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Full Length Research Paper

Examining the sensibilities of the different sectors active in Düzce concerning clean production

Aybike Ayfer KARADAĞ[1] and Derya SEVİM KORKUT[2]*

[1]Department of Landscape Architecture, Faculty of Forestry, Duzce University, Duzce, 81620, Turkey.
[2]Department of Forest Industrial Engineering, Faculty of Forestry, Duzce University, Duzce, 81620, Turkey.

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Industry, having become the backbone of development and economic improvement today, increases the pressure on the natural resources, but it has carried the environmental problems to unresolvable levels. Some developed countries realising the seriousness of the issue developed various methods, techniques and technologies to reduce the environmental effects of the industry. "Clean production", which was put forward especially with the concept of sustainable progress, was defined as inclusion of environmental sensibility to all processes from designing to planning, is an approach to reduce the industry's environmental pressure and, in contrast to the traditional approaches, it aims to prevent pollution before it appears. In this study, the aim is to examine the practices of clean production in the fast growing industry in Düzce province, which has the most important active fault line, Melen river basin supplying clean water for Istanbul, vast forests having rich biodiversity, etc. For this purpose, in 50 enterprises directing the economy of Düzce and being active in different sectors, "a questionnaire of 43 questions including 6 parts and 37 variables" was applied with face-to-face interview method to define clean production awareness, technique and technologies. In the study, it was seen that the enterprise did not have the necessary information, technique and technology about clean production, and this situation was interpreted as the result of the industrial policies and practices in the country.

Key words: Clean production, pollution control, industry, environmental sensibility, Düzce, Turkey.

INTRODUCTION

In the second half of the 20th century, industrial and technological developments reached a dazzling degree and increased the quality of life. However, this situation not only has brought along such problems as the destruction and threat of natural resources, increase in the price of disposal of wastes, but also has caused them to reach to international levels. This situation has limited economical growth and pit "economy and ecology" with each other. The theorists of growth and development evaluated this situation within the frame of the questions: "what is the relationship between economical growth and environment?" and "How can we avoid from the growth limitation caused by environmental pressures?" (Alagöz, 2007). Today, in which Industry- born environmental problems have reached to an irresolvable level, this discussion has turned into such situations as "the expenses for improving and protecting the environment and environmental values" and "the expenses, which the economy has to put up with, to remove the damages given to the environment".

Two approaches have been come about in the process of the discussions about ecology or environment and economy. The first approach is the pollution controlling (pipe-end) approach that is defined as removal of the pollution with various methods after it emerges, and this approach requires high investments. The second approach is the clean production approach which is defined as preferring the productions and processes that harm the environment less during the production process, using the raw material more effectively, avoiding from lose of raw material which becomes waste during the production process, reducing the need of water and energy required during the production process, etc. (Anonymous, 2010).

*Corresponding author. E-mail:deryasevimkorkut@duzce.edu.tr. Tel: +90 380 5421137. Fax: +90 380 5421136.

Table 1. The differences between pollution control and clean production approach (Anonymous, 2010).

Approaches of pollution control	Approaches of clean production
The negativities caused by pollutives are tried to be removed	The formation of pollutives is prevented in their roots and with integrated precautions
Pollution controls are the practices coming into being after processes and productions are developed	Pollution control is an inseparable part of process and production development processes
Environmental improvements done with pollution control are considered as additional cost factors by institutions	Pollutives and wastes are considered as potential resources that can be converted into useful products or byproducts by making them harmless
Practicing pollution control technologies is the duty of such environment experts as waste managers, etc.	All the workers of the institution including designing and process engineers are responsible from meeting the needs of environmental improvements and clean production.
Environmental improvements require execution of various techniques and technologies. Precautions of environmental improvements are taken to comply with a series of standards put by the authorities	Environmental improvements require not only technical, but also non-technical approaches. Clean production is the process which aims at always reaching better environmental standards
Quality is defined as the response to the needs of customers	Quality is defined as producing the products which will respond to the needs of customers, and also as minimizing the effects on humans and environment
The technologies used for the control of pollution have a continual cost and this expense increases in time	The cost of control of pollution can be high at first, but the practice in the long run, managing and maintaining costs in total are lower

The differences between pollution control and clean production approach are given at Table 1.

Clean production was defined for the first time as “applying an integrated and protective environmental system to processes, productions and services to increase the total efficiency and to decrease the risks to human health/environment” by United Nations Environment Program–Department of Technology, Industry and Economy in 1989 (Ünal et al., 2005). There are different definitions of clean production. Demirer (2009) defined clean production, for processes, as “reducing the amount and toxic of the wastes and emission caused by the processes of production and service, raw material and energy usage, toxic material usage”, and for productions, as “preventing/reducing its negative environmental effects in the course of lifecycle (from raw material acquiring to last removal)”. Kotan and Bakan (2007) defined clean production as “Using less raw material and energy, taking not cleaning approaches, but preventing approaches as basis for pollution control, increasing reusing and recycling, forming less waste and reducing dangerous waste amount, using clean and recyclable energy resources, using the raw materials which were produced without harming the environment, preventing the usage of toxic materials, improving the technological processes in a way that will allow optimum usage and developing new processes, thus, contributing to the process of acquiring environmental development and economical development, which are among the aims of sustainable development.”

Clean production, first of all, indicates a process that prevents or diminishes waste formation to the least point and protects the environment and biological diversity by reducing consumption of the energy and resource that is used (Figure 1).

Clean production increases eco-fertility by aiming at applying environmental strategies to processes, productions and services, and at reducing the risks for human and nature. “Eco-fertility” is a term started to be used in 1992 by The World Business Council for Sustainable Development-WBCSD.

