

Developing a CO₂-Management System for Public Authorities

The conceptualization of a management tool suitable for reducing energy consumption and CO₂-emissions in a city has to be based on a broad analysis of possible tools. In a research project for the city of Dresden, an average-sized city in Germany, we have analysed 34 tools. We thereby focused on management instruments on the strategic level or on the operational level in one of the following fields of action: user behaviour, procurement of office equipment, respectively IT and investment decisions made in order to (re)build or modernize public buildings and technical equipment. At the same time we analysed which management instruments were helpful for overcoming different hurdles in a public authority, like knowledge or incentives.

1 Motivation

Over the last few years the public awareness of climate change and its expected effects has been constantly increasing. Furthermore, climate change has become an important topic for decision makers in politics, too. Here, local governments play an important role in reducing greenhouse gas emissions. A growing number of cities and communities engaged in climate initiatives like the climate alliance or C40 cities can be seen as evidence, that local authorities increasingly meet this challenge. Besides the increasing public awareness, especially rising costs for energy let many politicians realize the importance of reducing energy consumption and thereby CO₂-emissions.

The here presented toolbox – a detailed collection of available steering instruments, which in their majority are already successfully put into practice – can help interested authorities to learn about the manifold possibilities and choose the instruments fitting best the special situation of the individual community. Furthermore, the instruments suitable for every kind of public authority: city council; communal administration; state administration and federal administration. They could also be of interest for private companies.

Additionally, we conducted a hurdle analysis that means we analysed which steering instrument can overcome existing hurdles related to developing a CO₂-Management System for public authorities.

2 Research questions and methodology

The overall research question of this paper is: “Which steering instruments are appropriate for energy management and CO₂-management of public authorities?” In order to answer this question we do not aim at developing new steering instruments, moreover we assume that a high number of instruments for energy saving and therewith CO₂-emissions reduction are already developed. For this reason, we place special emphasis on existing innovative and successful instruments. Therefore we

conducted a literature research focussing on three subquestions: “Which instruments are appropriate for reducing energy consumption in a public authority significantly?”, “Which strengths and weaknesses are characteristic for this instrument?” and “Are there public authorities or other organisations that have already successfully applied this steering instrument?”

Furthermore we have to consider that reductions in CO₂-emissions can be achieved in different fields of actions. The energy consumption of public buildings is influenced by users and facility management, by procurement of office equipment and by investments for buildings or renovations. For the literature review we only register steering instruments that have an effect within the administration and fulfil one of the following conditions: First of all, it is a steering instrument on strategic level and leads to conditions that are essential for reducing energy. Secondly, the energy consumption patterns of the employees as the users of the public buildings, thus the user behaviour is targeted. Thirdly, the procurement of office equipment and IT is included, since it already contributes to as much as 40% of the energy consumption in a modern office unit (Radgen 1999: 1 or Berliner Energieagentur 2007: 5). Fourthly, investment decisions made in order to (re)build or modernize public buildings and technical equipment for example for heating or air-conditioning are considered. Here, the long life-span of the concerned machinery and constructions determines the future energy consumption for quite some time, making it very important to carefully consider every single possibility to save energy.

To ascertain the different theoretical existing instruments for steering energy management and hence CO₂-Management in the described areas (users and facility management, procurement of office equipment and investments for buildings or renovations), the literature search was conducted in the professional databases ebsco host and Elsevier science. Furthermore we used an established german data base for economics (wiso wissenschaften), the environmental literature data bases of the German Federal Environmental Agency (ULIDAT), the environmental research data base of the German Federal Environmental Agency (UFORDAT), the Saxon regional and university library (SLUB) and the internet search platform Google Scholar (www.scholar.google.de). For collecting the practical examples of successful applications in public authorities, relevant literature, but also the internet was used. The chosen examples are innovative and usually ranked in inter-municipal competitions like “Climate Star”, “Federal capital in climate protection” or “European Energy Trophy”. Additionally, good-practice-examples and case studies have been selected, that are published in connection with different relevant projects for example managEnergy, GreenLabelsPurchase, Procura+.

Besides, we investigate which steering instrument can overcome existing hurdles related to developing a CO₂-Management System for public authorities or derive possible hurdles for the implementation of a steering instrument. Here we apply the hurdles analysis method developed from the bases of power from French and Raven (1959). They differentiate five dimensions: reward power as perception of an individual, that the agent can reward; coercive power as perception of an individual

that the agent can punish; legitimate power as perception that the agent can prescribe behaviour; referent power as perception of an individual to identify himself with the agent and expert power as perception that the agent has special knowledge or expertise. The hurdles analysis based on those dimensions focuses on existing objectives (derived from the referent power), existing regulations (based on legitimate power), information (based on expert power), knowledge (based on expert power) and incentives (based on reward power) and sanctions (based on coercive power). Information and knowledge are distinguished in order to better identify the underlying barrier, whereas incentives and sanctions are matched, as they often can be transferred into each other. By analysing these barriers, the fourth subquestion can be answered: "Which steering instruments are helpful to overcome hurdles in public authorities?".

