Organizational Success Criteria for Effective Energy Management in an Energy Intensive International Holding Company

Wolfgang Posch, Montan University of Leoben,
Department of Economics and Business Management

ABSTRACT

The main goal of this paper - as an output of a research project with an Austrian based international paper company - is to show how highly effective organizational structures for energy management throughout holdings can be reached by using organizational design parameters. A further objective lies in the description of contingency factors helping to structure an energy management organization of a company in a certain environment. This leads to an contingency based organizational model that can be applied in several industries.

Why Energy Management Organization

Generally speaking energy management shall ensure a proper contribution to corporate goals by fulfilling corporate tasks in an energy conscious fashion. This can be derived in several ways (e. g. increased energy efficiency, increased security of supply, optimized energy procurement, improved maintenance…) leading to improved economies, reduction of energy related ecological impact and a saver handling of energy devices (Turner, W. C. 2005).

Previously the preferred fields for energy management optimization have been technological energy capabilities with the related technical solutions and more recently the implementation of energy management IT-systems. Organizational aspects have been dealt with only marginally and only in the most energy intensive industrial operations. Usually the organizational efforts ended with the nomination of an individual as the responsible energy person. Nevertheless those organizational aspects become increasingly more important with internationalization and larger sizes of corporations usually including a higher complexity of corporate structures and with ever more sophisticated energy management tools whose effectiveness relies on a certain degree of coordination (Sorrell, S. 2004).

In addition there exists potential to improve energy management by optimizing the overall corporate organization. This is mainly related to motivational aspects (Roberts, J. 2004). Although this kind of organizational aspects must not be neglected the following chapters will solely focus on the organization of energy management itself and its integration into the overall corporate organization.

Organizational Principles for Energy Management

Following the ideas of contingency theory (Scott, W.R. 2003) which is especially suited for structuring subsystems of a corporation we take three elements that have to be combined to get an optimized configuration for that subsystem. Those three elements are the organizational goals, the organizational design parameters and the contingency factors representing the surrounding situation of energy management.

The organizational goals can be understood as success criteria that represent an optimized energy management organization if fulfilled. The design parameters of an organizational structure are those elements which allow one to influence the division of labor and the coordinating mechanisms and thereby affect the way an organization functions. The contingency factors are those elements of the surrounding corporation and the energy related environment that have to be taken into consideration when shaping the energy management organization to fulfill the organizational success criteria.

Organizational Goals

The organizational goals are directly derived from the general energy management goals therefore ensuring at high level that the energy organization is in line with the other components of energy management. So if we take into account the general goals for energy management that we have defined right at the beginning of this paper, typical organizational goals would be:

- Optimization of organizational efficiency of energy management by the minimization of transaction costs with
  - Best possible usage of existing resources by appropriate grouping of tasks
  - Efficient and effective corporate wide energy information flows
  - Corporate wide efficient coordination of energy related tasks
- Harmonization of the energy policies of all subsidiary companies with the energy policy of the holding by logical coordination
- Enabling the vertical fit of energy strategies throughout the holding corporation and the derivation of appropriate actions
- Best possible organizational support for a corporate wide enforcement of energy related guidelines

As already mentioned there exists no “One size fits all”-approach to fulfill those goals but different organizational solutions for different situations. So lets have a look at the relevant design parameters and the contingency factors which they are influenced by.

Organizational Design Parameters

The organizational principle basically consists of the two main mechanisms “differentiation of tasks” and “coordination”, which in the end lead towards the configuration of energy related tasks. Differentiation and coordination themselves can be broken down to more detailed design parameters.

Differentiation. If we talk of differentiation the central design parameter for the energy management organization is the grouping of tasks, which leads to grouping respectively separation of tasks according to certain characteristics on a certain hierarchical level of the corporation. The tasks can be grouped along certain functions, along certain objects or along certain regions. As for the energy organization the grouping along functions (e. g. corporate grouping of all energy procurement related tasks) and the grouping along certain objects (e. g. grouping of all tasks that are related to a certain production machine) play a dominant role.

Grouping along functions even can lead to outsourcing of certain tasks – an option being chosen ever more for energy related tasks since the forthcoming of "core competence"-thinking.

Delegation of decision-making power down the chain of authority is related to the competencies at certain hierarchical levels. As regarding to energy management this is important, as the decision making power of the energy manager has a major impact on his/her ability to enforce energy related guidelines.

