



# Cleaner production in Iran: necessities and priorities

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Received 28 June 2003; accepted 21 January 2004

## Abstract

The purpose of this paper is to underscore the necessity for implementing a cleaner production strategy in order to achieve sustainable development for Iran's industries. While reviewing the reasons for the need to adopt the strategy of cleaner production for the industries of developing countries, the special features of Iranian society which makes the use of cleaner production necessary were also studied.

It is important to develop a model or method for developing a priority for industrialists to work with in initiating cleaner production activities. This was done in Iran using the "multiple criteria decision making method" (MCDM). This included, among other things, interviewing the relevant experts and directors, for each industrial group. A relative ranking score was developed and based upon it, the priority of each group was determined. Within this process, the industrial groups of "textiles, apparel and leather industries" were given the highest priority and the industrial group of "manufacture of wood and wood products, including furniture" were given the lowest priority.

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*Keywords:* Iran; Priorities of cleaner production; Necessities of cleaner production; Multiple criteria decision making

## 1. Introduction

The adoption of cleaner production practices helps conserve raw materials and energy, can help to ensure the reduction or elimination of toxic materials, and can reduce the quantity and toxicity of emissions and wastes during the production process. The UNEP defined the objectives of its cleaner production programs as designed to promote worldwide awareness of preventive environmental protection strategies and to encourage their adoption by industries, with the help from the government.

The cleaner production approaches that can be applied in production processes include recycling, process modification, plant operation improvements, and input substitution. Cleaner products, on the other hand, can be obtained by ways such as redesigning the products, modifying the production processes, and changing the chemicals used to less hazardous ones [1].

In the Islamic Republic of Iran, there are still a lot of subject areas wherein applied research is yet to be undertaken to identify effective measures for environmental protection, especially among industries. Point and non-point sources of pollution from cities and industries lead to pollutants being dumped into the rivers, seas and groundwater everyday. Most of these pollutants have not been identified, quantitatively or qualitatively; nor are they properly treated before disposal [2].

This article underscores the urgency of the need for the development and implementation of a cleaner production strategy within Iran's industries. Such a process could help Iran solve many of its current environmental problems.

## 2. Country profile and environmental protection policies

### 2.1. Geography, national economy, and industries

The Islamic Republic of Iran, located in the center of the middle east, covers an area of 1,648,195 km<sup>2</sup>; it is

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strategically located between Armenia, Azerbaijan, Turkmenistan, Afghanistan, Pakistan, Turkey, Iraq, the Persian Gulf, and the Sea of Oman, which are bordered by Kuwait, Bahrain, Dubai, Oman and Saudi Arabia. The Caspian Sea is situated at the north of the country, thereby making Iran a neighbor of Russia and Kazakhstan.

After the Islamic revolution in 1979, the new government was established. The population of Iran is over 60 million. The country is supervised by a religious leader elected by a council of experts that comprises about 80 religious leaders who are elected by the people. The president, elected by the people, serves for a term of 4 years. There are 22 ministers working under the president. The parliament of Iran, with over 290 members elected by the people, is responsible for the country's legislation. The religious leader, on the other hand, appoints the head of the Justice Department.

Education has become popular after the revolution, especially in the last decade. Almost one-third of the population (around 20 million) is studying in schools; over 1.6 million are university students, and about 65% of them are women: this imbalance has concerned the country's policy makers. About 35% of the population is employed by either the government or the private sector, and the unemployment rate is around 13%.

A large portion of Iran's economy is led by the government or affiliated companies or through public divisions under the supervision of a religious leader. The share of the private sector is between 30% and 40%.

Major industries such as oils, petrochemicals, and steel are very active and have substantial exports. In addition, many food and agricultural products are produced and exported. The share of industries in Iran's gross domestic products (GDP) is around 20%, which is lower than in most industrialized countries. The share of agriculture is around 25%. The share of the oil sector is 16 % (average of the past 20 years) and the remaining portion is from the service sector. (But about 85% of the export income and 54% of the public budget is provided by oil exports.)