Insert Figure 1 about here

4 Steering instruments for energy management and CO₂-management in public authorities

In total, 35 steering instruments have been identified, whereas 13 of them are instruments of the strategic level and 22 are instruments that focus on the fields of action that have been chosen before. In detail, six instruments target on user behaviour. Respectively, eight instruments are supporting procurement and investment decisions. Table 1 shows all steering instruments. For every instrument, the toolbox includes a description of the instrument itself, a recommendation of how to adopt it for energy saving issues, a list of strengths and weaknesses and different practical examples. As this paper is just a synopsis of the conducted research, only a selection of the most interesting instruments is presented in the following paragraphs.

Insert table 1 about here

4.1 Steering instruments on the strategic level

Public authorities already use numerous steering instruments on the strategic level that - independently of the concrete task - aim at steering the general administrative work. To avoid over-regulation or the parallel existence of contra dictionary steering tools, the steering power of these instruments should be used first, then intending to manage energy consumption in a community. For this reason, the paper first describes the possibilities, the constructive use of such "classical" instruments offer. Here, we use the mission statement, the implementation of strategic objectives, the use of key figures or budgeting and benchmarking as examples.

Besides, there are strategic instruments that focus especially on the theme of energy consumption, for example the management schemes of energy consumption controlling, the European Energy Award or the municipal energy management.

4.1.1 Mission statement, strategic objective and key figures

The so-called mission statement of an organisation comprises the essential leading principles and basic rules of administrative office. It establishes the core values and the intrinsic motivation of the organisation as a common basis for the strategic aims and a meaningful system of key figures. The strategic target is deduced from the mission statement, a system of key figures controls the achievement of the strategic objectives. Moreover, the mission statement, strategic objectives and key figures are an orientation for all participating persons.

Referring to energy saving, the public authority can integrate corresponding objectives into its mission statement, additionally, energy saving could be a concrete strategic aim as well. Defining key figures, which show the developments in the area of energy consumption for the accounting and controlling systems are of high importance as they provide the fundamental basis for the internal information system.

The strengths of these steering instruments can be seen as follows: environmental protection becomes part of the organisational culture. It is assured by the documentation of the political intention. Besides environmental issues also other policy guidelines can be integrated into the strategic concept within the modernization of public administration structures; thus this instrument can be seen as an embedded system for the internal management system that has to be (re-)established anyway. Weak points of this instrument could be that the organisational culture is often determined by informal rules like motivation or cooperative behaviour. These can be in opposition to the mission statement. Furthermore, other objectives of the organisation are in competition to environmental objectives (goal conflicts).

In the past a lot of cities integrated environmental aspects into its mission statements or into its strategic targets like the cities Dresden, Nuremberg, Wuppertal or Wien. The environmental guideline of the city Dresden defines environmental protection as a managerial task. In addition, objectives are formulated and the organisation and documentation of environmental management is determined. (BMU; BDI (2002), pp. 47; Dresden (2008), n. pag.; Stadtrat Nürnberg (2001), n. pag.; UBA (2003), pp. 119; Wien (n. d.), n. pag.; Wuppertal (1998), n.pag.)

4.1.2 Contract management

Different hierarchical levels of a public authority need to agree upon obligatory quantitative and qualitative targets to fulfil in a certain period with a certain budget. A set of operating ratios here could verify the intended objectives. On the one hand rewards can be an incentive for employees to work towards a successful target achievement. On the other, also sanction systems (budget constraints) in case of failing the internal goals, might be of positive impact.

Referring to the reduction of energy consumption it is possible to integrate clear ecological goals into agreement on objectives. For instance, it can be fixed that, to increase environmental procurement, 40% of the products must have an environmental certificate.

The strengths of this steering instrument are that every smaller organisational unit can implement a contract management, no high expenditures are necessary; high transparency is given about past activities and work to be performed in the future. However, this instrument will not be useful if the formulated contracts are too superficial. With weak formulations like “we want to decrease the environmental procurement” it is difficult to successfully fulfil organizations’ targets. It is also unavoidable that, besides the environmentally friendly, non-environmentally investments have to be made. Currently no concrete example exists. (Interpublic Berlin (2006); Senator für Finanzen der freien Hansestadt Bremen (2002); Speier, F.; Friederer, H.-J.; Klee, G. (2001), pp.109; UBA (2003), pp. 120.)