WBCSD defines eco-efficiency as being achieved by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity through the life cycle to a level at least in line with the Earth’s estimated carrying capacity (Oikawa et al., 2005). Eco-efficiency is reached by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle, to a level at least in line with the earth's estimated carrying capacity. Eco-efficiency therefore combines economic improvements with the more efficient use of resources and the prevention of emissions. The WBCSD has identified seven components of eco-efficiency (Anonymous, 2011a):

1. Reduce material intensity of goods and services
2. Reduce energy intensity of goods and services

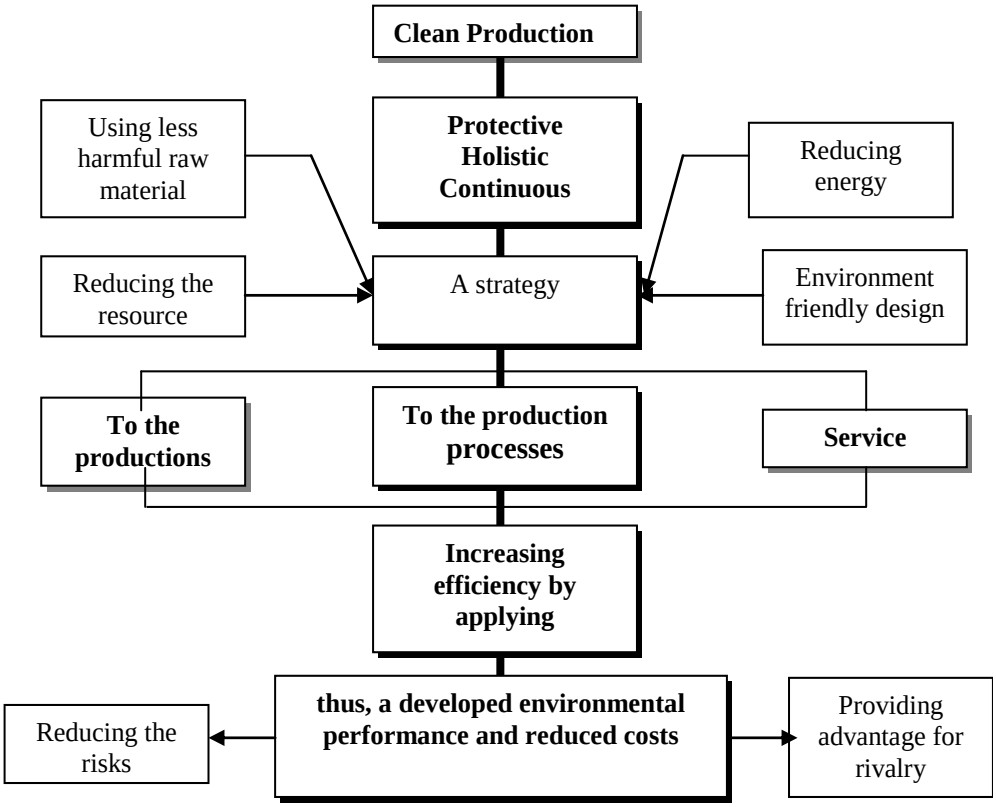

Figure 1. Clean production process (Kotan and Bakan, 2007).

3. Reduce toxic dispersion
4. Enhance material recyclability
5. Maximize sustainable use of renewable resources
6. Reduce material durability
7. Increase the service intensity of goods and services.

For all this to be achieved, the creativity of the business community is needed, creativity which deploys new technologies, initiates improvements along the entire value chain and brings new products to the market (Anonymous, 2011a).

Clean production brings along solutions for the issues of water and energy saving, reducing wastes, reusing and management, reducing air pollution and carbon emission with various techniques and technologies (Yücel and Ekmekçiler, 2008).

The primary techniques and precautions that will provide water saving within the frame of clean production can be summarised as follows (Anonymous, 2009; Ulutaş, 2011):

1. Accumulating rain water and using it,
2. Preferring dry processes,
3. Reducing chemical usage,
4. Optimizing the processes of washing, rinsing,
5. The systems with high pressure and low flow that provide water saving in an important level in the washing systems and pipes,
6. The methods and technologies for detecting leaks in the water tanks used during the production process, and in the pipes,
7. Flow controls to prevent overflows in the tanks,
8. Lifespan, filtering and maintenance of water based baths,
9. Usage of recycled water in some processes,
10. Water measuring devices in the processes having too much water usage,
11. Water pumps and pipes special to production,
12. Optimisation and automation of plate baths,
13. In cooling, using cooling towers of closed twirling systems, minimizing tower bluffs and regaining them,
14. In heating; improving vapour systems, regaining vapour, preferring heat exchangers, minimizing boiler bluffs,

The primary techniques and technologies to provide energy saving within the frame of clean water can be summarised as follows (Anonymous, 2011d):

1. Generating electricity from recyclable energy resources and laying them down,
2. Wind power stations,
3. Geothermal power stations,
4. Generating biogas and electricity (heat) from organic wastes,
5. Using photovoltaic (PV) systems,

6. Using hybrid systems,
7. Laying down heat energy underground and using ground heat,
8. Managing heat insulation of the enterprise,
9. Isolating the electricity circuits to prevent leaks,
10. Making the electricity hardware to be in such a level to meet real power need,
11. Suitability of the heating-cooling system for production, and its generating lower emission amount,
12. Insulation of the storing tanks that are cooled or heated with heat pipes and stopcocks,
13. Regular maintenance of cooling and heating systems,
14. Using solar cooling and heating technologies,
15. Regaining/recycling of the waste heat coming about during production,
16. Using energy saving bulbs,
17.Cleaning the illumination system regularly,
18. Using the illumination system with motion sensor for illumination,
19. Providing electricity saving by revising such devices as fan, pump, compressor, etc. with system optimizing approach,
20. Improving the systems of burning (boilers, ovens, burners, etc.), heating and cooling,
21. Making the production technology used (melting, fusion, annealing, drying, pressing, moulding, painting, etc.) more efficient,
22. Process and management optimisation of shortening the production time, dropping the heat or pressure levels, and
23. Increasing the efficiency of electricity generation, generating electricity and heat together.