Job specialization finally deals with the personalized split of tasks. For energy management the degree of specialization mainly depends on the size of the corporation – the smaller the corporation the less specialized the employees will be and the more energy management tasks will be only part of a heterogeneous set of functions for employees.

Coordination. Here we can differ between structural, technocratic and personal coordination. Structural coordination can be imposed by the primary organization (e. g. matrix structure, hierarchies, "dotted line" principles, …) or – what is especially relevant for energy management organizations – by a secondary organizational form, which can be time limited (task forces) or unlimited (standing committees). Technocratic coordination comprises all kinds of formal coordination like planning, budgeting, target setting, handbooks, etc. This often leads towards certain degrees of standardization. Personal coordination plays a more informal role as it results from personal contacts.

Configuration. For energy management – as in the case of other subsystems of the corporation – we have to differ between a so called internal configuration and a so called external configuration. The internal configuration defines the structure of the energy department (if one exists) of a corporation and how the tasks are grouped internally. Typically we find there energy generation, energy accounting and controlling, management tasks (planning, staff management, organizing, …), energy strategy and energy procurement (although this task can also be found very often in the corporate procurement department). This grouping usually is done by function.

The external configuration determines how energy management is integrated into the corporate structure – centralized vs. decentralized, at a lower or higher hierarchical level, how operational energy related tasks are spread throughout the corporation and how the corporate wide coordination of energy tasks is done. This external configuration strongly depends on the primary corporate configuration.

Main Contingency Factors

The contingency factors allow one to decide how the energy management organization shall be structured to fulfill the organizational goals under different circumstances. For the energy management organization there can be found six major factors which mainly come from the corporation itself.

As independent factors there can be identified the relevance of energy management for the corporation, the size of the corporation, the organizational configuration of the corporation and the existence of onsite generation. As intermediate factors, which are by themselves determined to a certain degree by the independent factors, we find the degree of integration of energy management into the corporate structure and the hierarchical integration. Both involve decisions with high impact on the optimized organizational structure of energy management.

The significance of energy management results on the one hand from the importance of energy for the corporation (amount, impact on production, …) and on the other hand from the degree the patterns of energy supply and usage can be affected by the corporation (market liberalization, on site generation, choice of production technology, …). So this contingency factor combines the environmental and the corporate perspective. Clearly a low attractiveness of energy management makes most activities related with the optimization of energy management obsolete as money and time can be spent on other corporate tasks with higher impact.

The size of corporation mainly influences the degree of specialization and the preferred way of integrating energy management into the corporation. The existence of onsite generation usually implies a line department for energy management whereas in the absence of onsite generation energy management makes much sense as a staff function, too.

The organizational configuration of the corporation has a major impact on the selection of coordination tools (one just has to think of a matrix structure), the decision of process orientation (a process oriented energy management structure only makes sense within a corporate process organization) and on the way operational energy tasks like energy maintenance are integrated into the corporation (grouping by functions or by objects). Additionally it makes a huge structural difference for energy management whether we talk about a stand alone corporation or a holding corporation.

The two intermediate factors mainly depend on the attractiveness of energy management and on the size of the corporation and themselves influence the selection of coordination tools and the grouping of energy tasks.

Optimization of the Energy Management Organization

Following those organizational principles just discussed we can design the structure of the energy management organization with the help of the design parameters by varying them according to the contingency factors. This theoretically enables us to fulfill the organizational goals characterizing an optimized energy management organization.