Pollution from all industries creates various kinds of environmental problems in Iran. About 10–20% of the industries are located inside or in the vicinity of the capital city, Tehran, with a population of about 10 million.

There are over 120,000 people employed by the industries in Tehran. The number of industrial units that employ more than 1000 people is about 20–25, with most of the rest employing from 10 to 100 workers. Most of these industries are located in highly developed districts that also have a very high population density.

## 2.2. The environmental management profile

The Department of Environment (DOE) has established standards and regulations to provide guidance on the discharge of effluents to the environment. Although much has been done in the country to implement these standards and regulations, much more must be undertaken.

One can divide the industries into the following three categories:

- Old industries located inside cities or very close to residential and/or commercial areas. This is considered an undesirable situation. In fact, the government has plans to re-locate these old industries to places outside the cities, but has to postpone these plans due to a lack of financial resources. These industries are causing many human health hazards.
- New industries located outside the cities in residential and commercial areas. These industries pose fewer environmental problems, and the DOE achieves a higher degree of success among them in implementing its effluent standards and regulations. The main problem encountered is that some of the effluents are unknown to the DOE and it lacks both equipment and information to undertake proper analyses. It should be stated, however, that some researchers from universities are undertaking limited studies and analyses to assist specific industries to comply with the DOE's standards and regulations.
- Industries located in industrial complexes of the cities. As mentioned earlier, many of the effluents are unknown to the DOE, and also, different industries generate different types of effluents. Furthermore, the fact that many of these industries are located in the cities compounds the seriousness of the problems. As such, more effort is necessary to be undertaken to identify these "new" effluents, which may pose serious threats to the city dwellers living in the vicinity of these industries.

In Iran, environmental laws and regulations were first enacted in 1928. Furthermore, article 50 of the country's Constitution (1979) states that, in the Islamic Republic of Iran, the protection of environment is a public obligation to ensure good and progressive life for both present and future generations. Therefore, human activities that create pollution which cannot be treated are forbidden.

## 3. Examining the need for implementing cleaner production practices in Iran's industries

Before dealing with the particular issue related to Iran, it is necessary to give an introduction on the need

171 for implementing cleaner production practices for  
172 industries in developing countries.

### 173 3.1. The necessity for implementing cleaner production 174 practices in industries of developing countries

175 In development plans, there are two major elements:  
176 industrial development and sustainability. In order to  
177 ensure sustainable development, industrial development  
178 should be founded on the environmental sustainability  
179 concept: sustainable development is development that  
180 meets the needs of the present without compromising  
181 the ability of future generations to meet their own  
182 needs [3].

183 In fact, at the national level, not only actual econ-  
184 omic growth but also the process of such growth is of  
185 significance. Experience has shown that through pro-  
186 tection of environmental resources, economic develop-  
187 ment can be accelerated. However, poverty reduction  
188 programs often falter when development initiatives are  
189 not conceived and implemented in the framework of  
190 sustainability [4].

191 This issue is of greater importance for the developing  
192 countries because although the industrialized countries,  
193 with only 16% of the world's population, consume 75%  
194 of the total global energy and natural resources and the  
195 incorrect patterns of production and consumption in  
196 these countries are one of the main reasons for  
197 environmental problems at the global level, poverty  
198 and unfair income distribution in the developing coun-  
199 tries has a severe impact on their environment and cau-  
200 ses extensive destruction of their natural resources [5].

