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Implementation of green management concepts in sport complexes

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ABSTRACT: Implementation of green management in sport complexes can ensure the continuous arrangement and assessment of activities from the environmental perspective and will end up in control and prevention of contaminants. Enghelab sport complex (ESC) in Iran is selected for this study due to its size and long-term activities. Due to the comprehensive plan of the aforesaid sports complex, numerous centers and departments were established in this site in order to materialize its envisioned sports, recreational and cultural objectives. The results of the questionnaires distributed amongst the members and the personnel of the complex revealed that approximately 50 % occupants were not acquainted with green management and only 30 % were faintly familiar with it. The personnel's knowledge on green management was much better and about 64% of them were well acquainted with the related issues. Total amount of solid waste produced in the complex is about 547.5 tons/yr. in 2004; constituents are plastic (24.1 %), putrescible materials (45.9 %), glass (7.6 %), paper (19.3 %) and metal (3.1 %). According to the economic analysis conducted, the investment required for implementation of all the solid waste separation techniques amounts to us $ 11200. The result of present investigation is indicative of a medium level of optimization for energy and water consumption in ESC and there is a high potential to improve the efficiency of the system.

Key words: *Green management, consumption pattern, environmental quality, sport complex*

INTRODUCTION

During the past few years, new concepts like Green Management, Green Government, Green University and etc. have been introduced in management systems (Lindsey, 1990; Thumann, 1991; Turner, 1993 and Reyahi, 2004). Taking into account the ever increasing prominence of environmental management in world, the implementation of green management systems could enhance managerial recommendations as well as improve the preparedness of pertinent organizations to face up whith the future challenges such as consequences of global warming (Green Government, 2004). Therefore, establishment of green management system with the cooperation of senior managers and members of the related organizations would pave the way for profound alteration and evolution of executive branches of such institutions (Maknoun, 2004 and SABA, 2003). The green management system is considered as a management system, which is entrusted with dynamic and continuous arrangement and assessment of activities and processes from the environmental perspective and to monitor, prevent and control contaminants (Karbassi, *et al.*, 2006). According to the ratification of the Council of Ministers dated April 6th. 2003, green management is considered as a component of national managerial system and organizations should function based upon the objectives of the green management (DOE, 2004). However, not only the sport complexes are involved with physical education, but also they address cultural, social and recreational aspects. Thus, the Enghelab sport complex (ESC) as the largest sports complex in the country is a prominent target for the implementation of green management in sport facilities. The successful implementation of such system in the above-mentioned

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sport complex could be used as a model for establishment of green management at national and international levels. The establishment of ESC is among important national projects whose framework was founded in late 1950s. The green management pursues greater productivity, lower water and energy consumption, reduction of consumed materials like paper, management of solid wastes and creation of a recycling system in ESC. This sophisticated complex provides a broad range of sports and recreational services to the residents of Greater Tehran and thus could be considered as a suitable model for similar facilities.

MATERIALS AND METHODS

The current status of the sports complex in terms of available spaces and buildings; number of personnel; diversity of applications; type and number of fauna and vegetation coverage; level of water, electricity and gas consumption and other related parameters was assessed. Secondly, the environmental and energy status of the complex in terms of water quality, noise, air quality, solid wastes, and energy consumption were then evaluated. Moreover, the other pertinent issues of interest like economic and investment aspects for enhancement of the current status were examined. Finally, after conducting the preliminary measures and the above-mentioned study, the guidelines for establishment of green management system in sport complexes are provided based on four major topics namely: (1) education, dissemination of information and enhancement of personnel awareness; (2) measures for optimization of resource consumption; (3) measures to improve the environmental status of the complex, monitoring and continuous supervision; and (4) preparation and implementation of the guidelines in ESC along with a list of managerial and executive recommendations. A Solomat 510 e apparatus was used for determination of CO, CO_2, temperature, humidity and wind speed. The numbers of suspended particulate matters were then determined by measuring apparatus model Met One. Noise level were measured using B and K-2236 sound level meter.

RESULTS

In order to establish green management system in ESC, it is necessary to attain adequate familiarity with the sports and recreational activities as well as the environmental status of the complex. Table 1 shows a summery of related information about the sports complex.

In order to determine the environmental status of the complex, eleven stations have been identified to measure the concentration of air pollutants at various time intervals. In order to have a proper record of air pollutants concentrations; 33 measurements were taken at various time intervals considering peak traffic hours, weekday and weekend traffics outside of the sport complex. Fig. 1 indicates the location of these stations and Table 2 shows the concentration of major pollutants and the noise levels in the aforesaid stations.