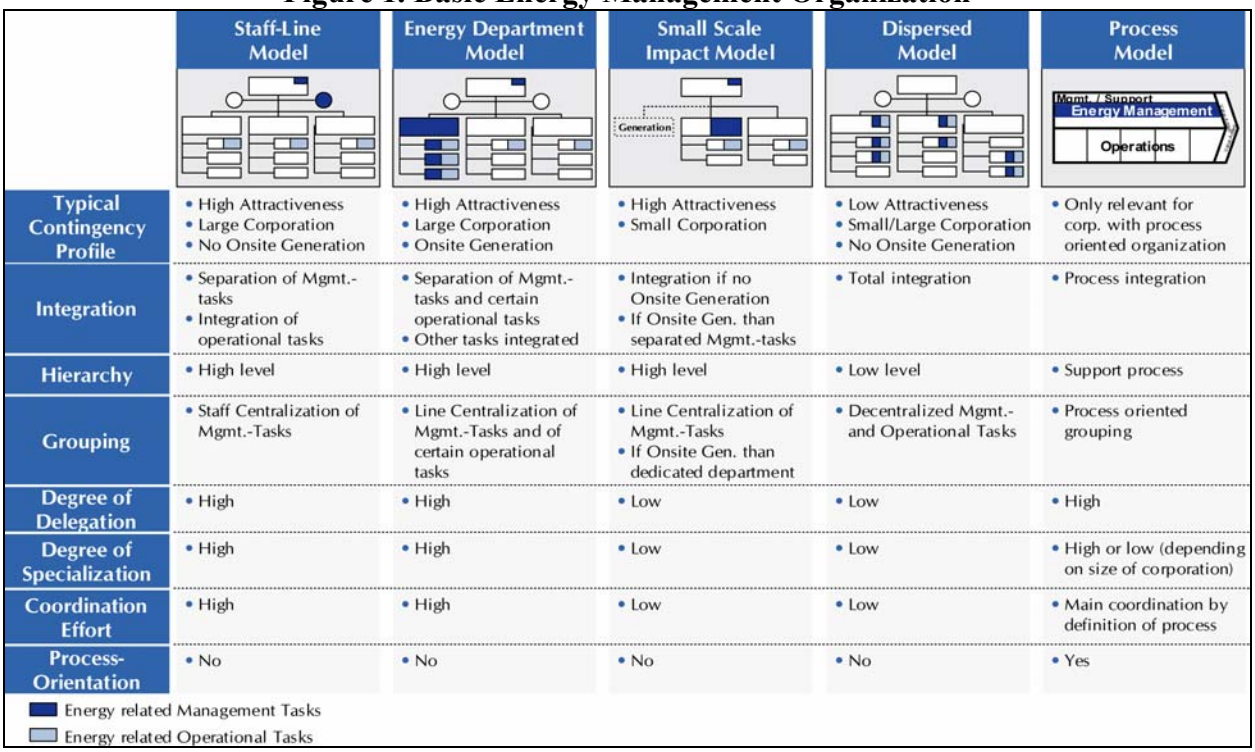
If one starts with the potential variations of the contingency factors and the resulting combinations it soon turns out that 5 patterns of energy management organization emerge that should fulfill the organizational goals to a higher degree than other organizational models under the same circumstances (i. e. under the same variations of the contingency factors). These patterns mainly differ in the way the management tasks are bundled, how the energy tasks are integrated into the corporation and how much effort is necessary for coordination.

So the first step of the optimization of the energy management organization is to select the most reasonable base model under the given circumstances. For further adaptation of energy management on the corporate structure some organizational fine tuning has to be done. This comprises the integration of the decentralized operational energy related tasks into the corporate structure and the optimization of the corporate wide energy management coordination. For a holding structure some additional synergies have to be considered.

Organizational Base Models for Energy Management

The 5 organizational base models have to be seen as first indicators of how to structure an effective and efficient energy management organization (see fig. 1). They still have to be varied to a certain amount in each case depending on the individual specifics of each corporate organization.