201 Moreover, the population density in the developing  
202 countries aggravates the severe impacts of poverty.  
203 Although industrialization is considered a way to  
204 escape from problems related to poverty and under-  
205 development, the lack of necessary financial resources  
206 for undertaking environmental measures, low levels of  
207 know-how and industrial standards, lack of infor-  
208 mation systems, improper and inadequate environmen-  
209 tal regulations and lack of public awareness on the  
210 importance of solving environmental problems result in  
211 continued use of inappropriate production processes  
212 which have low efficiencies in the consumption of raw  
213 materials and energy and which cause extensive  
214 environmental/human health problems that must be  
215 addressed. Of course, the government is trying to  
216 change this situation through laws and regulations, but  
217 without the proper infrastructure, these rules are lar-  
218 gely ineffective.

219 In addition, a major portion of the energy and raw  
220 materials for the industrialized countries are provided  
221 from resources belonging to the developing countries.  
222 Ignoring environmental problems such as destruction  
223 of natural resources, trade problems and inadequate  
224 technology transfer will be political problems as well.

225 Currently, at the global level, evaluations of the mea-  
226 sures of environmental sustainable development that  
227 are applied in a country or company are being used to  
228 evaluate the stage of its development. A country may  
229 be considered to be developed when it has appropriate  
230 environmental protection policies and programs in  
231 place, and since under-development of such protection  
232 measures within developing countries may lead to a  
233 negative political reputation, failure of some companies  
234 within developing countries to meet adequate environ-  
235 mental performance standards compared with compa-  
236 nies in developed nations may lead to the pretext for  
237 excluding such companies from some independent  
238 countries from the global market arena [6].

239 In order to avoid or solve these problems, various  
240 strategies and standards have been adopted. This  
241 author is of the opinion that in order for Iran to avoid  
242 exclusion from the global markets, it must adopt clea-  
243 ner production practices to make environmentally and  
244 economically sound improvements as quickly and effec-  
245 tively as possible. Cleaner production concepts and  
246 approaches have been documented to be effective and  
247 are already being implemented in some companies in  
248 many developing countries, such as China and India  
249 [7]. This must also be done now within Iran.

### 250 3.2. Examining the specific issues related to Iran

251 In addition to the necessity of promoting and imple-  
252 menting cleaner production practices in industry,  
253 especially in the developing countries, due to several  
254 general reasons including those listed below, there is a  
255 further need for Iran to adopt such strategies.

#### 256 3.2.1. Lack of competitiveness

257 Due to various economic, cultural and technological  
258 reasons, in recent years, Iran's industries have encoun-  
259 tered the problem of lack of competitiveness with simi-  
260 lar foreign producers. This is due, in part, to problems  
261 such as a high domestic inflation rate compared with  
262 low inflation rates and stable foreign currencies. Also,  
263 technical and scientific backwardness, lack of job pro-  
264 motion and productivity, inadequate economic struc-  
265 tures and deficient market mechanisms as well as other  
266 similar problems have undermined Iran's domestic  
267 industries. A further factor contributing to Iranian  
268 industrial inefficiency is the high rate of waste of mate-  
269 rials and energy, which has led to an increase in pro-  
270 duct prices.

271 The concepts, approaches and tools of cleaner pro-  
272 duction practices could help them to become more  
273 efficient and profitable, will lead to conservation of  
274 basic materials and provide dramatic opportunities for  
275 improvement at many levels, including economic,  
276 environmental and human health dimensions.

### 3.2.2. Technical backwardness

As a result of poor economic and political relations with the outside world, Iran's industry has endured severe technological backwardness in the past two decades. Today, this industrial structure must be updated and polluting emissions must be dramatically reduced. Considering the concepts and approaches of cleaner production practices, it is clear that it would be appropriate to apply such simple solutions for Iran's industries rather than those strategies that are based on advanced and very expensive end-of-pipe pollution control technologies [8].

### 3.2.3. High energy consumption

Iran has one of the highest levels of energy intensity (i.e. the energy cost for producing each gross domestic production unit) in the world. The continuation of such conditions (there are many reasons for it, e.g. technical, cultural, economic, etc.) severely threatens the future of Iranian society with regard to the consumption of resources belonging to future generations. Energy consumption per capita in Iran has increased 5 times in 35 years and gasoline consumption is increasing at an annual rate of 8–10%. If this trend continues in the next two decades, Iran's oil consumption will be more than its current production.