4.1.3 Budgeting

Unit objectives for an administration are developed, which define especially economic parameters by internal commitment. Budgeting is characterized by determination of a maximum expenditure of certain financial positions and, contemporaneously the extension of competence and responsibility of the organisation’s decentralised areas that have to generate the output. The public authorities’ overall budgeting plans financial resources for every specific department and the department for itself decides how to allocate these resources. The saved expenditures can then be used for any purposes and can partly be carried forward into other periods.

The steering instrument budgeting can be used for energy saving by users (for example schools or specific departments) or by departments that are responsible for facility management and servicing (for example real estate office or administration department for schools). The first group is urged to change their user behaviour while the second group is urged to undertake energy saving investments and periodic service and maintenance.

The steering instrument fosters energy saving because of reduced costs that then can be used for other purposes. By using the instrument budgeting of energy costs by users the user behaviour will most likely change. A disadvantage of budgeting could be that, instead of purchasing new and energy-saving office equipment, the old equipment with high energy consumption stays in place, as this, in the short-term, the cheaper but also less efficient way.

Kindergartens and schools often use this steering instrument for example a school in Main-Kinzig-District. At this school the budgeting of energy and operating costs on a volunteer basis was introduced; employment costs and costs for substantial building measures are not included. 50% of the saved costs are paid back directly to the school’s budget so it could be used for the school’s own projects. The other 50 % are used for establishing a reserve for example extensive building measures for the other district’s schools. At the beginning of the year the school gets information about the

budgeting and every month an updated statement of account. Furthermore a working group that consists of principal and administrative staff was established with the target of exchange of experiences. (BMU, BDI (2002), pp. 25; Bolay, S. (2006), p. 14; Hessisches Ministerium für Wirtschaft (2004), pp. 27-31; Kopatz, M. (2006), pp. 118; Speier, F.; Friederer, H.-J.; Klee, G. (2001), pp.109; UBA (2003), pp.; UBA (2003), pp. 99, 121, 190)

4.1.4 Benchmarking

Benchmarking is an analytical instrument for comparison of performance, costs, processes, technologies or administrative structures with Benchmarking-partners. The partner could be another administration unit (internal benchmarking) or another public authority (external benchmarking). The aim of benchmarking is to reveal own strengths and weaknesses and also possible improvement opportunities by means of predetermined key figures. Benchmarking can be of use for comparisons of resources consumption per building or type of use and analysing the differences. A comparison between organisations and municipal energy managements' success is also feasible. Environmental protection activities can be an item of benchmarking as well as different utilized political instruments (taxes, guidelines, regulations) and its effects could also.

The strength of benchmarking is that possible improvements and innovative solutions are shown. Thus the public authority can better assess its own performance and the effectiveness of its own or other applied energy saving measures. Because of differences in processes or products comparisons are not always applicable.

The city Horb am Neckar implemented an internal benchmarking in kindergartens, controlling the monthly consumption of energy and water. Additional consumptions and related additional costs are analysed so that the kindergarten knows can analyse the reason for variances. Moreover measures are determined in order to reduce the total consumption. Furthermore the public swimming bath of the city Horb am Neckar takes part in an external Benchmarking, whereby some weak points could be identified in the past. (BMU; BDI (2002), pp. 27; Krems, B. (2008): Benchmarking; Speier, F. Fiederer, H.-J.; Klee, G. (2001), pp. 38 & pp. 80.)

4.1.5 Energy consumption controlling

Energy consumption controlling, which was developed for specific reduction of energy consumption of municipalities, conduce monitoring and minimizing of energy consumption. For that purpose, in the first step data for power consumption and heat energy supply is collected and in a detailed manner . In the second step ratios are developed and established and in the third step the current situation is analysed concerning absolutely present consumption with regard to the target state as wells as with regard to the trend over a past period;. The fourth step then is the forecasting of the future consumption.

The advantage of this instrument is that it provides the basic information for an effective energy consumption management. Energy consumption controlling is

therefore also an excellent basis for Benchmarking or Energy-Reports. If any form of controlling exists in public authorities (and also in private companies) mostly there is only a sub-optimal solution with different controlling-systems in parallel (finance controlling, eco-controlling, energy consumption controlling). Indeed developing an integrated controlling system is very difficult and requires high effort (time).

The city Luneburg introduced in thirteen buildings an energy consumption controlling, five further buildings are planned. (BMU; BDI (2002), pp. 39; Arbeitskreis Energieeinsparung des deutschen Städtetages (2000), pp. 2; Deutscher Städtetag (2007), p. 12.)