Noise level ranges from 55 to 105 dB_A with a mean value of 68 dB_A obviously the highest ones have been observed in the borders of complex with adjustment streets. Numerous visits were made to the complex during different seasons of the year with the intention to determine the status of the produced solid waste production in ESC through the identification of solid waste ingredients and the applied management schemes for their collection, transportation and disposal.

Table 1: Specifications of Enghelab sports complex (ESC, 2003)

No.	Specifications	Remark
1	Number of members in 2003	52,083
2	Number of employees	310
3	Total area of the complex (Hectares)	95
4	Green coverage area (Hectares)	70
5	Minimum temperature 1989-1999 (°C)	14.1
6	Average annual precipitation 1989-1999 (mm)	245.15
7	Number of trees	23,951
8	Constructed area of the administration building (m^2)	2,290
9	Number of in-door pools	3
10	Number of out-door pools	2
11	Number of tennis courts	37
12	Municipality district No.	3

Table 2: Concentrations of air pollutants at Enghelab sport complex

Station No.	Wind speed (m/s)	Number of suspended particulate matter (m No./m^3)	CO (ppm)	NO (ppm)	Leq (dB_A)
1	0.49	261.53	2.5	1	68.7
2	0.38	80.09	5.5	2.5	69.1
3	0.74	91.39	4.5	1.5	69
4	0.34	141.50	11	0.5	70.3
5	0.45	345.22*	4	0	69.8
6	1.16	111.23	2	0	69.5
7	0.5	89.27	2	0	69.3
8	0.7	81.96	3	0	69.3
9	1.61	81.01	2	0	67.7
10	0.5	82.03	5	0	71.5
11	0	183.95	24*	1.5	77.8
Min.	0	120.39	4.5	0	65
Max.	1.6	345.22	24	2.5	77.8
Mean	0.62	140.83	5.9	0.6	72

*Not considered in mean computation

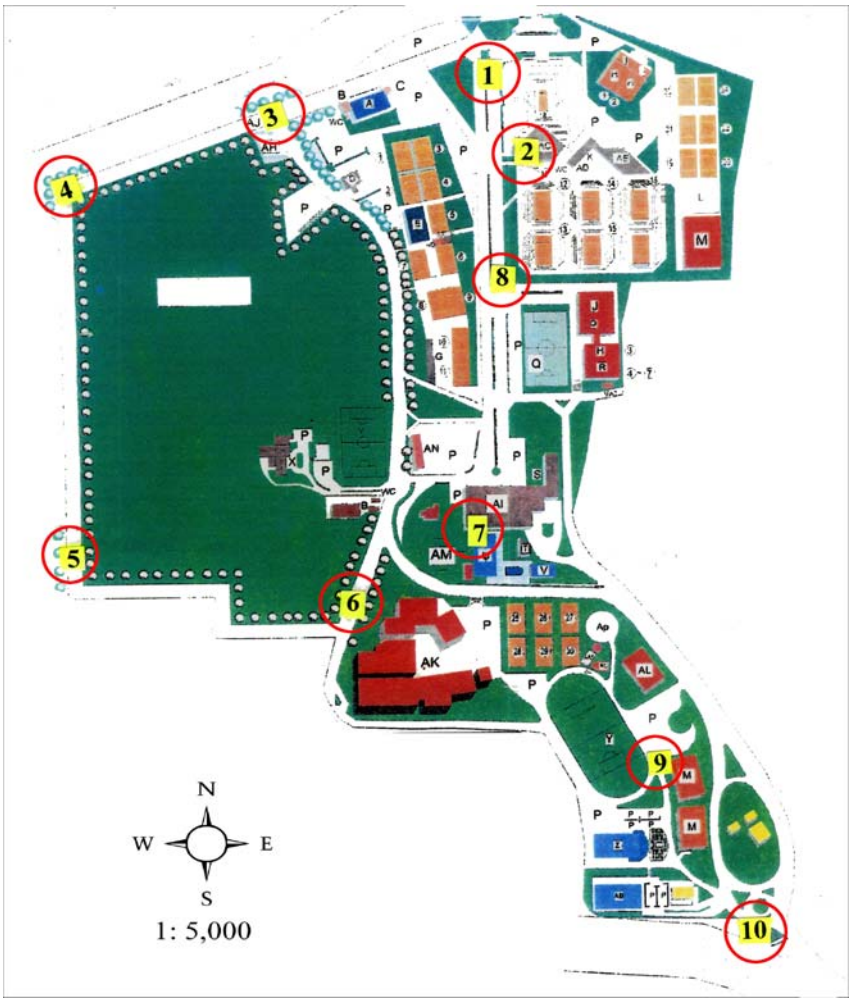

Fig 1: Location of air and noise pollution measurement stations in Enghelab sport complex

Manual separation and weighting of the solid wastes was conducted every month for a period of one year to identify the qualitative status of the produced garbage (Table 3).