The primary techniques and technologies that can be used in the processes of preventing and diminishing the wastes within the frame of clean production, “preproduction (providing raw material, its transportation, waste), production process (solid and liquid wastes, waste water decharge, gas emissions), preconsumption (packing, storing, transportation loses) and post consumption (usage wastes)” can be summarised as follows (Zanbak, 2007; Anonymous, 2009):

1. Reusing the by products/wastes, their recycling and finding opportunities of selling to other enterprises,
2. Storing the wastes separately for recycling purpose,
3. The fact that the storing areas are impermeable,
4. Using containers that can be reusable in storing and can be returned to the supplier,
5. Packing the products with using less package,
6. Using recyclable or reusable materials in the product packages,
7. Using the technique and technology to reduce defective productions,
8. Storing chemical and dangerous materials in the containers and preventing possible leaks/pours
9. Using the practices that make the life of the solvent which is used in various phases of the production,
10. Reusing the waste water produced as a result of washing the chemical material containers in the process,
11. Dosaging the chemicals with the help of pumps to prevent material lose,
12. Reducing oil consumption/oil waste formation, and
13. Using dust holder filter.

The primary techniques and technologies to reduce emission amount within the frame of clean production can be summarised as follows (Anonymous, 2009):

1. Detecting the emission resources formed by the enterprise and defining their characteristics,
2. Using the processes and technologies with lower emission,
3. The air conditioning should be in such a level to keep the moist and heat of the enterprise at optimum degree,
4. A proper exit system/watching equipment should be there to control the air emission from the boiler room, and
5. Carbon keeping and storing systems should be there.

MATERIALS AND METHODS

This study was carried out in Düzce province center (Figure 2) located in the North latitudes of 40° 37’ and 41° 07’, and East longitudes of 49’ and 31° 50’. Within the scope of the study, as from 2010, it was aimed to examine the clean production practices in the context of environmental sensibility in the enterprises that are members of the Chamber of Trade and Industry of Düzce, and whose main activity subject is production, and whose production unit is in the borders of Düzce city center. Düzce was chosen as the research area, as it has an active fault line, usable water resources, biodiversity and endemic species and tender ecosystem, and it has been industrialised for the past 10 years. The fact that the term in which industrialisation in Düzce and emergence of clean production approach in Turkey is the same will put the possibility of practicing clean production approach in the industry more clearly.

Two important factors played roles in the development of industry in Düzce. The first factor is the fact that the city gained province status with the statutory decree which is dated 1999 and the law no 23901, and is about “Establishing One Province and Two counties” to improve the city again as a result of 17 August 1999 Marmara and 12 November 1999 Düzce earthquakes (Eser and Şerifoğlu, 2002; Anonymous, 2004). The second factor is the fact that the city was taken into the promotion scope with the law that is dated as 2004 and the law no 5084 (Anonymous, 2011b). Also, the fact that the city is located between the capital city Ankara and the biggest city in the country, İstanbul, and its closeness to other industrial cities (Bursa, İzmit, etc.) triggered industrialisation and caused the industry stretch along Düzce plain.

Chamber of Trade and Industry of Düzce was established in 1959 and is composed of 14 professional committee. Its number of members is 2.801. With the acceptance of Düzce to the law scope about “Investment and Employment Promotion” whose law no 5084 a change was observed in the structure of industry, and with the addition of 1. 2. Organised industrial site (OIS) to the present small-scale industrial establishments, large-scale factories started to be established and became active. The OIS established in Düzce has a square measure of 1.080.105,19 m^2 and it was assigned for 57 firms. 43 of these carry out production, 8 of whose construction has been finished and 6 of them is under construction. In 43 facilities that are carrying out production, 4.612 people are employed, and when all of the firms are activated, it is planned that 9.500 people will be employed. Düzce OIS is the fastest growing OIS