Figure 1. Basic Energy Management Organization



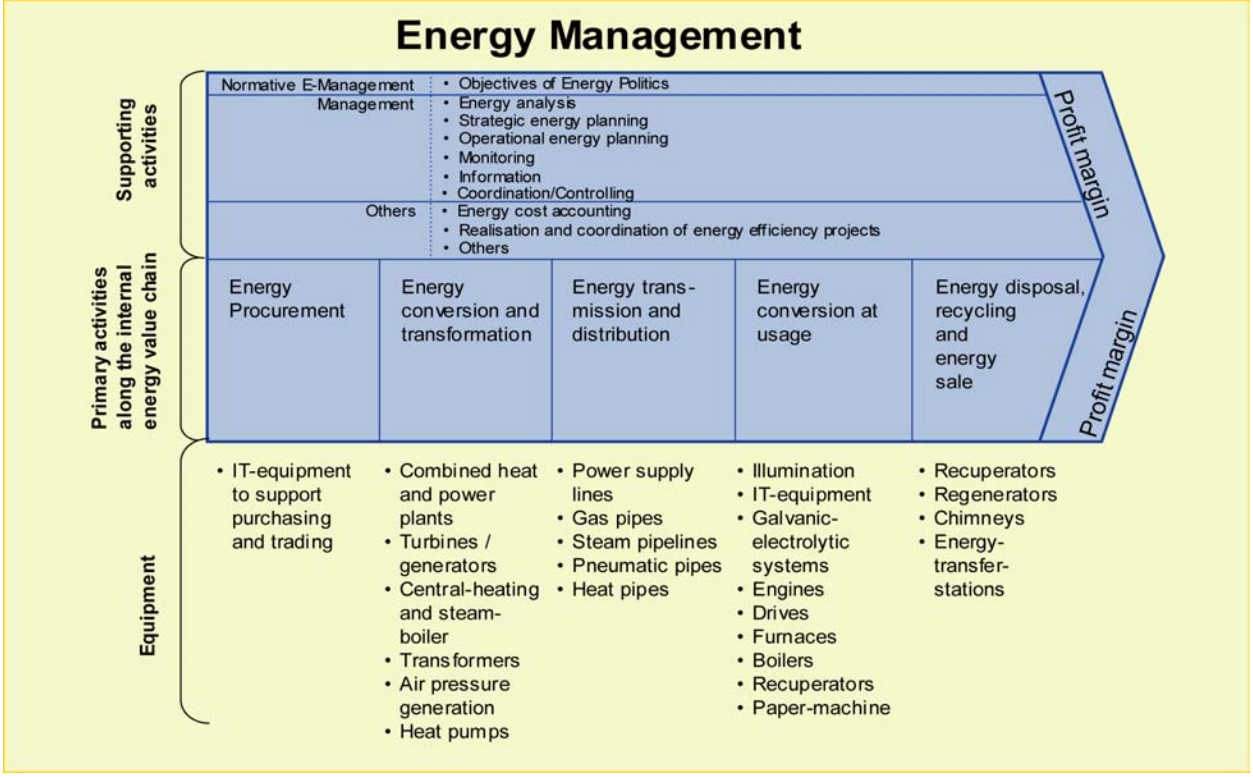
So it is not really plug and play but always some sort of customization. The 5 organizational models can be roughly described as follows:

- **Staff-Line Model**: The staff-line model is suited for large corporations where energy plays an important role without having an onsite generation. The centralized / decentralized approach positions energy management at staff level at a high enough level for decision making inside the corporation and enables the necessary operational contact at shopfloor level with decentralized operational tasks (e. g. maintenance, ongoing energy optimization, …) which are integrated into the corporate structure. According to the size of the corporation and the large scale energy management organization the degree of delegation, the degree of specialization and the coordination effort are rather high.
- **Energy Department Model**: As well as the staff-line model this model is best suited for large corporations where energy plays an important role. But when having a relevant onsite generation it makes sense to create an energy department because of very specialized tasks needed to operate a powerhouse and the resulting coordination of a dedicated workforce. In this case it doesn´t seem to make sense to bundle energy related

tasks additionally at staff level but to use the energy department as the energy center of the corporation.

- **Small Scale Impact Model**: This model best caters to the needs of small corporations where energy plays an important role for corporate success (e. g. if the company relies on highly power quality sensitive equipment). Unless there exists some onsite generation the energy related managerial tasks will be grouped in a line department (e. g. production or engineering). Because of lower job specialization in smaller companies one person seldom will specialize only on energy matters but combine it with other corporate tasks.
- **Dispersed Model**: If energy doesn´t matter for corporate success this is the model of choice. Although size doesn´t make a difference for basic assumptions it can be said that at a certain size energy cannot be neglected simply if one takes into consideration the energy needs for infrastructure. This model implies that only the most necessary energy related tasks are fulfilled without a conceptional framework behind it.
- **Process Model**: From an integrational point of view this model of course only makes sense for corporations which are strictly organized by process structure. Then it is most reasonable to define an energy management process which can be organized along the corporate energy value chain (see fig. 2).

Figure 2. Energy Management Process



Integration of Operational Energy Related Tasks

After having selected the base model for energy management one has to decide how operational energy related tasks that are not part of energy conversion / transformation and energy transportation (those are mostly grouped by function in the energy department, in the

engineering department or with central maintenance) have to be integrated into the corporate structure. Those are usually tasks around energy procurement (including energy trading), tasks related to operations and maintenance of energy equipment that is located at the point of energy usage and the planning and construction of new energy devices (e. g. drives, engines, recuperators, …).

