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Sustainable carbon management in corporate governance: A case study

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Abstract

Institutional structures having leader roles in sustainable development must make regular and sustainable situation analyses to improve management strategies and particularly energy resources when environmental strategies are being developed. However, in Turkey, there is not a model defined to develop in particular sustainable carbon management strategies in a holistic structure. These approaches, as a decision support component, will provide significant gains in terms of monitoring, managing and projecting of energy consumptions responsible for carbon threat in institutions. In this respect, it is necessary to develop an institutional model and to create feasible actions. However, in management inputs, it is important that the energy efficiency, the usage densities and the consumption efficiency potentials are shaped with which criteria and how. This study, which is addressed in this direction, has been shaped as a public model for enterprise structures.

This work first presents a structure including an integrated carbon management system, which collecting public buildings in a single system management architecture that targets all components within their context. This model study aimed to manage the dynamic consumption processes for each building based on resource demand management. It is aimed to provide a manageable, controllable and developable infrastructure by creating a common language for the terminals of the energy systems having different languages and structures, which is the main source of carbon emissions. Early results from preliminary studies in some schools point to savings of over 20% in consumption.

Keywords: Institutional structures, energy management, information architecture, energy analysis, efficiency.

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1. Introduction

Since the 1970s, the problem of the increase in energy demand caused by the oil crisis has become a priority problem for the societies. However, uncontrolled consumption has become an important cause of the global warming and climate change threat that has arisen since the 90s. The development of environmental awareness in communities may not prevent the increasing fossil energy demand of the society, even though it raises awareness [1]. On the other hand, despite the improvements in energy technologies and the conveniences of modern life, the increase in demand has been continuous and in particular the cost of consumption from fossil fuels is being affected.

Energy as an economic and environmental actor in sustainable development strategies and practices is not only a matter of cost potential, but also of environmental impact. The most important element in carbon management is energy management. This concept has made developing of energy management systems and increasing of the more efficient energy utilization more worthwhile. The efficient and effective utilization of energy in energy management and the development of cost effective solutions have made holistic approaches a necessity for sectorial or sub-sectors as well as national strategies[2]. The public sector, which has a considerable share of energy consumption, should be seen as an area where energy is not used correctly and effectively due to legal protections. In this sector at which almost all energy consumption elements can be used, energy management should be seen as a necessity in all local or integrated elements. This study, which is dealt with in this direction, firstly showed that the efficient development of carbon management strategies of state and accordingly the efficiency of energy management. Accordingly, firstly, explains energy management and accordingly developed model, evaluation of the energy management system architecture developed within the scope of this project together with the results of the related institutional model.

2. Carbon management

Carbon management is a strategic management tool in energy and environmental management. In this respect, it is especially important for public administrations to develop a management strategy for all emissions-related consumption, especially for energy supply security. Carbon management is a structure in which all emissions and pollution-related elements are managed together for a sustainable environment [3,4]. However, the first element of sustainability is a holistic management approach. In this respect, a holistic energy management model has been developed in corporate governance.

3. Integrated carbon management architecture

Institutional structures are complex structures that incorporate different business disciplines and bring together different system components. Such structures are mostly seen in public administration. To build an integrated management model in such structures is possible primarily by modeling the corporate infrastructure[5]. In order to establish a carbon management model for institutional structures, it is first necessary to define the institutional process. In this context, the institutional process model developed for an organizational structure is given in Fig.1. These may be placed next to each other to save space.

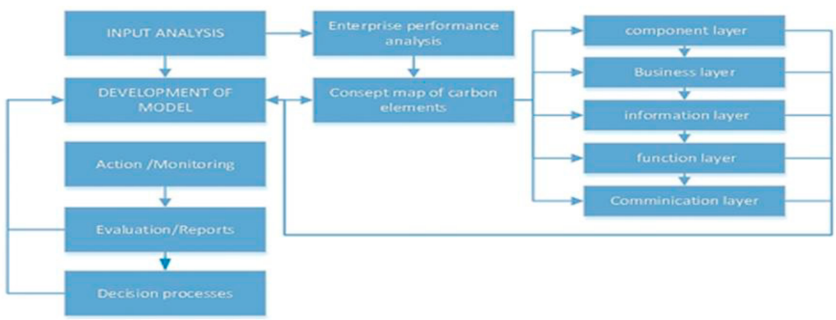


Fig. 1. Enterprise process for holistic carbon management strategy

Institutional energy management architecture, the public domain, should be addressed in a different integrated structure. In this context, the components that are interested in institutionalization can be considered as institutional and non-institutional inputs. The most important problem that institutional models can face in integrated structures is the configuration of institutional structure according to carbon management strategy. Legally relevant processes are considered to be a significant deficiency in the formation of such building models. In this study, for an enterprise model, the implementation details of a sample integrated building model are presented below.