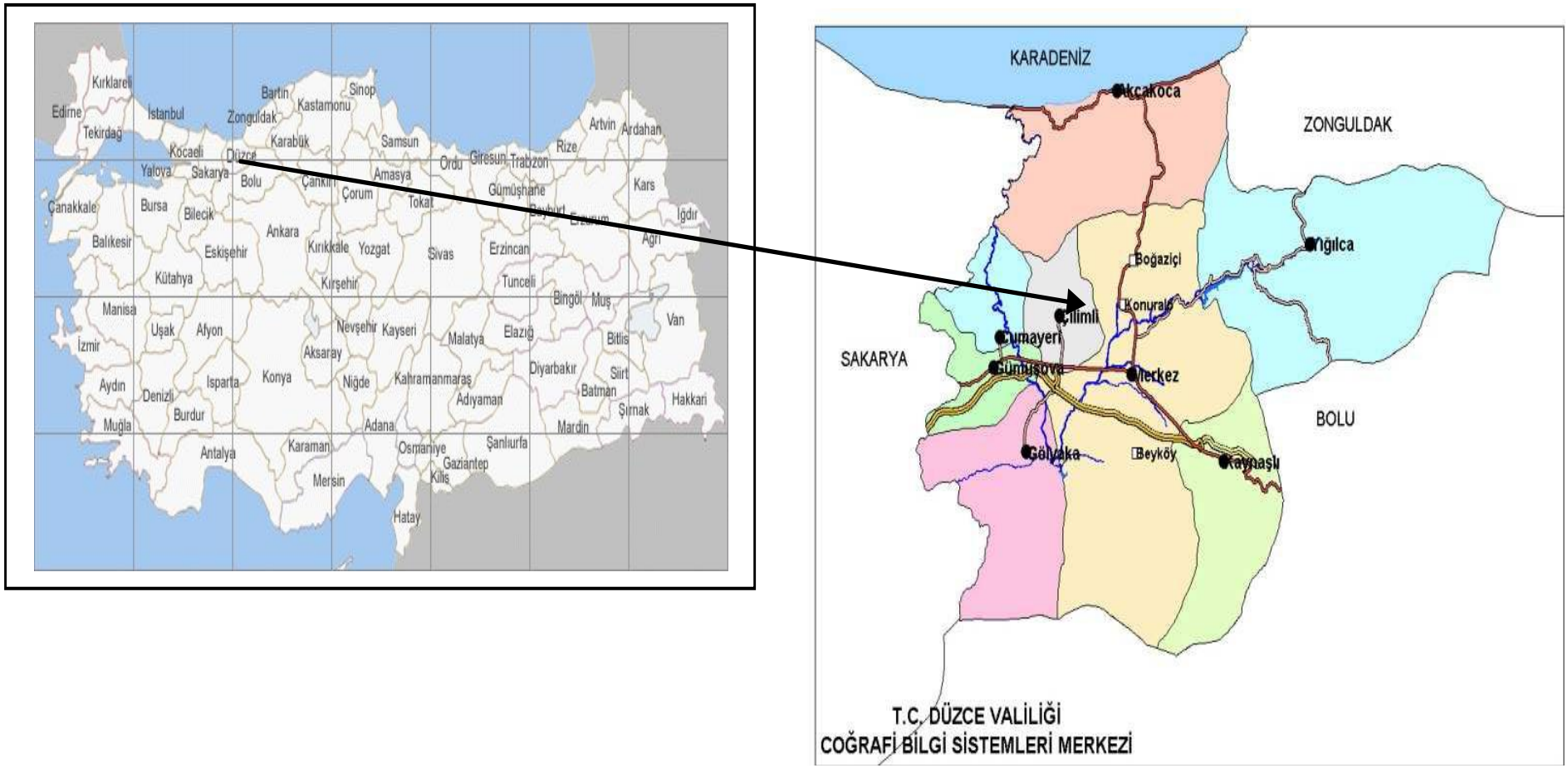

Figure 2. Düzce location.

after 2004. With the effect of the law of 5084 law no, the second OIS was established on 478.476,00 m^2 in Tepetarla area to meet the dense investment demands, and this second OIS was assigned for 11 firms. 3 of these firms have started to produce, 2 of whose construction have been finished, 4 of them are under construction and 2 of them are newly assigned. In 3 facilities producing 164 people are employed. When 11 firms start to produce, it was planned that nearly 1.200 people would be employed.

In the Düzce city center, “Small Industrial Site” is being constructed which has 120.000 m^2 closed area (total area is 458.000 m^2) and whose 85% has been finished. The sectors in which the most production takes place are the sectors of wood industry, hazelnut kernels, machine production, textile, food, metal, furniture, plastic and automotive. Primarily these production industry sectors, the number of people working in production industry are nearly 20.000 (Anonymous, 2011b).

Industrialisation revived the employment and economy in the city by increasing the population which was decreased after the earthquake in 1999. However, urbanisation speed and industrialisation brought along the issues of water, earth and air pollution, wrong usage of land. This situation was evaluated in the report prepared by the Ministry of Forest and Environment (2010) as the environmental problems of the city and the environmental effects of the industry.

Table 2. The enterprises recorded in Düzce Chamber of Trade and Industry located in Düzce city center as from 2010 (Anonymous, 2011b).

The sector of production industry of Düzce				
Main sector	**Number of firms**	**%**	**Number of workers**	**%**
Package	10	2.74	653	3.19
Hunting gun industry	7	1.92	94	0.46
Electricity	10	2.74	377	1.84
Other	15	4,11	384	1.88
Hazelnut	21	5.75	914	4.47
Food	31	8.49	638	3.12
Ready-mixed concrete	5	1.37	142	0.69
Medicine	3	0.82	322	1.57
Cosmetics	3	1.82	29	0.144
Machine production	9	2.47	459	2.24
Medical products	1	0.27	11	0.05
Marble industry	1	0.27	13	0.06
Metal Industry	17	4.66	649	3.17
Forest products	62	16.99	1743	8.52
Furniture production	18	4.93	751	3.67
Automotive	18	4.93	3693	18.06
Plastic	10	2.74	239	1.17
Weapon Industry	1	0.27	268	1.31
Stone chips aggregate	4	1.10	103	0.50
Textile	83	22.74	6928	33.88
Construction	23	6.30	1634	7.99
Food industry	13	3.56	404	1.98
Total	365	100	20.448	100

In the report, the environmental problems in the city were counted according to their priority degrees as “wastes, water pollution, air pollution”, industry-born environmental problems “air pollution, water pollution, solid wastes, liquid wastes, it damage to agricultural activity, its damage to natural life, it effects on residential areas, noise pollution, visual pollution, smell problem” (Anonymous, 2011c).

The forested lands and water resources of Düzce are quite important for the environmental effects of industrialisation. Düzce has 2593.000.000 m^2 area and 47% of this area is forested land. These forests are very rich for biodiversity (Anonymous, 2004). There are 71 endemic plant species, according to the classifications of International Union for Nature Conservation (IUCN) in Düzce Province and 11 of these are under threat (Aksoy et al., 2010). Distribution localities in land use of determining 71 endemic species and their distribution in Düzce province, which are plotted 82 as forest, 6 hazel nut, 4 non irrigated, 1 irrigated, 8 pasture and there is no shrub areas. The natural habitats of endemic species in forest are under the threat of forestry activities, road and dam constructions, in hazel nut are clear cutting to understory flora and hedges of nut tree farming, in non irrigated are urbanization and road construction, in irrigated are agricultural activities and road construction, in pasture are animal grazing, agricultural activity and urbanization, there is no locality of endemic species in shrub because the natural area of shrub in Düzce province are destroyed by forestry and agricultural activities (Aksoy and Uzun, 2011).

