finding ways to link up energy efficiency to the corporate strategy;
- *Energy Management assessment:* A basic assessment checklist and guiding for initiating the implementation of energy management for the steam system (as a start) compatible with the requirements of ISO 50001-2011;
- *Non-energy benefits and how to value them:* Guiding on how to identify, qualify and value non-energy benefits linked to a web tool for collection and determination of non-energy benefits;
- *Defining EnPI's and regression analysis:* Guiding for defining EnPI's including regression analysis to account for influences like production volumes, weather conditions, etc.

The Steam-Up audit will be piloted at 75 companies in the 8 member countries of the Steam-Up consortium and continually updated and improved based on the previous audit results, experiences and insights while working with the methodology.

STEAM-UP ENERGY MANAGEMENT CENTRE ENMC

To accommodate the implementation of energy audit results and be able to develop management grade business cases for the identified measures an on-line support tool, Energy Management Centre (EnMC), for energy managers is developed. The tool is compatible with the European Standard for Energy Audits EN 16247 and freely available via: https://www.energy-management-centre.eu/.

The EnMC is a web-app (Open Source) that seeks to reduce the effort described for Energy Managers. Auditors can use the EnMC as a digital reporting solution. Energy Managers directly apply it for organising the implementation process. The EnMC offers currently:

- Interactive Gantt chart for time planning, see Figure 4, allocation of responsibilities, description of tasks;
- Dashboard with action plans (prepared by the auditor) and a reminder for deadlines;
- Generation of business case descriptions and management reports;
- Monitoring solution;
- Social Network for energy managers and energy auditors;
- Economic evaluation methodologies like NPV, IRR, LCC.

The EnMC will soon be extended with the following features:

- Bench mark application filled with data collected from the 55 companies being surveyed;
- Overview of steam saving options which include the specific non-energy benefits.

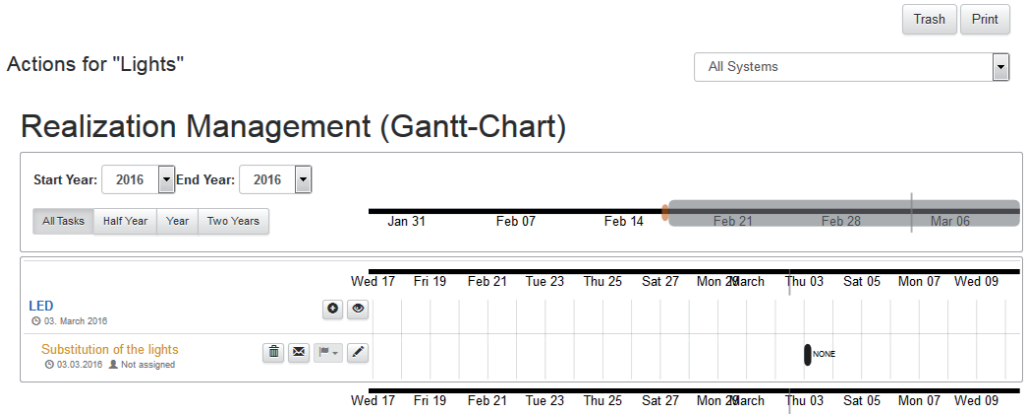

Figure 4. Interactive Gantt chart for time planning in Steam-Up EnMC.

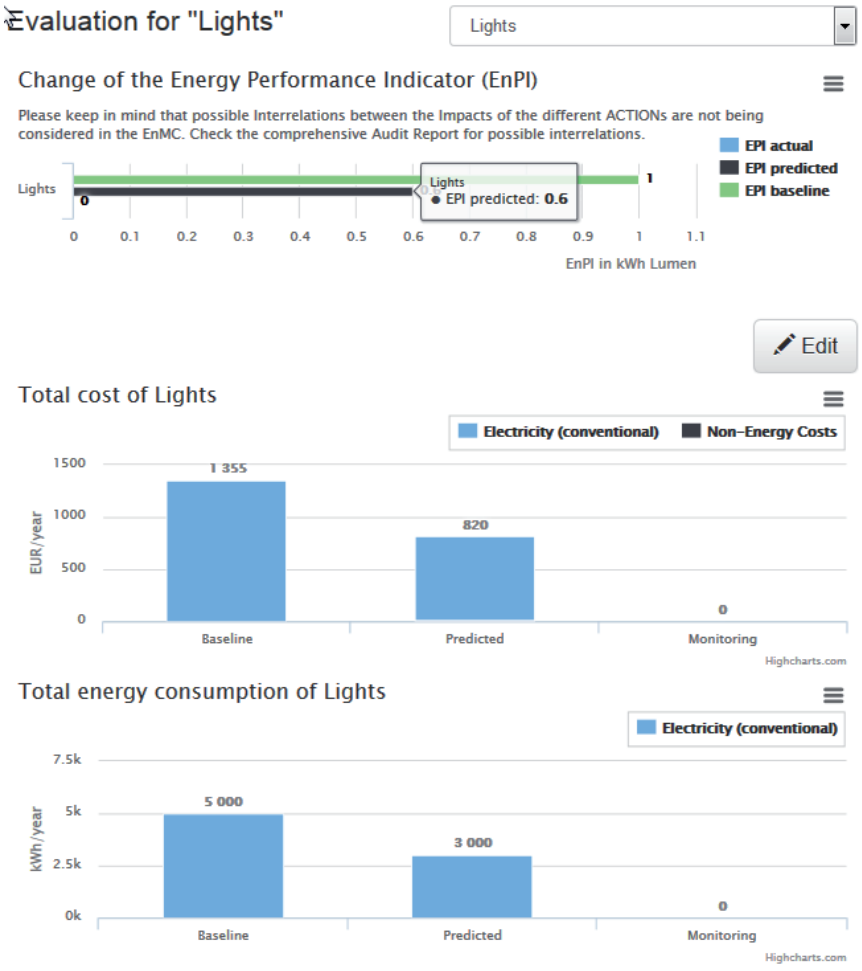

Figure 5. Economic evaluation and EnPI development of energy efficiency measures in Steam-Up EnMC.