A review were made on the water and electricity bills were made with the aim of assessing the water and energy consumption of the Complex whose results are presented in Table 4.

The status of the administrative building from the energy consumption perspective was studied with the purpose of assessing the potentials for energy conservation in that facility. The aforesaid building was selected as the model for the preliminary auditing. Therefore, electrical appliances in the administrative building were identified and it was found that fan coils consume the highest electricity (744 kWh/month).

The opinions of managers, personnel and members of the sports complex are quite useful in proper preparation of the desired management system. Thus, due to the considerable number of members and their related issues, it was decided to prepare a questionnaire and ask 50 members and 50 personnel to fill it out in order to facilitate the proper establishment of green management.

DISCUSSION AND CONCLUSION

The air quality in city of Tehran is a dependent function of air pollution and its stability. Thus basedon the conducted measurements, the stations adjacent to Seoul and Neayesh Expressways with heavy traffic congestion registered higher levels of air pollution. For this reason, stations No.11 and No. 4 registered the highest levels of CO (10.3 and 24 ppm).

On the other hand, stations No. 2, No. 3 and No. 11 had the highest levels of NO, registering 2.5 ppm, 1.7 ppm and 1.5 ppm, respectively. Moreover, stations No. 11 and No.4 recorded the highest numbers of suspended particulate matter. It is important to point out that most of the registered levels exceeded the permissible standard (Environmental Standards and Regulations, 2003). The CO levels in stations 11 and 4 surpassed the standard limit of 9 ppm, which indicate the need for remedial measures. Meanwhile, the level of suspended particulate matter in the aforesaid stations went beyond the standard range of suspended particulate matter in clean air (from 7.06 to 35.32, number of particulate matter per cubic foot of air). It seems that the status of the air pollution in the complex is designated to follow the pollution pattern of Tehran (Environmental Standards and Regulations, 2003). Therefore, reduction of energy consumption measures in the administrative building was identified as shown in Table 5. This is a 3 floor building and has an area equivalent to 2290 m^2. The result of energy saving measures shows a potential reduction of about 41% in electric energy consumption. Similar measures can be carried out on other buildings.

At the mean time, the utilization of GIS and Arc view software and introduction of resulted data and information on the levels of carbon monoxide and particulate matter made it possible to draw up the graphic map of air pollution and the location of the air and noise measurement stations. These maps are shown in Figs. 1, 2 and 3. The noise quality of the Complex has exceeded the standard limits most of the time and the lowest registered level “Leq” belong to station 9 at with a value of 67.7 dBA.

Table 3: Status of solid wastes production (type and amount) in the complex

Parameter **Material:**	Plastic	Putrescible materials	Glass	Paper	Metal	Total solid waste produced annually
% of Produced solid waste	24.1	45.9	7.6	19.3	3.1	100
Weight of produced solid waste (Tons)/Yr.	131.40	250.75	41.61	105.12	16.97	545.86

Table 4: Water and energy consumption in Enghelab sports complex

Consumption **Time:**	Spring	Summer	Autumn	Winter	Annual
Water consumption (m^3)	303.9	2904.1	1131	110	4449
Energy consumption (kWh)	1294191	1322161	1550142	1659070	5825564

Table 5: Measures for reduction of energy consumption in the administrative building (kWh/month)

No.	Activities	Power consumption (present condition)	Power consumption (Modified condition)	Energy saving
1	Substitution of light bulbs with low energy consumption brands (110 bulbs)	712.8	256.4	456.4
2	Proper use of lighting systems (e.g. using switch timer)	1782	891	891
3	Substitution of old refrigerators with more efficient ones [standard labeled refrigerators] (24 refrigerators)	257.04	216	41.04
4	Reduction of the number of existing computers and their proper use (16 computers)	624	390	234
5	Reduction of the number of existing printers and their proper use (6 printers)	28.08	17.55	10.53
6	Substitution of present copier with star energy labeled brand	72.8	54.6	18.2
7	Do not leave TVs unattended (2 TV)	20.8	5.2	15.6
8	Using the fan-coil system with thermostat to control temperature (and stop the system during closing)	744	465	279
9	Proper use of ventilator (and stop the system during closing)	84	52.5	31.5
Total consumption		4325.52	2348.25	1977.27
Total annual consumption				23727.24