Düzce is also rich in water resources (running water, lake, watery areas and geothermal resources). The great Melen river basin forming the source of the project of Melen Drinking water, which will provide Istanbul with drinking water, includes a great deal of Düzce’s city borders. Düzce is located on the fault line of North Anatolia, the most important active fault line of Turkey, and this situation is very important for future of industrialisation.

In this study, to examine the present situation of clean production process, the present situation concerning “water usage, energy usage, waste water-solid waste and dangerous waste amount, air emissions, the presence of clean production techniques and technologies’’ in the enterprises are accepted as criteria. In the process of the study, 230 enterprises (food, textile, forest, shot gun, chemistry, sector of stone earth and metal items) (Table 2) in the city center were reached, however, 50 enterprises accepted to take part in the study. Because, the enterprises are reactive against participating in the studies about environment and/or their documentation (data base) systems are inefficient.

The study was planned according to the techniques of face-to-face interview and questionnaire (October-December 2010). Information gathering forms were used to carry out evaluations concerning the criteria in the enterprises. In the course of making the forms, the studies carried out in the similar subjects taking place in the literature were examined and a new form was prepared complying with the aim of the study. The form consists of 6 parts including 43 questions and 37 variables in total. In the first part, the qualities concerning the enterprises were examined, in the second part, water usage was examined, in the third part, energy usage was examined, in the fourth part, waste water-solid waste and dangerous waste amount were examined, in the fifth part, the present condition concerning air emissions, in the sixth part, the present condition concerning the presence of clean production

Table 3. The number of workers working in the enterprises.

The groups of workers number	The number of workers (permanent)		The number of workers (seasonal)	
	Density of enterprises	%	Density of enterprises	%
No worker	-	-	41	82
1-9 person	6	12	6	12
10-19 person	12	24	2	4
20-29 person	6	12	1	2
30-39 person	2	4	-	-
40-49 person	2	4	-	-
50 -99 person	13	26	-	-
100 person and over	9	18	-	-
Total	50	100.0	50	100.0

Table 4. The number of technical and directory workers.

The groups of workers number	Technical worker		Directory worker	
	Density of enterprises	%	Density of enterprises	%
No worker	10	20	-	-
1 person	10	20	5	10
2 person	7	14	6	12
3 person	10	20	6	12
4 person	4	8	5	10
5 person and over	9	18	28	56
Total	50	100.0	50	100.0

techniques and technologies was examined. In the evaluation of the data, SPSS 18 package program was used.

RESULTS

The present conditions of the enterprises

The establishment dates of the enterprises within the scope of the study goes back to 1967. According to 10 years of evaluations, it was detected that 6% of the enterprises were established between 1960 and 1969, 8% of them were established between 1970 and 1979, 10% of them were established between 1980 and 1989, 36% of them were established between 1990 and 1999, 36% of them were established between 2000 and 2009 and 4% of them were established in 2010.

It was seen that 43.9% of the enterprises located in the sample were anonymous, 46.3% of them were limited, 7.3% of them were individual and 2.4% of them were collective corporations. The workers of the enterprises were examined in four different categories; permanent worker number and seasonal (Table 3), management and technical personnel number (Table 4).

Permanent worker number changes between 5 and 2855. It was found out that in 9 of the enterprises, there were seasonal workers, and the number of seasonal workers changes between 1 and 21. In the enterprises participating in the study, 5452 permanent workers and 53 seasonal workers in total were working (Table 3). 20% of the enterprises did not have any technical workers. It was seen that only 1 enterprise had 20 technical personnels and 1 enterprise had 62 executive personnel. 163 technical and 447 directory workers are working in the enterprises that have attended the research and the average number is 4 for the technical workers and 9 for the directory workers (Table 4).

58% of the enterprises can not answer the question, “what is your way of production?” 28% of the enterprises which answered this question pointed out that they achieved order production, 10% of the enterprises pointed out that they achieved serail production, 4% of the enterprises pointed out that they achieved both serial and order production .It is pointed out that 23.4% of the enterprises work full capacity and 76.6% of the enterprises can not work full capacity .The capacity rate of the enterprises which can not work full capacity ranges between 10 and 98%. The capacity usage rate of the enterprises ranges between 80 and 99% (Table 5).

64.7% of the enterprises’ open area is above 10.000 $m^{2.}$ There is 1.021.014 m^2 open area and the smallest open area is 300 m^2; the biggest open area is 143.803 m^2.

Table 5. Capacity usage condition.

Main factor	Option	Percent (%)
Capacity usage condition	We can not work full capacity	76.6
	We work full capacity	23.4
	TOPLAM	100.0
The rates of capacity usage (%)	1-19	3
	20-39	9.1
	40-59	27.3
	60-79	27.3
	80-99	33.3
	TOPLAM	100.0

The open area that the enterprises have is averagely 22.689 m^2. 4.3% of the enterprises continue their production on the close area less than 1000 m^2, 29.8% of them on the close area more than 10.000 m^2. Joining the research and having 352.673 m^2 close production area, the enterprises have 300 m^2 close production area on the least and have 38.134 m^2 at the most. It was figured out that the enterprises make their production averagely on 7.504 m^2 close area.

The research of the usage of clear water in the enterprises

Water usage

The enterprises use network water and well water. 50% of the enterprises use network water (N=25) and 54% of the enterprises use well water (N=27).

