

**Research Article**

## **Reduction of greenhouse gas in National Iranian Oil Products Distribution Company by Clean Development Mechanism (CDM)**

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### **ABSTRACT**

This study is conducted to implement CDM project for National Iranian Oil Products Distribution Company in Tabriz. To do this, at first national company of oil products distribution of Tabriz was investigated in terms of consumption and electric energy and fossil fuels. The, quantitative and qualitative evaluation of consumption energy was performed to estimate saving potentials and solutions of energy consumption output in production, machineries and optimization process and consumption reduction in this company. Technical, economic and environmental evaluation of energy renewable projects and efficiency of distribution national industry is done via proForm software. The amount of carbon, profit or tax rate, capital return and financial analyses of clean development mechanism in national company of Iran products distribution are provided as graphic and final analysis was performed. The results show that carbon price policy should be 22dollar per Ton; otherwise CDM project is not economical in Iran.

**Keywords:** Global Warming, Clean development, Economy, ProForm, National Iranian Oil Products Distribution Company

### **INTRODUCTION**

The increase of greenhouse gas and global warming have important influence on the world environment as weather models predict that the temperature of the world is increased about 1.4 to 5.8 °C in 2100 (Bidhendi, 2007). This climate change is the greatest change in the past 1000 years. UN environment plan and global Meteorology organization held an Intergovernmental conference regarding climate change. After four years of study and evaluation of climate change of man-made greenhouse gas emission, climate change convention was signed in Rio de Janeiro in earth summit. Avoiding the

increase of earth temperature via greenhouse gas emission control as controlling the dangerous intervention of human activities with weather system are the goals of this protocol. On December 1997, the members approved Kyoto protocol as determining definite amount of greenhouse gas emission for developed countries. According to article 3.1, the industrial countries are obliged to reduce their greenhouse gas emission to 5.2% below the emission level in 1990 during 2008-2012.

In 1996, Iran joined climate change convention and signed it in 1992 and jointed Kyoto protocol

in 2005. The mentioned protocol founded new approaches to reduce greenhouse gas as trading of publication and shared implementation as performed in developed countries. Also, CDM was performed to encourage the implementation of shared projects of reduction of emission among developed and developing countries.

Like other developing countries, according to the articles of climate change convention and Kyoto protocol, Iran has not commitment to greenhouse gas but it can participate in CDM projects.

If we absorb considerable share of this investment in CDM plans, this is possible that negative effects of execution of this protocol is reduced and in this case the result of effects is positive.

The goals of the present study are as follows:

- The identification of energy loss in the required industry
- Determining energy in National Iranian Oil Products Distribution Company and calculation of GHGs for productions and consumed fuel
- Determining energy saving potential in the studied industry
- Determining the potential of reduction of greenhouse gas emission in the studied industry
- Estimation of required investment to reduce GHG<sub>s</sub>

To estimate the emission and reduction of greenhouse gas and its costs, proForm software is used. ProForm software applied to evaluate the environmental and financial impacts of energy efficiency projects. ProForm enables the project designers, financial institutions and other people to conduct studies regarding the change of main hypotheses effective on key parameters of project. ProForm can be applied for energy recycle projects, renewable energy and energy efficiency projects. ProForm can analyze three efficiency technologies at the same time (CDM/JF Manual book 2007).

ProForm can be used for the following projects:

- Energy recycle
- Renewable energy
- Energy efficiency projects (saving in electricity and fossil fuel consumption)
- The projects of simultaneous production of electricity and heat and achieving Methane gas in trash landfill

This software can evaluate a project from two aspects of environmental and financial.

#### 1- Environmental evaluation

ProForm calculates Co<sub>2</sub> emission and other pollutants as combustion of fossil fuels and the reduction of their emission in CDM project.

#### 2-Financial evaluation

This software calculates the net present value (NPV), Internal Return rate (IRR), financial annual turnover and payment of a project from the view of investors before and after tax. National Iranian Oil

Products Distribution Company can distribute more than 220 million Liter of different oil products and this is done by using 12 thousands staffs in 37 regions and more than 220 areas and 21 thousands channels. Management and planning of this company includes transportation and storage of this product, construction of oil, liquid gas warehouses and service, maintenance utilities and keeping the relevant utilities, financial activities. The present study selects National Iranian Oil

Products Distribution Company of Tabriz as case study. Azarbayijan Sharghi has 12 areas including central areas, Sarab, Jolfa, Miane, Maraghe, Bostan Abad, Marand, Ahar, Shabestar, Hashtrud, Malekan and Benab.

The warehouse of the region has 18 reservoirs with mobile ceiling and 15 reservoirs with fixed ceiling and 2 reservoirs with sphere ceiling. 8 reservoirs are dedicated to petroleum (with mobile ceiling), 9 reservoirs to gasoline (1 reservoir with mobile ceiling, 8 reservoirs with fixed ceiling), 6 reservoirs to white oil (1 reservoir with fixed ceiling and 5 reservoirs with mobile ceiling), 2 reservoirs to Mazut (with fixed

ceiling), 2 reservoirs to A.T.K (with mobile ceiling), three reservoirs to molten tar (with fixed ceiling), two reservoirs to pollution (1 reservoir with mobile ceiling and 1 reservoir with fixed ceiling), two reservoirs of liquid gas (2 reservoirs with sphere ceiling) and a reservoir with mobile ceiling dedicated to solvent. This warehouse includes 72 loading platforms and some of them are used. The region has 5 corporate stations, 76 specific stations, 22 sale platforms and 4 regions under construction (according to the statistics from National Iranian Oil Products Distribution Company).