There are two reasonable options for energy procurement which both involve grouping by function. It is possible to integrate energy procurement into corporate procurement or into the energy department – in both cases one person or a small group of persons acquire those very specific skills around energy trading and procurement. Some corporations with huge energy demand even have outsourced energy procurement to energy procurement specialists. Whether this is cost efficient mainly depends on the design of the contracts.

The grouping of energy equipment maintenance and operation strongly depends on the corporate configuration. If the corporate maintenance philosophy tends towards a functional grouping of maintenance with a strong centralized maintenance department at a location it makes sense to integrate the energy maintenance part into it by functional grouping. If that is not the case the object oriented grouping along certain assets (e. g. dedicated maintenance staff for each paper machine) prevails. In both cases the operations part mostly stays with the machine operators as they are the ones who continuously have an eye on the equipment.

Planning and construction of energy equipment are ideal candidates for outsourcing as they are very specialized tasks that can be scheduled and are not happening on a continuous base.

Corporate Wide Coordination

The corporate wide coordination of energy management shall lead to a vertical energy policy and strategy harmonization from the holding down to the subsidiary companies and from the board of directors down to the shopfloor on the one hand. On the other hand the horizontal coordination among the business units has to enhance the standardization of similar processes and tasks and can lead to additional synergies by reasonable grouping of tasks. The harmonization with management systems like ISO 14001 or ISO 9001 plays an important role especially when talking of monitoring and auditing procedures or the compilation of manuals (Brown, M. and V. Key. 2003). Nevertheless this is rather a function of energy controlling so we will not pursue that topic any further.

Technocratic coordination certainly can help a lot with vertical coordination. A well designed planning and budgeting process not only harmonizes goals and strategies from top to down but also breaks down strategic plans of top management level to daily actions on the shopfloor. During recent years the balanced scorecard has been established as the appropriate coordination instrument especially for holding companies. Unfortunately until now only a few balanced scorecards include energy key figures meaning that the energy coordination is not fully included into corporate coordination. Hopefully this will change.

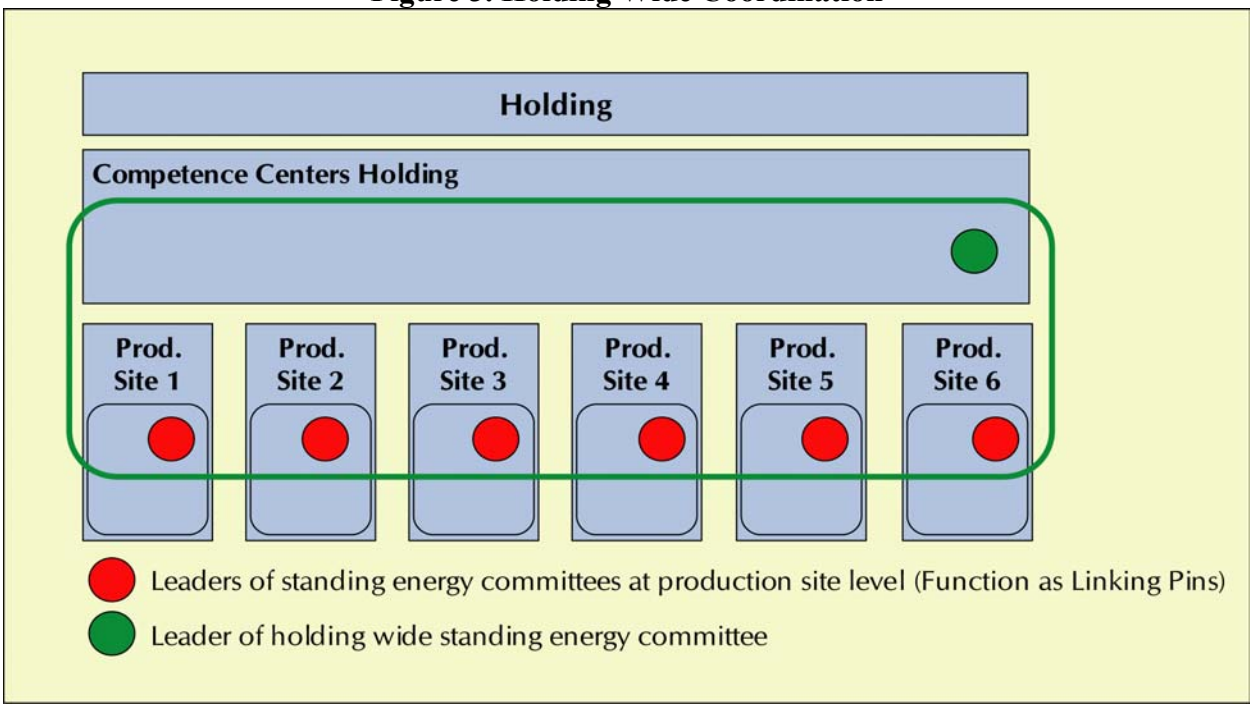
For horizontal coordination across the border lines of departments and divisions the instrument of choice is the building of secondary organizational configurations, i. e. standing committees and task forces (Mintzberg, H. 1979). This structural coordination even combines horizontal and vertical coordination when implemented in the right way as we will see in the following.