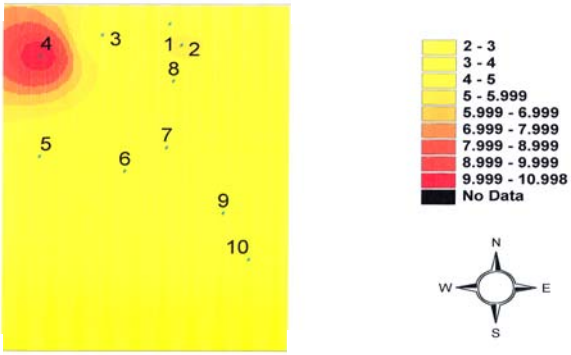

Fig 2: Air pollution map in Enghelab sport complex (CO; ppm)

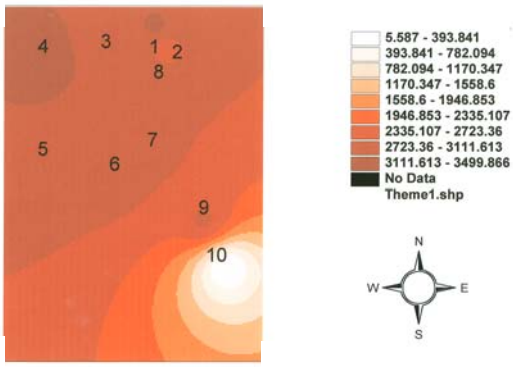

Fig. 3: Air pollution map in Enghelab sport complex (SPM; m/m^3)

On the other hand, the highest registered level belongs to station 11 with a value of 77.8 dBA. By taking into consideration the noise pollution standard in commercial areas of 65 dBA during 7am to 10 pm period and 55 dBA during 10 pm to 7am (DOE, 2003), it could be concluded that the noise levels in Enghelab Sports Complex is considerably higher than the permissible limits. This issue becomes more significant, when the instantaneous noise levels of over 105 dBA at the Complex are taken into consideration. The above-mentioned values indicate the need for control and monitoring measures by the pertinent authorities.

Total amount of solid waste produced in this complex is 547.5 tons/yr. in 2004; constituents are plastic (24.1%), putrescible materials (45.9%), glass (7.6%), paper (19.3%) and metal (3.1%). According to the economic analysis conducted, the investment required for implementation of all the solid waste separation techniques amounts to us $ 11200. The appropriate implementation of the above-mentioned techniques and selling of the separated wastes could produce an annual income of us $ 13079.13, which indicates an investment return in 11 months.

Based on these studies, new schemes for energy consumption in the administrative building and ultimately recommendations for reduction of energy consumption in the aforesaid building are provided. Although, only a portion of these energy conservation methods are mentioned here, their implementation will increase the energy efficiency of the building considerably.

According to the results of the completed questionnaires, green management checklists and the assessment of the research team , the average electricity consumption for illumination of building and the surrounding areas, the average electricity consumption in heating and air conditioning facilities and the average water consumption in the building and the surrounding area are estimated. The result of present investigation is indicative of a medium level of optimization for energy and water consumption in ESC and there is a high potential to improve the efficiency of the system.

Meanwhile, the results of the questionnaires distributed amongst the members and the personnel of the complex revealed that approximately 50% occupants were not acquainted with green management and only 30 % were faintly familiar with it. The personnel's knowledge on green management was much better and about 64 % of them were well acquainted with the related issues.

Table 6: Guideline for promotion of green management in sport complexes

Action	Remarks
1-Training, dissemination of information and enhancement of members and personnel's awareness	1-1-Providing training on protection of the environment to the members 1-2-Providing training to the personnel on protection and preservation of the environment 1-3-Providing training to the personnel of the Complex on protection and preservation of the resources
2-Implementation of optimization measures on resource consumption	2-1- Measures for reduction of water consumption 2-2-Practical measures for reduction of electricity consumption 2-3- Practical measures for reduction of the consumption of natural gas 2-4-Practical measures for reduction of paper consumption 2-5-Practical measures for improvement of energy consumption in heating and air conditioning systems
3-Measures for enhancement of environmental conditions of the complex	3-1-Measures for reduction of solid waste production and separation of garbage at origin 3-2- Measures to reduce noise pollution 3-3- Measures to reduce air pollution 3-4- Measures to reduce wastewater production
4-Continuous monitoring and supervision	4-1-Monitoring the activities for optimization of paper, water and energy consumption 4-2-Monitoring and supervision of educational training programs and their proper implementation 4-3-Monitoring and supervision of environmental quality

The importance of general and specialized training of personnel and members is quite significant in proper implementation of the green management.

According to the results of the study, the following guidelines in four major topics are provided to modify and enhance the water, paper and energy consumption pattern for the improvement of the environmental status of the complex and proper execution of the green management. As conclusion, in order to establish green management in such sports complexes it is necessary to create a proper environment, in which all people whether as member or employee do their best to cooperate in preservation of all aspects of environment. The management of the ESC adopts itself by making necessary changes in present organizational chart to meet such demand.

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