Therefore, once again, there is need for emphasis on promoting and developing the strategies and concepts of cleaner production. It is obvious that this topic should be dealt with in the industrial, governmental, academic, NGO, and consumer sectors of the country.

### 3.2.4. Increased role of SMEs in Iran

Major industrial activities in Iran take place in small- and medium-sized enterprises and it is obvious that such units, as a result of poor financial, technical and human resources, are unable to benefit from complex technologies for solving environmental problems. The use of simple and economically effective solutions of cleaner production will help such industries from needing to implement solutions that require high costs, long time periods, high technologies and strong scientific backgrounds. Perhaps that is why cleaner production practices have succeeded well in the South Asian countries, in particular in India and China, and why they should also be utilized in Iran's industrial sectors.

### 3.2.5. Critical conditions of the environment in some regions

In recent years, Iran has followed the same approach as that of other developing countries; i.e. we have placed economic development above environmental considerations.

In this way, growth of industries, roads, towns, vehicles, etc., has and will continue to result in irrevocable

consequences for the country, and some regions such as large cities or forests are being devastated by environmental pollution that is already nearly irreversible in some locations. These problems can be solved by the cleaner production approach [9].

## 4. Using a method to prioritize industries for implementing cleaner production in Iran

It is clear that practicing cleaner production within all industries of Iran at the same time would be impossible, since without successful examples within Iran, industrialists will not be interested to use that approach themselves [10], and to plan and implement cleaner production requires case studies for each industrial sector, which requires experts, of whom unfortunately, there are only too few available, and they are not familiar with the cleaner production concepts and approaches.

In addition, since the government plays a significant role in the country's economy, it is important for the government to invest on certain industries based on priority so that other industries will follow the cleaner production strategy after they have observed and learned from the successes of their colleagues in other sectors.

### 4.1. Classifying the industries

In order to prioritize the cleaner production efforts, Iranian manufacturing industries have been classified based on the international standard industrial classification (ISIC) standards. The classification is as follows:

- Manufacture of food, beverages and tobacco,
- Textile, apparel and leather industries,
- Manufacture of wood and wood products, including furniture,
- Manufacture of paper and paper products, printing and publishing,
- Manufacture of chemicals and chemical, petroleum, coal, rubber and plastic products,
- Manufacture of non-metallic mineral products, except products of petroleum and coal,
- Basic metal industries,
- Manufacture of fabricated metal products, machinery and equipment,
- Other manufacturing industries.

It is clear that it is impossible to examine the "other manufacturing industries" group out of the nine mentioned above, and thus priority should be developed based on the first eight groups.

#### 4.2. Selecting and weighing the indices

Since it is necessary to have a number of indices before prioritizing industries, a brainstorming meeting was held with four of the university professors familiar with the concepts and approaches of cleaner production. They suggested many indices and later some were selected. At that stage, efforts were made firstly, to limit the number of indices, secondly, to draw people's attention to the specific situation of Iran, thirdly, to include all views which could be used to encourage an industry to move towards cleaner production and fourthly, to ensure that the different elements of the indices are independent of each other, otherwise later stages of the model would face difficulty.

Ultimately the following six indices were selected:

1. The number of industrial units in the related industrial group;
2. The amount of pollution produced due to industrial activities;
3. The environmental longevity of the pollutants (length of time for the pollutants to decompose in nature);
4. The economic value of resources and materials of each industrial group;
5. Costs for waste disposal through "end-of-pipe" (EOP) approaches;
6. Accessibility of the needed technology for cleaner production practices.