4.1.6 European Energy Award

The European Energy Award is a European management- and certification program that is developed especially for municipalities and is predicated on the management cycle “analysing – planning – implementing – mentoring – adapting”. The management cycle was developed within the scope of fifth research program of the European Union. The Communal-Labels-limited liability company, Zurich, takes over coordination, advancement, granting of a licence and quality assurance.

This steering instrument was specifically developed for reducing energy consumption. The strengths of this instruments are: establishment of organisational, personal and structural preconditions for energy consumption reductions; systematic ascertainment and bundling of activities; teamwork of most important stakeholder leads to higher willingness to cooperate; data-processed identification of the most effective projects or measures; a list of measures to be taken is appropriate for next projects; yearly efficiency review, certification and award are public-oriented and can also leads to higher motivation of the employee; compatibility to different steering-instruments and also climate-saving measures. The weaknesses of this steering instrument are that on the one hand further personal and financial expenses are needed and, on the other hand engaged public authorities with an efficient energy-management have not that surplus value and thus can not benefit from an instrument like this.

In Germany about 120 municipalities for example Gorlitz take part in European Energy Award. Gorlitz was certified the first time in 2004 and re-certified in 2007. (B.&S.U. (n.d.); Energieagentur.NRW (2007); Jena (2006); Jena (n.d.); Starke, V. (2008))

4.1.8 Municipal energy management

Municipal energy management comprehends optimal steering of buildings constitution, building physics, technique, line operation, user behaviour and drafting of contracts. It includes: energy purchase and contract management; energy billing procedure and cost allocation; energy controlling and benchmarking; optimum scale of operations; prepare energy diagnostics and energy concepts; realisation of energy saving measures; participation in building measures; control and contractual matters;

development of guidelines and standards; communication and public relations work; possibilities of funding.

Municipal energy management enables identifying energy saving possibilities, the know-how and competences of different experts are bundled. Measures referring to organisation, structure and user behaviour for energy saving can be implemented more easily. Partly the competences of the department "Municipal energy management" are inadequate and the cooperation between specific departments is also insufficient. Often the financial and personnel resources are calculated tightly and the monitoring and documentation of monthly consumption can be a very time-consuming task. Some measures can also result in conflicts with the users for example constraints for warm water supply or special configuration of the PC (shut down automatically). This steering instrument is used in the cities Berlin and Frankfurt am Main. (BMU; UBA (2003), pp. 14, 147 and 83 (appendix); Deutsches Institut für Urbanistik (1998); Frankfurt am Main (n.d.); Kuhn, V. (2003), pp. 10, 12, 47; UBA (2003), p.72)

4.2 Steering instruments in the area of user behaviour

Energy efficient user behaviour and appropriate facility management could save 5-20% of the overall energy costs. The advantage in this field of action is that "user behaviour" can be targeted without investive measures. The main hurdle in this area is the lack of motivation to save energy on behalf of the employees. Therefore, we concentrated on steering instruments providing an incentive for saving energy for example energy savings competitions, informational and educational offers or certificate trading.

4.2.1 Energy savings Competition

In an energy savings competition, desired behaviour is rewarded with a bonus. Possible target groups are individuals, teams or whole organisations. The bonus could accord to some persons or the whole organisation. Into consideration could come following topics: achieved energy saving, energy saving idea or energy saving projects.

The strengths of this steering instrument are: a high publicity effect; the possibility of creating rankings; target group and topic are configurable; it is appropriate for starting new projects. It could be disadvantageous that it is only a singular impulse and it is of high expenditure because of organizational complexity: data collection and information processing; result analysis; organisation of award ceremony. Numerous schools adopted this instrument for example in Emden, Dessau or Bologna. (Dessau (2005); Deutscher Städtetag (2007), pp.13; Hessisches Ministerium für Wirtschaft (2004), pp. 34; UBA (2005))

4.2.2 Informational and educational offerings

A multitude of measurements are possible in order to inform users about energy saving possibilities for example course of instruction, employee briefing, excursions, lectures, newsletter or E-mail-newsletter, workshops, informational magazines or counselling interviews. In preparation for an informational or educational offering the target group and the specific target of the measurement is to be defined.