When the water which the enterprises use is analyzed, it is figured out that 22 enterprises have 1 well, 3 enterprises have 2 wells, 1 enterprise has 3 wells. Additionally, it was figured out that only 16 enterprises (61.5%) have confirmation document. The capacity of water wells ranges between 3 and 250 tons. It was figured out that the enterprises use well water as a means of drinking, cleaning and garden irrigation between the years 1 and 8.

It was seen that when the practice of water saving is questioned in the enterprises, the enterprises do not have any clean production technique and technology neither in the process of water providing nor in the process of production.

Energy usage

Enterprises pointed the sources of energy that they use in production as electricity, natural gas, coal and wood. Enterprises uses electricity 96% rate (N=48), wood 37% rate (N=13), natural gas 16% rate (N=8), and coal 14% rate.

When the electricity consumption amount of enterprises is analyzed, it is seen that the annual electricity consumption amount ranges between 600 and 25.000.000 kw/year. The average consumption amount is 20.929.96 kw/year. When the wood consumption amount of enterprises is analyzed, it is pointed out that the annual consumption amount ranges between 240 and 5400 tons/year. The average consumption amount is 1560 tons/year. When the natural gas consumption amount of enterprises is analyzed, it was pointed out that the consumption ranges between 1.800.000 and 2.200.000 m^3/year. The average consumption amount is 2.200.000 m^3. When the coal consumption amount of enterprises is analyzed, it is seen that the annual coal consumption amount ranges between 5 and 4500 tons/year. The average coal consumption amount is 1562 tons/year.

When the enterprises' practices for the energy saving is questioned, it was pointed out that enterprises use energy saving lambs, heating Technologies using sun, lighting systems with censorship, fan and compressor.

Waste water-solid waste and dangerous waste amount

It was pointed out that enterprises produce solid waste 68% rate (N=34), liquid waste 22% (N=11) and gas waste 6% rate (N=3).

It was figured out that enterprises produce liquid waste between 3 and 300 tons. The average annual liquid waste amount is 125 tons. It was pointed out that the liquid wastes are waste glue, polishing line, the water used for area irrigation and vapour cauldron. The liquid wastes are decharged to canalization in the enterprises that have refinery. There are refineries in only 16% (8 in number) of the enterprises. In the other enterprises, the dangerous waste is laid down in depots, plastic containers, plastic tanks and barrels.

The amount of the solid waste that the enterprises produce ranges between 1 and 8000 tons. The annual solid waste amount is 448 tons. It was pointed out that the solid wastes are "wood, iron, steel, aluminium, packing stuff, cardboard, scrap, packing wastes, production deficiencies, iron sawdust, MDF deficeincy, wood stracth plates and wood wastes, covering, timberlands,

Table 6. Subjects of the researching and development studies of the enterprises.

Subjects of the researching and development studies	N	Percent (%)
Decreasing the energy consumption	15	30
Decreasing the energy sources	5	10
Decreasing the consumption of water usage	5	10
Recycling of the wastes	7	14
Developing new Technologies	17	34
Decreasing the environmental pressure	6	12
Decreasing the toxic wastes	2	4
Increasing the production capacity	21	42
Increasing the product quality	21	42
Improving the enterprises' conditions	17	34
Marketing	17	34
Employment	11	22
Others	2	4

plastic, rubber, ash, wood stracth, wood wastes, chocolate parts, curtain wastes, wool, metal wastes, wire, and galvanize".

It was pointed out that enterprises store their wastes to depot areas or municipality garbages. It was pointed out that 24% of the enterprises give their wastes such as packing wastes, broken glass pieces, frame, plastic plate, iron, iron chips, aluminium chips, metal, cardboard, plastic, polypropylene, massif panel, resin and chemicals, galvanize and profile chips, chemicals and boar oil to recycling factories. Additionally, some enterprises sell their wastes as scrap or burn them to obtain energy.

Enterprises pointed out that for the destruction of the wastes, they show sensitive approach to environment by having refineries, by giving their wastes to recycling factories, by storing wastes in unleaking containers or tank soar by burning them to gain energy.

Air emissions

21 of the enterprises (42%) pointed out that they have filter systems, 4 of them (8%) pointed out that they have recycling facility, 28 of them (56%) pointed out that they have dust absorption system.

The enterprises pointed out that in the environment caring technologies, they have are only chimney filters, dust and carbon measuring devices, and dust absorbing machines.

When the availability of environmental caring technologies is questioned, 17 of the enterprises (34%) pointed out that they have environmental caring technologies.

RESEARCH AND DEVELOPMENT TECHNOLOGIES OF THE ENTERPRISES

59% of the enterprises pointed out that they have researching and development studies. The studies that the enterprises made are given in the Table 6.

Additionally, 46% of the enterprises (23 in number) pointed out that before their enterprises were found, they had prepared a document called environmental ımpact assessment (EIA). 48% of the enterprises (24 in number) pointed out that they have feasibility reports. 22% of the enterprises pointed out that they have ISO 14000 environment directory document and the 9 enterprises that have this document pointed out that they use this label on their products.

DISCUSSION, CONCLUSIONS AND SUGGESTIONS

Industry is the main prove of one country's development process. Because industry, with its wide background sectors, plays an important role in the development process of agriculture and and other services and helps the refreshing of the economy and inreases the rate of employment and urban population and directs the area usage. Besides, it indicates the future of industry, raw materials that is provided by natural sources and environment quality. This complicates relationship between the envirironment, industry and economy which forms the future of today's world. For this reason, very different approaches are developed which saves the economical balance and decreases the environmental pressure to convert this relationship to a compatible union. Clean production process is one of the most important approaches to this.