It is clear that prioritizing the industrial groups requires a scientific approach based on the above-mentioned indices. The research team decided to utilize the multi-criteria decision making method (MCDM). The method utilizes a number of weighting techniques, which are presented in [11,12]. One of the weighting methods appropriate for this case is the "simple average weighting" (SAW) method. This method was applied by enlisting the inputs from a number of experts and directors as listed below:

- Four experts and directors from the Management and Planning Organization (MPO) who work in the section related to the environment;
- Seven experts and directors from the DOE;
- Four professors in the field of environment;
- Twenty-one directors from industry (this included six people from the governmentally operated industrial sector, four people from the industrial sector that is under the supervision of the religious leaders, and 11 people from the private sector whose factories have gained remarkable success in the area of environmental protection).

The surveys were conducted through telephone calls. The interviewees were asked:

How would you weight each index for prioritization of different industrial sectors for implementing cleaner production?

The answers were averaged and normalized and the results are given in Table 1.

#### 4.3. Prioritization of industrial groups

It was then necessary to clarify the situation of each industrial group in each of the above indices. Since, generally, there is no adequate statistical system in Iran and it is difficult to have access to correct statistics, it was infeasible to determine quantitative information for the indices. Thus, at this stage, another technique was applied with the same interviewees. In other words, each of the persons was asked to answer questions with regard to his/her profession:

1. The four experts and directors of the MPO were asked to determine the situation of each industrial group for the first index based on the qualitative definitions "very much, much, average, little and very little".
2. The same was performed with seven experts and directors of the DOE for the second index.
3. The professors of the university did the same for the third and sixth indices.
4. The 21 industrial directors were asked to answer with respect to the fourth and fifth indices.

In this way, each group of experts answered questions that were most relevant to their individual expertise. The results are given in Table 2.

Table 1  
The weights of each index for priority of industries in cleaner production

Indices	Weight (%)
(1) The number of industrial units in the related industrial group	40
(2) The rate of pollution produced due to industrial activities	20
(3) The longevity of the pollutants produced in that sector (length of time to decompose)	15
(4) The economic value of resources and materials of the industrial group	10
(5) Costs for waste disposal through "end-of-pipe technologies" (EOP)	5
(6) Accessibility of the needed technology for cleaner production practices	10
Total	100

Table 2  
The importance of each industrial group in each index

Industrial groups	Number of indices					
	1	2	3	4	5	6
Manufacture of food, beverages and tobacco	Very much	Average	Very little	Average	Average	Very much
Textile, apparel and leather industries	Very much	Much	Little	Much	Little	Much
Manufacture of wood and wood products, including furniture	Very little	Very little	Very little	Average	Very little	Little
Manufacture of paper and paper products, printing and publishing	Little	Little	Little	Average	Very little	Very much
Manufacture of chemicals and chemical, petroleum, coal, rubber and plastic products	Average	Very much	Very much	Very much	Very much	Little
Manufacture of non-metallic mineral products, except products of petroleum and coal	Very much	Much	Average	Average	Much	Average
Basic metal industries	Little	Average	Average	Little	Average	Average
Manufacture of fabricated metal products, machinery and equipment	Very much	Little	Much	Very much	Average	Little

463 Since all indices are very positive with regard to the  
464 potential for practicing cleaner production, a quantita-  
465 tive figure was allocated for each qualitative phrase  
466 according to the following method:

Very little = 1/5  
Little = 1/3  
Average = 1  
Much = 3  
Very much = 5

467 By incorporating these into the decision matrix, for  
468 each alternative (i.e. the industrial groups), the results  
469 were multiplied by the weights of the indices and the  
470 results were calculated in order to determine the score.  
471 For example, for the first alternative (manufacture of  
472 food, beverages and tobacco), the score was calculated  
473