This instrument allows a target group specific and tailor-made implementation. It can be combined with further steering instruments for example competition. Very important is the fact that further knowledge is generated and this can foster changing behaviour. But a once-only activity or measure may be forgotten fast therefore activities should repeat once or twice a year, so that the information or the new knowledge keeps in mind. Because of its simplicity the instrument is used very often for example the „Energy-Fit-Week“ in Wuppertal, „Super climate“ in Wiesbaden or „Energy wins!“ in Thüringen. (Arbeitskreis der hessischen kommunalen Energiebeauftragten (2003); Berliner Energieagentur (2008), Deutscher Städtetag (2003), p. 137; DStGB, DUH (2006), pp. 6; Energie gewinnt (n.pag.); Klima-Bündnis (2000), pp. 15, 56, 58); Klimabündnis (2004), p. 9; Münster (2000).)

4.2.3 Certificate Trading

The energy consumption and with it the CO₂-emissions can be steered by a maximum emissions cap, by amount of certificates that is equivalent to emission cap and the possibility for internal trading. Later on the emission cap should decrease in dependence on the emission target. By using this instrument a multitude of resource consumption or emissions could delimited. The advantages are that predetermined reduction targets will achieve and that the energy reduction occurs in that places where the cost are at its lowest. However it needs a lot of time to prepare an emissions platform and to allocate the certificates. Certificate trading is not an appropriate instrument for a single department because the departments don't decide about investment issues.

The company BP Amoco introduces an internal emission trading system in 1997. The target of the emission trading system was to reduce emission by 10 % up to 2010 in comparison to 1990. In 2001 BP Amoco achieved the target and abandoned the project. Over a period of four years the company saved 650 million \$. (Akhurst, M.; Morgheim, J.; Lewis, R. (2003), pp. 657-663.; BMU; BDI (2002), pp. 47; Victor, G.D.; House, J.C. (2006), pp. 2100-2112.)

4.3 Steering instruments in the area of procurement

Used office equipment in modern office buildings needs 30 to 40 % of consumption of electricity (Radgen, 1999, p. 1; Berliner Energieagentur (2007), p. 5). In order to reduce the consumption of electricity it is very useful to proof energy efficiency criterion before new office equipment will purchase. By integrating energy efficiency criterion in the procurement the effort of the development of bidding documents will

increase. Therefore we have searched for instruments and measures that decrease this effort and also legitimate. The research shows different instruments that very often not used from procurement operator. Possible steering instruments in the area of procurement are informational and educational offers, procurement guidelines,, product data base and life cycle costing.

4.3.1 Procurement guidelines

Procurement guidelines content all relevant regulations with regard to organisation, responsibilities, scheduling and further special features of procurement in general. In this guidelines can define standards for environmental friendly procurement or criterion for environmental protection and resource protection. Following issues are possible: definition of objectives for environmental procurement, determination of specific procedural methods, naming of minimum requirement of procured products or implementation of a controlling system so that favoured objectives are guaranteed.

The strengths of this instrument are beforehand defined regulations for environmentally friendly procurement, responsibilities and desired procedures. Often criterions of environmental protection exist, but because of insufficient motivation and controlling and also because of legal uncertainty these procurement criterions are not applied. (Amt für Umweltschutz Heidelberg (2004), p. 9; Hamburg (2007a), pp. 33; Hamburg (2007b); UBA (2007), p. 68; Umweltamt Münster (1995), pp. 11)

4.3.2 Product data bases

Product data bases support procurement operators running a market analysis by providing data about currently available products and its product specifications.

In particular if created for the purpose of environmental friendly procurement such databases enable analysis of the state-of-the-art of specific products and thus can help choose the one with for example the highest energy efficiency.

A range of databases has been designed and published recently. They provide, on the one hand, up to date information and their detailed product information about the state-of-the-art of technology ensures a fundamental decision basis for procurement processes. On the other hand it is difficult and of high effort to keep them up to date as the life-span of many products gets shorter, products are upgraded or replaced. Yet some databases are still under construction. Those as well have to cope with the challenge to provide information about many different criteria that have to be taken into account if one wants to choose the most environmental friendly alternative of a specific product.

An example is the database "Office-Top Ten" (www.office.topten.de) supplied by the German Energy Agency. It compares the most energy saving office devices such as notebooks or desktop-PC by calculating energy consumptions over the whole life-span. (DENA (2008))

4.3.3 Life-cycle costing

For selecting the most economic offer in purchasing processes costs and revenues of the whole life cycle have to be calculated. That means not only acquisition costs have to be considered but also costs of the use-phase and the end-of-life. By doing so, the follow-up costs are taken into account in an adequate manner.

In particular energy consumption and the use of water but also manufacturing supplies and expendables are considered by calculating the follow-up cost. Also maintenance cost or the costs for disposal may differ between different products. Therefore the calculation of life-cycle costs can reveal the true costs of a product: an energy-saving device may have a higher purchase price, but lower energy costs during the use phase can reduce the costs over the life-cycle.