Standing energy committees. The standing energy committee is a rather permanent interdepartmental grouping, one that meets regularly to discuss energy issues of common interest. Formally this standing committee is decoupled from the corporate hierarchy which means that the members of the committee discuss and decide without hierarchical differences. This is especially important for the energy manager who generally is the head of this committee and often is not high enough in the hierarchical chain to push decisions among the department or even division heads. Typical members of such a committee would be the energy manager, the head of production, the head of engineering and maintenance, the energy buyer / trader and as non-permanent members the CTO and other relevant managers or experts.

For the combination of vertical and horizontal integration standing energy committees have to be implemented at each production site and on each level of the holding corporation. Those committees are interlinked by the so called "linking pins" who are committee members of committees of different corporate levels. As fig. 3 shows this leads to a holding wide energy management network.

The main task of this standing energy committee is the discussion and decision of energy guidelines, energy conservation projects, energy organization, monitoring instruments and processes, corporate wide energy key figures and innovations.

Figure 3. Holding Wide Coordination



Energy task forces. Task forces are groups that are formed to accomplish a particular task and then disband. They are relevant for the energy management organization as a lot of energy management tasks are timely limited and need expertise in several fields for accomplishment. This is particularly true for energy efficiency projects.

The members are chosen according to the needed expertise. The coordination of those projects can be done by the energy manager or - what often can be found in large corporations – by a centralized project office.

Additional Organizational Synergies for International Holding Companies

As regarding to energy management organization we talk of economies of scope that can be realized throughout internationally spread production sites of a holding corporation. These economies can be found especially for planning, building and maintenance of energy equipment, for energy procurement/energy trading and the related energy risk management.

For planning, building and maintenance of energy equipment this would lead towards international competence centers and interdisciplinary local teams for the ongoing operations. The main barriers to gain these advantages can be the configuration of the corporation and existing maintenance philosophies preferring regional or object grouping.

In the case of energy procurement, trading and risk management some companies already have installed international energy procurement centers on holding level to gain the profits of an internationally optimized procurement portfolio. The barriers can be too long distances on the one hand (energy – especially if taking into consideration grid based energy markets – still remains a regional business) and regional regulatory differences (e. g. the degree of market liberalization).

Development of an Energy Management Organization for an International Paper Holding Company

In the following the process and preliminary results of the development of an energy management organization for an Austrian based international paper holding company by using the discussed methodology will be described.

Project Description

According to rising energy prices the international paper company (8 international production sites with significant onsite generation, an output of more than 2 mio. tons of paper per year and a holding wide primary energy consumption of more than 70.000 TJ) decided to define a holding wide energy savings target which has to be reached throughout the following years. One part of the solution will be an optimized energy management organization. This organization project can be split into three main phases, which in total cover roughly 4 months (implementation not included):