The term clean production came to agenda by Turkish Scientific and Technologic Researches Foundation and Turkish Technology Development Foundation with the "Science-Technology-Industry Discussions Platform, Clean Production- Clean Product, Enviromentally Friendly Technologies Studying Group Industry Report"

However there was no efficient study between the years 1999 and 2008. But within the scope of "Turkey's Development of Adaptation Capacity to Climate Change United Nations Corporation Programme" that took effect in 2008, with the United Nations Industry Progress (UNIDO)'s directory, nation-wide Eco-fertility (Clean Production) Programme was held by the Turkish Technology Development Corporation. Within this general frame, Ministry of Environment and Forestry, planned the background of the spreading of clean production in Turkey. Within this scope, in 2010, for the spreading of practices of clean production in "Turkey", finishing the frame contidions and the pointing of the needs Research and Development, a study towards clean production was started. Today, the other foundations that make studies fort the clean production are Ministry of Energy and Natural Sources, Ministry of Public Works and Settlement, Ministry of Industry and Working, Ministry of Transportation, Ministry of National Education, Middle East Technical University, Bosphorus University, Regional Environment Center (Anonymous, 2010, 2011d).

There are important arrangements about the clean production within the scope of environmental legislation in Turkey. These are "law of environment, water pollution control regulations,control regulation for the pollution that the dangerous substances causes pollution for water and its surrounding, regulation for the waste directory's general essentials, regulation for the control of solid wastes, regulation for the control of dangerous wastes, regulation for the control of oil waste, regulation for control of the herbal oil wastes, regulation for the control of battery and storage battery wastes, regulation for the control of packing wastes, regulation for the dangerous chemicals, regulation for some dangerous substance's, good's production, service to market, and about the limitations of usage, regulation for the inventory and control of chemicals, regulation for the limitation of usage of some dangerous substances, regulation for the control of expired productions, regulation for the decreasing of the usage of the substances that make the ozon layer thin, regulation for the decreasing of the usage of sulphur in some fuel, regulation for the control of the air pollution caused by ındustry and regulation for the environmental supervision. additionally, there are regulations about the energy efficiency and about the renewal of the energy resources. these are "the law of energy efficiency and regulation for the usage of the energy resources and the usage of energy, regulation for the increasing the efficieny of energy, the usage of the renewable energy for the production of electricity, regulations household productions tagging energy and the regulation for energy performance in buildings" (Anonymous, 2010). In addition to this, industry's raising awareness about the clean production and the encouragement for the clean production is the main policy of the 8th Five-year and 9th Seven-year development and European Union Compatibility Process (Demirer, 2009).

In Turkey, Environmental Impact Assessment (EIA) is very important for the blocking of industry's effects to environment and clean production process. It has been in progress from the date 7 February 1993 (Sencar, 2007). EIA is responsible for saving environmental values against ecenomical policies, determining all the possible negative environmental results of a planned facility beforehand and taking all the necessary precations without blocking the economic and social progress (Uslu, 1996). International Organization for Standardization (ISO) 14000 Environment Directory Systems are another important means fort he decreasing of industry's effect to environment. ISO 14000 is a series of standarts and a directory model built on risk analysis bacground which determines the environmental factors and takes these factors into control to decrease the harm that is given to nature to the least from the production's raw material to the service to the customers (Anonymous, 2011e; Karacan, 2002). In Turkey, the usage of ISO 14000 is bound to the wishes of the enterprises and not compulsory.But it is inevitable for the multi-national enterprises that want to trade internationally to adapt the environment directory standarts and ISO 14000. Because ISO 14000 is required for the enterprises both to increase their competitive capacities and ensure a specific standartization and quality for the customers and produce in accordance with the environmental awereness (Tavmergen, 2011).

In Turkey, environmental pressure on the legal and directory structure is increasing rapidly although the clean production term has been known since 1999. This situation is seen in the industry focused water and energy consumption, waste amount and carbon emission. For example in Turkey, when the industry sector's water usage is analysed, it is seen that it has the rate 11% with the 5 billion m^3 water usage. General Directorate of State Hydraulic Works (DSİ), with the help of its studies, indicates that, in the incoming 20 years, the need for water in industry will be 5 times more (Anonymous, 2011f). In order to determine the energy consumption in industry and service sector, the suvey made by Turkish Statistical Institute (TUİK) shows that the energy consumption is the most in the production sector (72.8%). Additioanlly, it is stressed that energy gives harm to bature from the production process to the consumption process. The most widespread pollution type is the fossil originated air pollution such as petrol, natural gas, and coal (Anonymous, 2011g). In the production industry, 36% of the decharged wasted water is recyled while 64% of it sent to the receiver area without recyling. It is stated in the Tuik's study about the production industry statistics that 1.2 million tons of the solid waste originated from the industry is dangerous waste. In spite of this production amount of waste, there is only one depot that is suitable for dangerous wastes (Anonymous, 2010). When the greenhouse gas emission amount calculations are analysed

for Turkey, electricity production and industry sector contributed mostly to the increasing CO_2 emissions between the years 1990 and 2003. Production industry's greenhouse emissions resulted from its sub-sectors including both emissions resulting from energy usage and emissions resulting from industrial processes (Anonymous, 2011g).

The working area, with its being the capital of Turkey and its closeness to industrial cities, with its tranportation possibilities and with its being a province and the industrial support it takes, is an industrially developing city. The province's being on the Melen River Basin which ensure water to the biggest city of Turkey (Istanbul), the province's covered with rich forest in terms of 50% biodiversity, its being on the most important active fault (Northern Anotolian Fault Line) and despite the 1999 earthquake, its being industrialized rapidly is really a confusing situation.

In the scope of study, 50 enterprises which belong to "forestry products, furniture, machinery, metal, plastics, gun, hunting gun, building, textile, electricity, otomotive" sectors were analysed and these sectors constitues 30% of the employment of industry in Düzce. The employment rate is very crucial in both putting forward the sector's contribution to economy and work potential and determining the dimensions of the environmental interaction. The rising of employment increases the development of the enterprises; unconscious rising is increasing the environmnetal pressure. The enterprises's importance in terms of employment in the scope of study is very important in terms of forming a general impression about the industrialization in the city.