4. Enterprise model study

The integrated energy management system, mentioned above, has been planned for a public enterprise and a carbon management model has been developed. An architectural infrastructure for decision makers has been established in the building, which is concerned with the integrity of approximately 11170 integrated structures within city planning management. The management model developed in this context can be seen in Fig. 2.

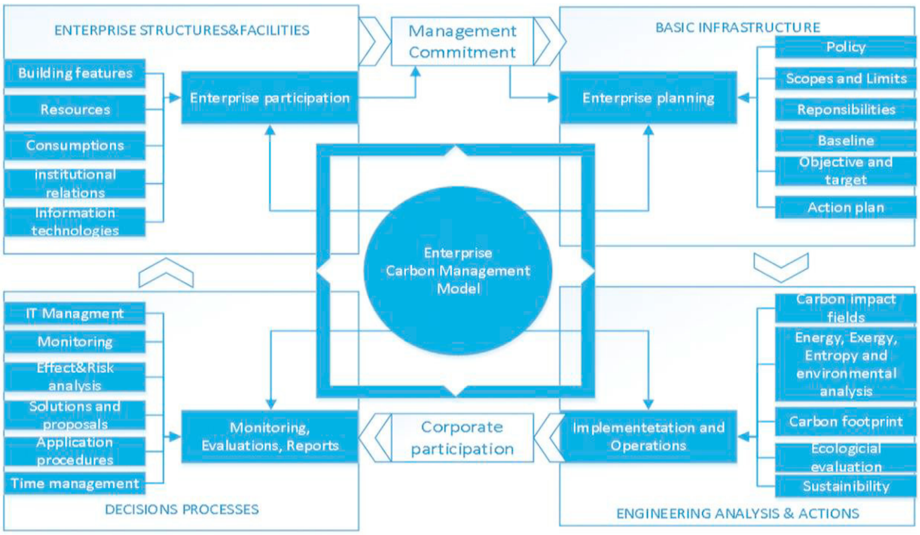


Fig. 2. Enterprise process for holistic carbon management strategy

In the developed model, the institutional relations and features of all the integrated structures are defined first. The most important phase of carbon management is the actions to be taken together with process analysis. In this direction, first of all, field detection together with the actions and field analyses related to these are performed [6]. In this context, energy analysis can be seen today where the most important area is fossil energy consumption. With an engineering background, it is necessary to study a surveying for each consumption process. The surveys to be performed on the field are applied to each integrated structure and an efficiency study is carried out. Accordingly, environmental threat potentials are also defined. The survey study for an enterprise structure is dealt with in the structure described in Fig. 3.

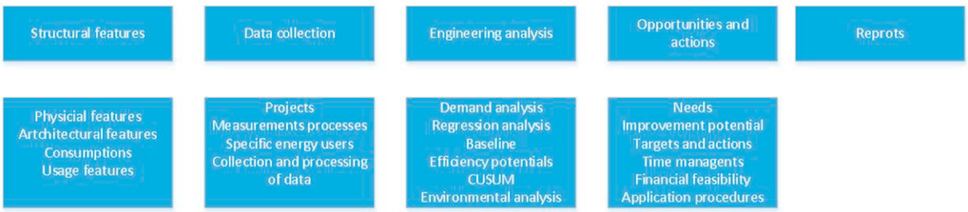


Fig. 3. Enterprise process for holistic carbon management strategy

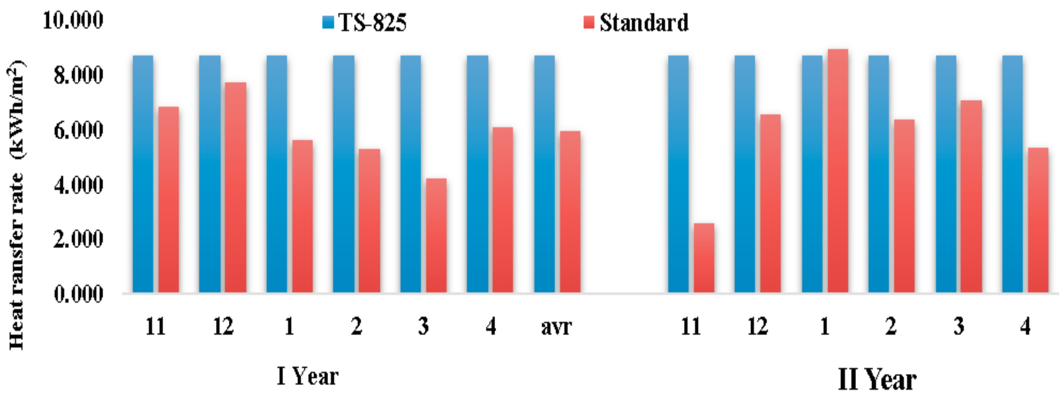
This assessment is a process that needs to be applied separately for each building. The work carried out in this context is primarily a process of action that will create the institutional baseline. This action was effectively evaluated in this study. In this context, details are given for a settlement and the results are described below.