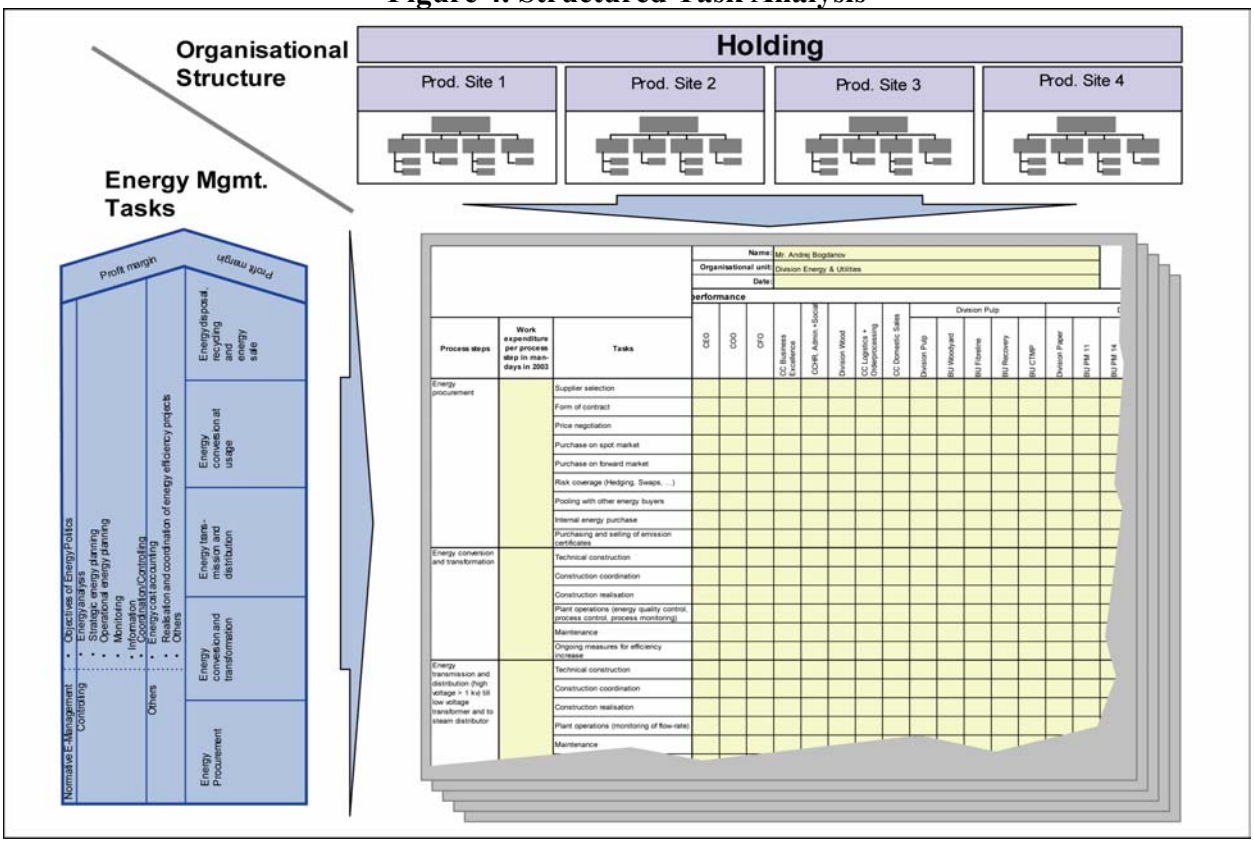
- **Phase 1**: analysis of the current organizational situation with a so called structured task analysis
- **Phase 2**: Design of an optimized organizational structure for energy management by using the contingency approach (starting with one production site as a pilot)
- **Phase 3**: Definition of an action list according to existing gaps

Structured Task Analysis

The structured task analysis is simply a linkage of the energy management tasks being performed with the units of the organizational structure in a matrix (see fig. 4). When choosing to fill in the amount of time which is spent by certain units for certain tasks one gets a good picture what tasks are being performed, where those tasks are being fulfilled and how much time

is spent for it. As this formalized analysis structure allows for good comparison between the production sites this method even allows a rough performance benchmarking throughout the paper holding company.

Figure 4. Structured Task Analysis



When using this analysis methodology it is important to have a common understanding of the listed energy management tasks and an agreed upon structure plan of the analyzed production sites. Especially a changing of the task list will proof to be very cumbersome, as results can only be compared for identical task lists. Usually it takes a few interviews afterwards to understand why some tasks are simply not done or why it takes the given amount of time to perform certain tasks.