The area that the enterprises cover is very important in terms of their being on the İstanbul river basin and environmental pressure. In this respect, there are 1.021.014 m^2 open area and 352.673 m^2 close area. Only 33.3% of the enterprises' rate of capacit usage is between 80 and 89%. Although this situation is a problem in terms of economy, it is very important forteh decreasing the environmental pressure.

When the water usage of the enterprises that are included in the study is analysed, it is pointed out that, network water, legal or illegal water wells are being used. It is seen that no technology is found for the water save in the frame of clean production. Additionally, no information is reached for the evoluation about the water used in production and wasted water. It is a factor that blocks the enterprises from water saving.

When the energy sources of the enterprises that was included in the study are analsed, it was pointed out that electricity, wood, natural gas and coal were used for the energy source. Because of the high prices of electricity and natural gas, the common use of coal contributed seriously to the emission of carbon in the city. When the enterprises' techniques and technologies for the energy save are analysed, nothing was found for energy saving. But a research made by Baath (2009) indicated that the wind energy potetial in the city is enough for all kind of energy that is to be ensured for the city. But no information or move have been taken for this situation. This situation is same for the jeothermal energy resources in the city.

No solid waste and water waste storage areas, techniques or technologies to decrease the waste amount have been found in the enterprises that was included into the study. The wastes are destructed in the area of organized ındustrial area. Additioanally, no information was found in the enterprises about the amount of raw materails, the production, and the wastes amount. This situation is another suject which prevent the consciousness in the enterprises to use the raw materials efficiently and decreasig the wastes.

The enterprises which koined the study have no other practice than using chimney filter in order to diminish the air pollution and decrease the emission of carbon. Even some of the enterprises do not know about the industry's effect on the carbon emission or global warming or do not accept these. However, industry is one of the sources that causes increase in carbon emission which is considered as the basic causes of the global warming. In the developed countries, putting forward the carbon footptints is aimed by controlling every enterprise's carbon emision.

The establishment dates of the enterprises participating in the study cahanges between 1967 and 2010. This situation is quite important to put the change concerning clean production process forward in temporal dimension. When the re-de studies of the enterprises were examined, it was seen that increasing ürün capacity and quality, improving the conditions of the enterprise, marketing and employment issues were primary. Energy saving and new technology searches were also among these priorities. The issues that are important concerning clean production process such as rcycling of the wastes, reducing the environmental pressures, reducing the energy resources, reducing water usage, reducing toxic wastes could be a topic of re-de studies of just 5 of the enterprises. This situation is the indicator of the fact that the economic expectations and concerns are beyond the environment or ecology in the enterprises participating the study.

46% of the enterprises in the study had EIA report. The enterprises nor having EIA were the enterprises that were esteblished between 1960 and 1993 and had entered to the sample. But these enterprises have grow in terms of production and employment and their environmental pressures have increased today. For this reason, the fact that the environmental effects of the enterprises that had been established before EIA report were a lawful excuse are not evaluated carries the quality of a deficiency of EIA report. ISO 14000 document is quite important in reducing the environmental effects of the enterprises. But only 9 of the enterprises have that document. This situation is very important in putting forward the insufficiency

of environmental sensibility and the attitude concerning clean production.

In the scope of the study, the enterprises were asked whether they knew the process of clean production or not and were asked to tell the process, but no information was gained. However clean production has been known in Turkey by various institutions and organisations since 1999; studies for clean production were carried out especially in the scope of “United Nations Common Program of Developing the capacity of Adapting to Climatic Changes of Turkey” and “The Project of Determining Re-De need and Extending Clean (suatinable) Production practices in Turkey” which was defined by the ministry of environment and forestry. This situation is very important in the point that the enterprises in the study follow the the updated developments in the industry, and in the evaluation of the sensibilities of the related associations about this topic.

For the clean production to be practiced in the industry in Turkey, an association is needed to carry out this exacution. Because, this execution should be a practice that will comprise all the small, middle and big enterprises in the country, and will have to be executed with such processes as planning, projecting, practicing, observing, examining, etc. For this reason, this Corporation from the center to the rural should have hierarchy and discipline. The Corporation should have a policy which is suitable with the country’s realities and development policies, and which unites with the industry interaction. Additionally, the Corporation should be authorized with legal regulations in order it to identify its responsibilities and practice them. The enterprises should have a financial mechanism to make them have clean production techniques and technologies. In order this studies to be seccesful, other industrial corporations’ companion is important.

Besides, in all enterprises, in the scope of clean production criterias there should be update and electronic data banks and all sectors should be educated aboutn the clean production process and clean production techniques and technologies.

The criterias that can be used in the clean production process and the formation of data banks should have the capability to evaluate the clean production process. These should be about “water use, energy use, wasted water, solid waste, and dangerous waste and air emissions”. Additionally, the criterias should be supported with the models that can put forward the differencies between the clean production techniques and technologies by means of ecolojical and economical profit odds.

In conlusion, enterprises can decrease the environmental pressure by using clean production techniques and technologies during the production process and at the same time they can increase the production performance and economical contribution. For this, an update data bank and clean production measuremnt will be enough for the enterprises. But in order the celan production method achieve succes in the industry, a mechanism should be formated ranging from the enterprise measurement to the natinal wide measurement.This mechanism’s feasibility needs a corporation that can run this work nationwide, policy, law, finance, interdisciliner and participating working.

Since the study is done in Düzce industry, the result have limitations to be widened to the other industry sectors in other regions of Turkey. But, despite the sensitive aspects that Düzce have, its rapid industrialization and the enterprises’ indifference to clean production approach can be shown as an example to environmental affairs being put forward in the industrialization in Turkey.

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