So, choosing the most economic product can save both energy and money. For some products request for bids are already available that demonstrate the approach for considering life-cycle costs in purchasing processes and thus help reduce the true cost of a product.

But calculating life-cycle costs is not always a simple task as it has to be based on assumptions. It might be difficult to estimate the life-span of a product or to define its typical operating state which determines amount of energy consumption. Also phrasing a request for bids requires high effort in particular if it is done for the first time.

The administrative regulations for procurement of energy efficient products and services of the German federal ministry of economy renew public procurement processes. As a result life-cycle costs have to be calculated within the public procurement processes, criteria for energy efficiency have to be integrated in requests for bids and, where possible, an environmental friendly contract handling has to be established. Guidelines and examples for request for bids as well as currently available calculation tools integrate the thinking in life-cycle costs in an adequate manner, supplying responsible persons with useful information for example about the course of action, cost factors, adequate assumptions. (BMU, BDI (2002), pp. 57; BMWi, BMU (2007), pp. 83)

4.4 Steering instruments in the area of investigation in buildings

Energy-efficient building is a very important regulating screw for sustainable reduction of municipal energy consumption. In the literature is mentioned energy saving potentials for energetic reconstructions of 40 to 60% of the regular heat consumption. Of particular importance is that investment decisions in buildings have long-term impacts. Badly reconstructed buildings will reconstruct again in about 40 years that has enormous impacts on energy consumption and also on CO₂-emissions. Below the instruments energy guidelines, consideration of environmental follow-up costs and contracting are explained.

4.4.1 Energy guidelines

Energy guidelines developed for reductions of municipal energy consumptions are a summary for planning, operating and energy management in a central set of rules agreed of municipal council. Energy guidelines not only common principles about the handling of energy but rather a summary of concrete planning instructions, operating constructions and also exactly established responsibilities.

Beneficial is the documentation of political commitment. If the energy guidelines are formulated in an appropriate manner, new and innovative techniques/ solutions are fostered and also the energy-efficient reconstruction of buildings. Energy guidelines are not useful if none pays attention to this guideline and if no appropriate controlling system exists. Employee briefing or instruction are essential. (Amt für Umweltschutz Heidelberg (2004), pp. 8; Arbeitskreis Energieeinsparung des Deutschen Städtetages (2003), pp. 1; Deutscher Städtetag (2007), p. 18; Hamburg (2007a), pp. 32)

4.4.2 Consideration of Environmental follow-up costs

Environmental follow-up costs occur due to negative environmental impacts of investments. Generally, they take effect rather off-side than on-side. Environmental follow-up costs of energy consumption include, among others, cost of: climate change, crop failure, damage caused to human health due to air pollution or material damage (corrosion, contamination), damage caused to ecosystem, water pollution. An adjusted efficiency analysis can integrate an appropriate cost rate for external costs can be geared to for example the average price of certificates of the European Union Emission Trading Scheme (EU ETS).

In particular for reducing energy consumption or CO₂-emissions respectively calculating follow-up costs supplements efficiency analysis. Nevertheless scarce resource funds can make it difficult to implement the most efficient alternative is implemented as the investor does not benefit directly from the saved follow-up costs: indirect savings give rise only to the overall budget rather than to the budget of the investor.

The city Frankfurt am Main considering environmental follow-up costs. Planning base for construction, use and maintenance of new buildings is minimization of overall costs. Investment costs are considered as well as operating costs and environmental follow-up costs. For the latter 50€ are calculated per t CO₂ and 1€ per 1m³ water. The Federal State Saxony, Germany, introduced Administrative regulations for energy efficiency. Validation rules for measures for more energy efficiency shall also consider ecological and social aspects. This is done firstly by a bonus system that grants each kg of reduced CO₂-emissions with 0.07 €, secondly more flexibility for periods of repayment, thirdly granting the right to reduce the calculated investment costs in profitability analysis if innovative technology, for example renewable energy technology will be implemented, fourthly costing rates can be estimated with a comparatively low cost rate of the German Ministry for finance. (Arbeitskreis Energieeinsparung des Deutschen Städtetages (2003), p. 1; Frankfurt am Main (2000); Frankfurt am Main (2007); Maibach, M. (2007); SMF (2008); UBA (2007a))