Resulting Energy Management Organization

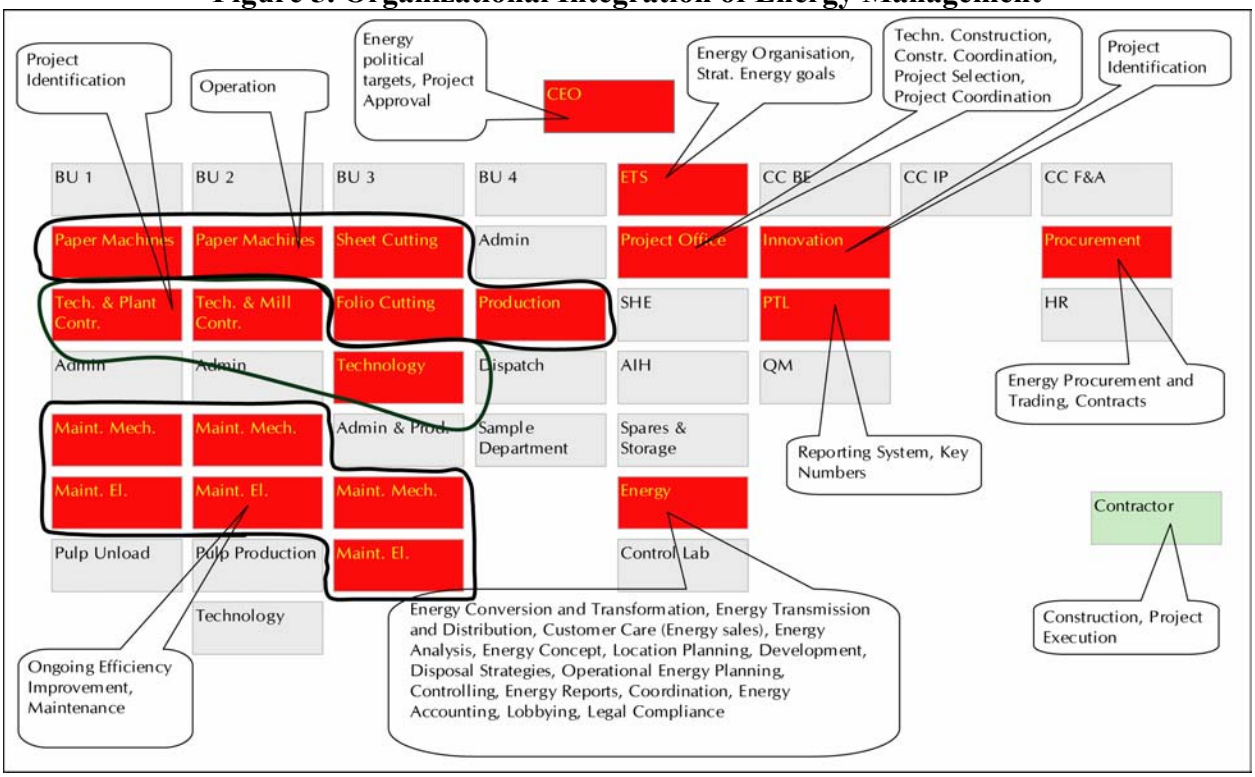
The model energy management organization can be found in two major steps. For the first step one has to single out the production site chosen as a pilot from the holding structure and has to define the energy management organization for this stand alone site. In the second step the holding structure is taken into consideration again, holding relevant energy management tasks are shifted on the holding level and potential additional synergies (usually economies of scope) with the other subsidiary companies are analyzed.

In the first step one starts with the selection of the organizational base model – in this case the energy department model has the best fit (Significance of energy, large corporation and onsite generation). Afterwards the energy management tasks are grouped throughout the

organizational structure of the production site according to the organizational principles (see fig. 5). When grouping those tasks one always has to bear in mind the organizational goals. In our case we find for example, that energy maintenance for the paper machines is grouped by objects as this follows the corporate wide maintenance philosophy. Afterwards the needed competencies to fulfill the energy management tasks in certain organizational units are defined and the coordination instruments are determined. In our case this was mainly the creation of a standing energy management committee.

In the second step the holding relevant tasks are shifted towards the holding and energy procurement is defined as a holding wide centralized task to gain related economies of scope. Finally the standing committee structure is expanded so that we get a holding wide secondary organizational configuration with linking pins to ensure coordination.

Figure 5. Organizational Integration of Energy Management



Gap Analysis and Action List

The preliminary results (as we are still in the pilot phase no benchmarking is possible) already show the need for the building up of new energy management structures, the consideration of new energy management tasks and the implementation of new coordination instruments.

Summary

The contingency theory has proven as an appropriate tool to create an energy management organization for holding companies which is well integrated into the overall structure and fulfills the goals of effective energy management. This can already be shown with the preliminary results of an organizational project with an international paper company.

The next research steps will be to include this organizational concept into an integrated energy management model made up from a set of managerial components (e. g.: energy planning, energy controlling, …).

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