6. Results and discussion

Energy management, one of the main players in carbon management, must be dealt with first with an efficiency strategy in institutional structures. In this study, the results of the energy study and the carbon emission potentials of the energy consumption needs of the institutional structure are examined. Consumption per unit area (m2) or consumption per capita is taken into account when assessing potential for institutional structures. In this direction, the energy consumption of the campus has been studied.

In particular, the study covers the basic structure of the campus for winter 2015-2016, including the structure and method of operation of the campus, as well as the determination of the structural heat demand due to climatic conditions. Two different analysis methods namely the Energy Consumption Standard and the cumulative total value method were applied for the energy data collected on a monthly basis. The project was assessed based on actual needs in target identification, which is different from normal energy scans. When the 2015 and 2016 energy consumption data are taken into account; the total energy consumption for 2015 is 177. 72 TEP and the energy consumption for 2016 is 207.89 TEP. This represents an annual increase of 16.98%.

In these consumption distributions, consumption of 2 years consumption of the campus is evaluated based on m^2 and person. According to this, while the average monthly m^2 consumption is 2.71 kWh/m^2, the monthly cost per m^2 annual consumption is found as 1.25 TL/m^2 in average. According to this average consumption, the consumption cost was realized as 25.12 TL/person. The relationship between the monthly consumption differences of the settlement years is examined. In this context, consumption shows remarkable differences for some months. It is important that the rate of change is close to zero or that it has certain stability. However, significant deviations in consumption and costs are noteworthy. The campus has an average annual total consumption of 2.25 GWh /year, and the share of natural gas in this consumption is 58.31% and the share of electricity is 41.69%. Natural gas consumption, the majority of which is used for heating purposes, is the primary source of carbon management. In the analyses made, the consumption habits of the operators in the winter conditions were evaluated and the efficiency related to them was questioned. Firstly, the consumption potential is compared with the reference to the demand analysis of the settlement. The requested heat load was evaluated as both project and TS-825 separately. In addition, the average heat transfer rate over the heat demand rating day is calculated. According to the campus where the ambient temperature TS-825 is -6 °C for zone II is very day for Turkey. The building components were calculated and the building components were calculated as 0.55 W/(m^2.°C) according to the insulated building property in the calculation of U values for the total heat calculations. The indoor temperature was taken as variable at 20 °C indoor temperature. According to these values, the temperature demand TS 825 and grade day values of the settlement are examined separately and the results are given in Fig. 4.