Table 3  
Priority of industrial groups for cleaner production and their scores

Priority	Groups	Scores
1	Textile, apparel and leather industries	3.27
2	Manufacture of non-metallic mineral products, except products of petroleum and coal	3.10
3	Manufacture of chemicals and chemical, petroleum, coal, rubber and plastic products	2.93
4	Manufacture of food, beverages and tobacco	2.88
5	Manufacture of fabricated metal products, machinery and equipment	2.30
6	Basic metal industries	0.67
7	Manufacture of paper and paper products, printing and publishing	0.39
8	Manufacture of wood and wood products, including furniture	0.36

as follows: 474

$$5(40\%) + 1(20\%) + 1/5(15\%) + 1(10\%) + 1(5\%) + 5(10\%) = 2.88$$

The same was done with each of the other industrial groups and the results are presented in Table 3. 475 476

As can be seen, the textile, apparel and leather industries have the highest potential for practicing cleaner production in Iran. The next group is the manufacture of non-metallic mineral products, except products of petroleum and coal. Finally, the manufacture of wood and wood products, including furniture, is in the lowest priority category. 477 478 479 480 481 482 483

## 5. Conclusions 484

The Islamic Republic of Iran is facing serious problems of pollution and devastation of the environment. During the past 30 years, the area of the forests decreased from 18 million hectares to 5 million hectares and in the former forest area, the number of floods has increased 9 times and the severity of disasters has increased 20 times. More than 40,000 tons of urban refuse are produced in the country daily and are buried without proper management. This is leading to more soil and groundwater pollution. Each vehicle in Iran consumes on average 4345 l of petrol per year, which is among the highest rates of petrol consumption in the world. Within Tehran, around 1.5 millions tons of pollutants are released annually into the air, thereby exposing a large percentage of the inhabitants to pollutants that are causing rapid increases in an array of respiratory diseases. (The numbers of deaths due to air pollution has reached more than 7000 people/year within Tehran.) With the increase in population and rate of pollution of drinking water, access to clean water is also 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504

505 becoming increasingly difficult and the need to make  
506 improvements is becoming more urgent every day.

507 All these conditions, together with the reasons men-  
508 tioned in Section 3 of this article underscore the  
509 urgency to adopt and implement:

510 A holistic and integrated cleaner production strat-  
511 egy for all of Iran.

512 Of course, providing such a comprehensive strategy  
513 requires accurate and long term planning, which has  
514 not been undertaken as yet. However, based on the  
515 experiences of the author regarding such planning in  
516 Iran, the following points could be referred to:

- 517 1. The first step is to create public awareness. This  
518 will drive the government authorities to pursue  
519 the issue. The mass media will also play a signifi-  
520 cant role, in which of course their information  
521 should be prepared by the academicians.
- 522 2. Considering the low level of cleaner production  
523 knowledge in Iran, educating the educators is a  
524 very important issue whereby the use of the pat-  
525 tern of Ref. [13] can be very useful.
- 526 3. The MPO and the DOE should have a basic role  
527 in providing the national plan even though each  
528 of the governmental departments should also par-  
529 ticipate in this field and should design specific  
530 plans in this regard. There are various plans  
531 available from different countries, for example,  
532 the plan of the Czech Republic [14] or the  
533 national strategy of Egypt [15].
- 534 4. The preliminary costs for initiating this plan will  
535 not be too high and should be financed by the  
536 government. However, when the plan is found to  
537 be economically sound for the companies, they  
538 will automatically pursue the plan. This was also  
539 true for ISO 9000 certification.
- 540 5. Since the industrial and environmental conditions  
541 in Iran vary widely, in every province, a council  
542 should be set up in order to identify the priorities  
543 for development and production of cleaner prod-  
544 ucts.
- 545 6. The role of international agencies is also highly  
546 significant. These agencies could work in these  
547 areas through transferring experiences of other  
548 countries in formulating national plans and clea-  
549 ner products and also for the purpose of transfer-  
550 ring the know-how needed by the industries.  
551 Their financial assistance could also work as a  
552 leverage for motivating domestic investments.
- 553 7. Universities should develop courses on special  
554 fields related to training in cleaner production,  
555 whereby the Thailand model could be used [16].
- 556 8. A national center for cleaner production/cleaner  
557 products should be established as soon as poss-

558 ible so that the Iranian industry will be improved  
559 both economically and environmentally.