STEAM-UP NATIONAL TRAININGS

In order to build capacity amongst energy consultants and staff of industrial companies a set of training materials will be developed based on, where available, internationally recognised and available training materials and tools. Three types of trainings can be distinguished:

- 1½ day trainings for, among others, energy consultants and company staff;
- Training for trainers from (national and European) training institutions;
- 'On the job' training as part of the in-depth Steam-Up audit for company staff and management involved in the steam audits.

The trainings will cover the following subject (or parts of it):

- Introduction and guiding to the Steam-Up Audit methodology;
- Experiences and results from (75) Steam-Up pilot audits;
- Tools for steam system optimisation;
- Systems approach for steam system optimisation;
- New efficient steam technologies;
- Non-energy benefits: What are they? How to determine and value or quantify?;
- Organisational and behavioural aspects: What to take note of when inducing change towards energy efficiency?;
- How to connect energy efficiency to corporate strategy and involve (senior) management?;
- Implementation of an energy management system for steam based on ISO 50001-2011.

Conclusions

Apart from the interventions developed in the Steam-Up project, as described above, some general conclusions can be drawn from the analysis based on the Steam-Up survey and literature review. In order to accommodate energy efficiency in industry in general and in companies in particular four key elements should be part of any intervention, as depicted in Figure 6.

The key elements are, also referring to the Iceberg model for organisational behaviour:

- *Corporate Strategy:* Link with Corporate Strategy to connect with what the organisation WANTS;
- *Non-energy Benefits (NEBs):* Include NEBs to influence and change the THINKING to support energy efficiency measures being considered contributing to the corporate strategy;
- *Energy Management:* Build an ISO 50001 structure to secure energy efficiency culture, which include effective energy performance measurement for being able to show actual energy and cost savings;
- *Organisational and Individual Behaviour:* Take note of (the existing) organisational culture and individual behaviour and how this might interfere with your designed interventions.

Applying this key elements in your interventions is expecting to contribute to what the organisation finally DOES and thus shows as new behaviour.

Next steps and challenges

The Steam-Up project has only been running for 1 year now and we will be finding out if and how the designed interventions will accommodate energy efficiency in industry as we expected. Until the end of 2017 75 audits piloting the new approaches will be carried out in the 8 member countries and 400 professionals will be trained in using the new audit methodology and using new approaches. In order to be successful we fully realise we still have some interesting challenges to address. Steam-Up is bringing in several new (non-technical) elements in the expected work of, generally, technical oriented consultants, company staff and/or other employees that want to start to make the change ('change agent').

REQUIRED COMPETENCES FOR CONSULTANTS AND 'CHANGE AGENTS'

We ask more competences from, especially, energy consultants or stimulate them to involve experts on for example steam and business or management consultancy.

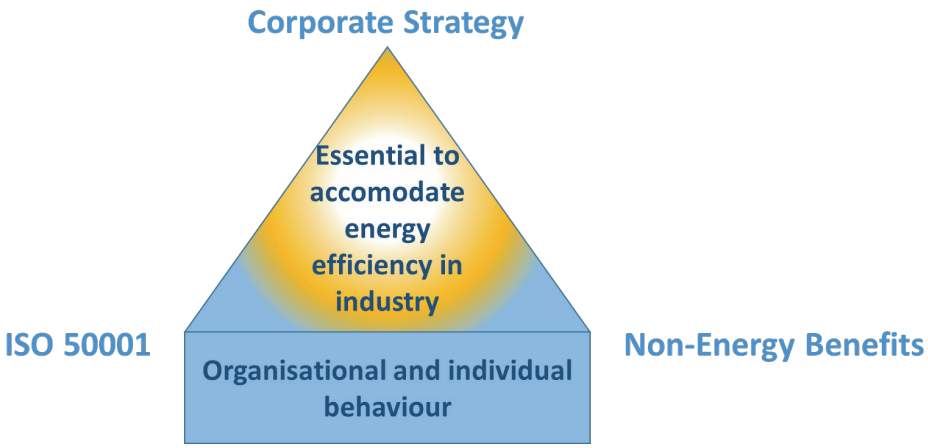

Figure 6. Key elements to design energy efficiency intervention in industry and/or company.

In this approach there is a need to get to know more about:

- The business the company is running, it's competitiveness and the market it is acting in;
- What is important for the business and what are the main concerns of the board of the company?;
- What are non-energy benefits and how do I qualify and quantify them?;
- How do I involve multiple stakeholders effectively?;
- How do I start with energy management implementation?;
- How to deal with organisational culture and behaviour?;
- And last but not least steam energy engineering as a basis for steam system optimisation.

The energy consultant or 'change agent' is expecting to act more and more as a business consultant with knowledge and experience on energy efficiency, energy management approaches and related issues that can help improving the business.

Also the attitude of the energy consultant or 'change agent' might need to be changed. From a strong technical advisory function he or she might need to 'coach' the company to use new solutions that helps the business and improves energy efficiency at the same time. This requires people that are competent in asking questions in order to find the main concerns of the company and its relevant (internal) stakeholders thus finding ways to hook on energy efficiency solutions and (energy) management approaches. This also includes asking questions to resolve resistances for change like: "What makes you think this is never going to work in your organisation?", "How do you think this new approach/technique will influence your production, as you are stating?".

A wise saying goes: "One fool can ask more questions than a million wise men can answer". Let us pray to find that wise men that can answer all our foolish questions.

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