4.4.3 Contracting

Within the scope of contracting the contracting authority carries over contracting-company at least financing, the planning (regularly), implementing and the mentoring of measures. The commission gets the contracting company over a specific period. There are different types of contracting: Energy-saving contracting, citizens-contracting, constructions-contracting. In the case of Energy-saving contracting the contracting authority gets a contractually guaranteed minimum of economisations that are used for investments. Financing of energy-saving-projects or renewable-energy-projects by citizens with private assets characterizes Citizens-contracting. After a defined period the citizens get a payoff. The contracting-company assumes the planning, financing, construction, operating of new investments or reinvestments and is able to sell generated net energy (heat, cooling energy, electricity). Energy-saving-contracting and constructions-contracting are recommendable up to € 100.000 energy costs per building. Contracting for building-pools is also possible – the minimum of energy cost is € 250.000. The administration benefits from cost-saving because of external financing. Further advantages are energy-savings are guaranteed, the contracting-company is rich in know-how and they also get auxiliary service for example courses of instructions. The possibility of building pools implements that less profitable buildings can also be part of contracting. The weaknesses of this instrument are high efforts, the establishment of a controlling system and the long-term contracts (ten to twenty years). Normally contracting is classified similar to a credit and the administration needs permission. (DENA (2004); Deutscher Städtetag (2003), pp. 100; DStGB, DUH (2006), pp. 9; Hessisches Ministerium für Umwelt (2002); Klimabündnis (2006), p. 11; Kuhn, V. (2003), pp. 48; UBA (2003), p. 156 and 51 (appendix); UBA (n.d.))

5 Steering instruments for overcoming hurdles

In order to select a suitable management tool, the hurdles that shall be overcome by the tool, might help. In the scope of a hurdles analysis five groups can be differentiated: no aims, no regulations, no knowledge, no information and no incentive and sanction system.

No aims: hurdles exists, because energy saving is no aim of the public authority.

No rules: in the public authority doesn't (still) exist no regulation, departmental for energy saving measures.

No information: this hurdle relates to required data that are necessary for decision processes for example energy consumption of a machine.

No knowledge: employees don't understand the relevance of energy saving projects of new implemented process or products or they don't know possibilities of energy saving.

No incentive or sanction system: Employees have no motivation concerning energy saving measures; there are no incentives and also no sanctions.

For the identification of the named hurdles and their reasons, decision-makers in the departments in Dresden have to be asked about the hurdles they perceive. At first we conducted a survey, after that we did in-depths interviews and finally we organized a workshop.

We used these three methods for identifying with which steering instrument can overcome which hurdles group. Table 2 presents the steering instruments for overcoming hurdles in public authorities.

Insert table 2 about here

For a public authority it is important to know, which hurdles exist, because very often hurdles prevent an effective management of resources and energy consumption. If the public authority know which hurdles exist, it should select the appropriate management tools addressing these hurdles.

6 Summary

The overall research question of this paper was: “Which steering instruments are appropriate for energy management and CO₂-management of public authorities?” At all we identified 35 steering instruments whereas 13 of them are instruments of the strategic level and 22 of them are instruments that focus on operational level. In detail we discovered six instruments that target on user behaviour. Respectively eight instruments tend to procurement and investment decisions. We described **every** instrument and how to adopt it for energy saving issues. Furthermore we analysed its strengths and weaknesses and searched for different practical examples. With these management tools public authorities can reduce energy consumption and improve its CO₂-management.

Additionally, a classification of the tools concerning the hurdles, which they intend to overcome, has been done. Therefore decision-makers in the departments in Dresden have to be asked about the hurdles they perceive. The existence of these hurdles in many cases prevents an effective management of resources and energy consumption. Here, it is very important to know, which hurdles are relevant for the specific local public authority. The authority then should select the management tools addressing these hurdles.