- 560 9. Regarding the bureaucratic structure and slow  
561 pace of change within the government, it would  
562 be appropriate to encourage all NGOs to have  
563 active roles in all stages of planning, implemen-  
564 tation, awareness raising, training, etc.
- 565 10. It is clear that designing and implementing such  
566 planning is not possible through a single entity  
567 and all governmental, academic, and manufactur-  
568 ing sectors, the public and the media should have  
569 active participation at both national and provin-  
570 cial levels.

571 Fortunately, today there has been an increase in  
572 public awareness with regard to the issue of environ-  
573 ment and many NGOs are currently actively working  
574 for protection and cleaning of the environment, and  
575 helping to protect wildlife and biodiversity. They are  
576 also actively fighting against pollution from transpor-  
577 tation vehicles and industrial polluters although they  
578 have a long way to go before achieving the urgently  
579 needed improvements.

580 Considering these environmental/human health facts  
581 and that the government of Iran has a major role in  
582 the economy of the country and based on the Consti-  
583 tution, it is responsible for protecting the environment  
584 for present and future generations, 'it should lead the  
585 development and implementation of the, "holistic and  
586 integrated cleaner production strategy for all of Iran".

587 The government should support the development  
588 and implementation of cleaner production practices  
589 in the industries through financial motivation, legal obli-  
590 gations, pressure on the governmental organizations,  
591 training experts needed for helping industry to  
592 implement this strategy, rendering information and  
593 technological services, imposing environmental fines for  
594 non-compliance with environmental regulations and  
595 norms, cooperation with international organizations  
596 and through other means.

597 Fortunately, nowadays, cleaner production practices  
598 have been proven to be economically and environmen-  
599 tally beneficial in countries throughout the world,  
600 including some limited examples from Iran and sur-  
601 rounding countries also. Experience has shown that  
602 industries would be able to save substantial amounts of  
603 money, natural and human resources if they apply clea-  
604 ner production since:

- 605 – It would lead to better processes and products;
- 606 – It would save energy and materials;
- 607 – It would improve their competitiveness due to  
608 increased usage of modern techniques and tech-  
609 nologies;
- 610 – It would reduce violations of environmental laws  
611 and the need to pay fines for that reason;
- 612

- 613 – It would improve the safety and health of the  
614 staff;  
615 – It would raise confidence and productivity among  
616 the staff;  
617 – It would help the company to improve its image  
618 within the community, among customers and  
619 among other companies;  
620 – It would reduce the excessive costs of end-of-pipe  
621 pollution control methods.  
622

623 In this way, it does not seem that capital constraints  
624 should hinder the activity of practicing cleaner pro-  
625 duction in Iran.

626 This research was done to draw the attention of  
627 governmental bodies as well as the private sectors  
628 towards the potential benefits to Iranian industry and  
629 society for them to implement cleaner production. In  
630 order to make rapid progress in this direction, the  
631 following research is urgently needed:

- 632 – How to involve the government in promoting  
633 cleaner production and to mobilize public aware-  
634 ness on the urgency to make improvements so as  
635 to help ensure governmental, industrial and aca-  
636 demic partnerships in bringing about the urgently  
637 needed changes?  
638 – How to develop strategies and priorities for the  
639 non-industrial sectors of the country to also  
640 implement cleaner production concepts and  
641 approaches?  
642 – How to develop and utilize cleaner production  
643 training materials to train governmental, indus-  
644 trial and academic personnel in the concepts, tools  
645 and approaches of cleaner production?  
646 – How to effectively deploy cleaner technologies and  
647 optimal management practices within each of the  
648 industries?  
649  
650

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