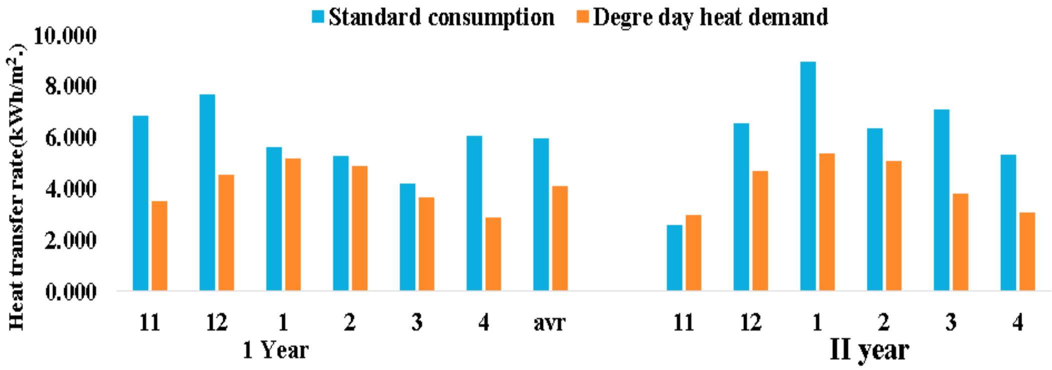


Fig. 4 Heat consumption potentials for TS-825, degree day and standard unit area

When the outside air temperature is -6 ° C, the building heat demand is approximately 8.702 kWh/(m^2.month). However, when the current consumption figures are examined, a minimum of 3.26 kWh / m2.ay and a maximum of 11.16 kWh/(m^2.month) have been realized. When the outside air temperature is taken into consideration here, there is consumption above the standard consumption of 11.16 kWh/(m^2.month) in January and 8.809 kWh/(m^2.month) in March above TS-825 data. This situation should be seen as an important problem month in terms of normal consumption data. When evaluated with TS 825, average consumption is 31.60% for the first year and 12.08% for the second year. However, in January and March of the second year, consumption above the standard is particularly striking. Significant differences also appear in the average between the standard consumption of the settlement and the degree-dependent consumption. According to the evaluation between TS-825 and degree day, the average demand for heat in the first year is 52.84% lower and the average consumption in the second year is 52.10%. All these consumption ranges have shown that energy efficiency studies for the campus should be based on standard consumption. The efficiency potentials of the operators related to these consumption curves are examined and the efficiency evaluation based on winter months for both years is given in Fig. 5.

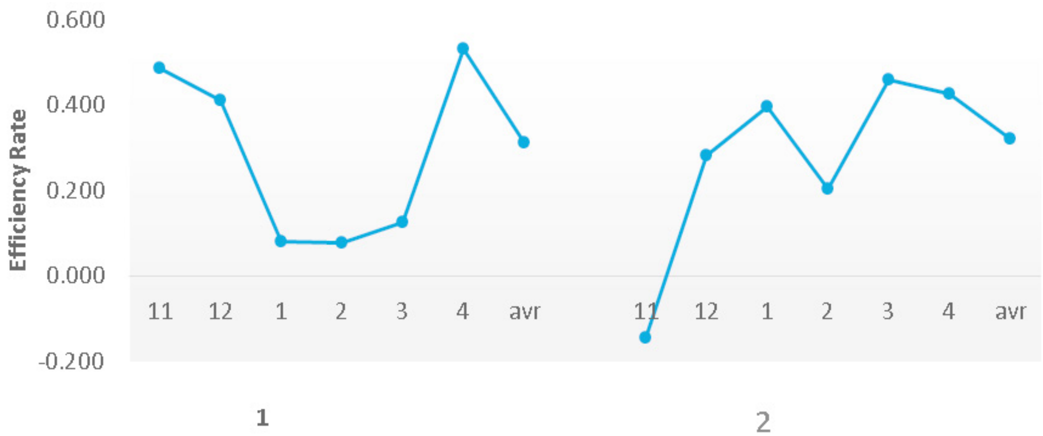


Fig. 5 Energy efficiency evaluation of the integrated building compared to m^2 based consumption

The efficiency potentials of the campus compared to the target consumption defined by demand analysis in natural gas consumption are 31.1% for the first year and 32.1% for the second year. Peak values in these consumption distributions stand out with 53% in April in the first year and 4 months in the first year, and 45.9% in the third year in the second year. With all these potentials managed, carbon management points out important measures. When the electric power plant is included in this consumption distribution, it can be seen that for the first year with average efficiency potential, target consumption is about 2.2 GWh while target consumption can be about

1.6 GWh. According to the target consumption, the total productivity potential of the settlement was found to be 27.52%. Similar analyses were made for the second year. Total consumption was about 2.50 GWh, while target consumption was about 1.82 GWh. According to total figures, the target energy efficiency ratio of the settlement in 2015 is found as 27.08%. According to this distribution, the operator represents a saving of 27.23% with a CO_2 saving potential of 161.23 tons CO_2 for both years. In this regard, the campus should also develop actions related to this.

7. Conclusions

This study focused to develop an integrated sustainable carbon management model developed for corporate governance and aimed at maintaining a sustainable energy management infrastructure. For the first time, the carbon management strategy and model proposed for institutional structures has been evaluated as a model for combating sustainable climate change. According to the average consumption in the settlement, 27.23% of energy is saved only in energy. Some of the actions developed in this context are presented below.

a. It has been estimated that consumption of uncontrolled hot water in the settlement creates an additional consumption of approximately 12% in natural gas. In this regard, especially in summer hot water solution can be solved with renewable resources.
b. System controls of the settlement heat processes are not used in place and effectively. Especially the thermostatic valve settings must be fixed.
c. In the existing heat processes of the settlement. However, insulation pads should be considered especially for system components such as valves and pumps.
d. The campus should be provided with reference to the outside air compensation in the thermal system management.
e. Central VRV systems have a significant potential for power consumption in the campus. VRVs should not be dropped below 24-26 ° C in summer.
f. With an effective energy management program, monthly data should be kept under control constantly.

Sustainable carbon management in institutional structures should be considered holistically. Authority and duty sharing should be established by creating a unit in the campus. In such sustainable governance activities should be provided that will raise the awareness of management and personnel. Institutional structures can easily provide sustainable carbon management strategies with the identified model.

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