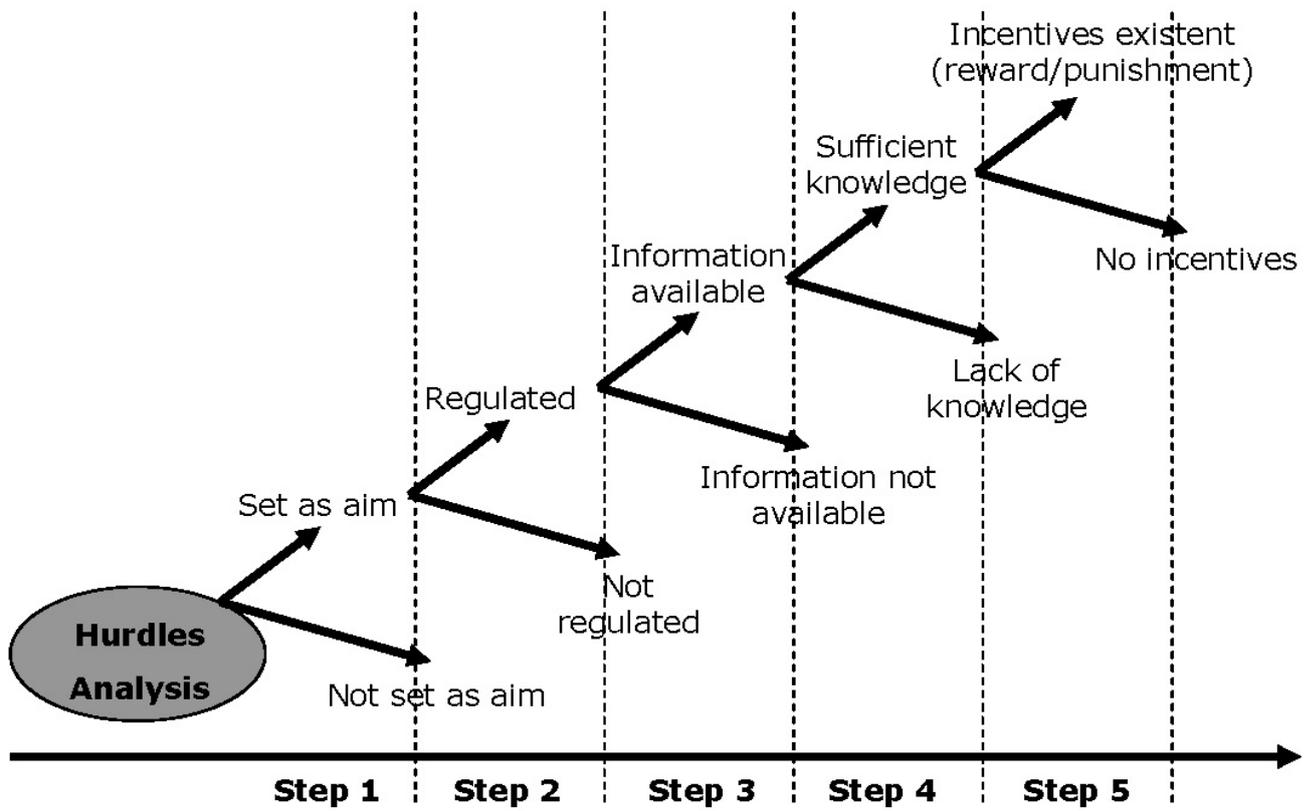


Figure 1: Possible hurdles in scope of developing a CO₂-Management System for Public Authorities

Table 1: Possible steering instruments for a CO₂-Management system for public authorities (highlighted in grey: in this paper explained instruments)

Strategic instruments	Instruments with focus on user behaviour	Instruments with focus on procurement	Instruments with focus on investment decisions
Mission statement, strategic objectives, key figures	Energy savings competition	Procurement guidelines	Energy guidelines
Contract management	Informational and educational offerings	Product databases	Consideration of environmental follow-up-cost
Budgeting	Certificate Trading	Life-Cycle Costing	Contracting
Benchmarking	Bonus scheme	Exemplary tender documents	Life-Cycle Costing
Energy consumption controlling	System of duties	Calculation tools	Intracting
European Energy Award	Bonus-Malus-System	Alliance of procurement	Conservation fond
Municipal energy management		System of duties	Informational and educational offerings
Cost accounting		Informational and educational offerings	Integral planning
Labelling/ Seal of quality			
Agreement on objectives			
Auditing			
Eco-Audit (Eco Management and Audi Scheme)			
Formation/ creation and description of (sustainable) products			

Table 2: Steering instruments for overcoming hurdles in public authorities
(Highlighted in grey: in this paper explained instruments)

With these steering instruments can overcome following group of hurdles
mission statement, strategic objective and key figures; contract management, agreement on objectives, formation/ creation and description of (sustainable) products	no aim
mission statement, strategic objective and key figures; benchmarking, municipal energy management, labelling, formation/ creation and description of (sustainable) products, Informational and educational offerings, product data bases, exemplary tender documents, calculation tools, alliance of procurement	no knowledge
benchmarking, energy consumption controlling, European Energy Award, municipal energy management, cost accounting, auditing, Eco-Audit by EMAS, municipal energy management, informational and educational offerings, product data bases, Life-cycle costing, exemplary tender documents, calculation tools, alliance of procurement, integral planning	no information
European Energy Award, municipal energy management, labelling, Eco-Audit by EMAS, procurement guidelines, energy guidelines, consideration of environmental follow-up-costs, intracting	no rules
contract management, budgeting, benchmarking, municipal energy management, cost accounting, labelling, agreement on objectives, auditing, energy savings competition, certificate trading, bonus scheme, system of duties, bonus-malus-system, , Life-cycle costing, consideration of environmental follow-up-costs, contracting, intracting, conservation fond, integral planning	no incentive and sanction system

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