#### Method

ProForm is a wide sheet software being applied to facilitate the evaluation of the environmental and financial effects of energy renewable projects and its efficiency. Based on the required data, ProForm calculates important financial indices and CO<sub>2</sub> emission and other environmental pollutants based on project can be avoided. This software is applied easily and is scientific and the results are valid (. CDM/JF Manual book 2007).

A general application of ProForm is preparation of the recommendation of CDM projects as the designers should present the plan to investors or present it to national organizations of climate change. ProForm enables the project designers, financial institutions and other people to conduct some studies regarding the change of effective hypotheses on key parameters.

To define the effectiveness of using CDM, ProForm software is used to calculate economic costs and estimation of greenhouse gases in 2013. The following information is used in software:

- 1- Project name
- 2- Project sponsor
- 3- Project location
- 4- Project type
- 5- Project technology
- 6- Project operation age
- 7- Energy productivity technology

- 8- General financial information of project
- 9- Financial information of energy productivity after entering the above information under various scenarios changing the gas price or share of internal and external participation.

The following outputs are extracted from software.

- 1- The capital return period
- 2- Capital return period without coupon credit period
- 3- CO<sub>2</sub> reduction based on Ton in year
- 4- CO<sub>2</sub> reduction based on Ton in project age
- 5- Net present value and internal return rate before and after tax
- 6- Net present value and internal return rate without selling carbon before and after tax
- 7- Tax credit revenue before and after project

Scenario making of proForm software is supported based on domestic fuel price and international fuel price. The project fuel price increase rate is 10% and in investment structure, the share of net asset of total investment in the first year is 100% and received loans in the country and in abroad are for 4 years with interest rate 18% and 3%.

The features of ten scenarios in this study are as follows: In the first, fourth, sixth, eighth and tenth scenarios of the input of ProForm software data, the price of natural gas fuel based on Iran local price is 0.43\$ and in remaining scenarios, the price of natural gas fuel is according to foreign price as 11.3\$.

#### First scenario

In the first scenario of proForm software for data input, the price of natural gas fuel is based on local price of Iran as 0.43\$. For project funding, capital loan with interest rate 3% and short term loan for four years is received from commercial banks and no loan is received of financial institutions and Carbon share is 100% belonging to the foreign country participating in project and the price policy for each Ton of Carbon is 22\$, 7\$ and 3\$ based on Gj.

### Second scenario

It is based on funding the project based on first scenario.

The difference of second scenario with the first one in ProForm software of CDM in National Iranian Oil Products Distribution Company and in the second scenario, the world natural gas price is considered and this increase net present value of project with short capital return and this project is economical for National Iranian Oil Products Distribution Company and as the share of National Iranian Oil Products Distribution Company of carbon is zero, no considerable profit is achieved.

Third scenario For project funding, capital loan is obtained from local institutions with interest rate 18% and short-term payment for four years and no loan is received of commercial banks and Carbon share is 100% belonging to Iran and National Iranian Oil

Products Distribution Company project and the price policy for each Ton of Carbon is 22\$, 7\$ and 3\$ based on Gj.

Fourth scenario- For funding the project and share of carbon and price policy, a scenario similar to third scenario is performed.

Fifth scenario-For funding of project, capital loan is received by commercial banks with interest rate 3% and from local institutions with interest rate 18% and short term payment 4 years and the ratio of local to foreign loan is 50% to 50%. The share of carbon and price policy is based on third scenario.

Sixth scenario-For funding project, fifth scenario is used and carbon share and price policy are like third scenario.

Seventh scenario-For project funding, capital loan is obtained from local institutions with interest rate 18% and commercial banks with interest rate 3% and short-term payment for four years and Carbon share for to Iran and National Iranian Oil

Products Distribution Company is 50% and for foreign company in project 50% as equal and the

price policy for each Ton of Carbon is 22\$, 7\$ and 3\$ based on Gj.

Eighth scenario-For project funding, capital loan is obtained from local institutions with interest rate 18% and commercial banks with interest rate 3% and short-term payment for four years and Carbon share for to Iran and National Iranian Oil

Products Distribution Company is 50% and for foreign company in project 50% in CDM. The ratio of local to foreign loan is 25% and the price policy is 75% and for each Ton of Carbon is 22\$, 7\$ and 3\$ based on Gj.

Ninth scenario-For project funding, capital loan is obtained from local institutions with interest rate 18% and commercial banks with interest rate 3% and short-term payment for four years and Carbon share for to Iran and National Iranian Oil

Products Distribution Company is 50% and for foreign company in project 50% in CDM. The ratio of local to foreign loan is 75% to 25% and the price policy is 75% and for each Ton of Carbon is 22\$, 7\$ and 3\$ based on Gj.

Tenth scenario-For project funding, capital loan is obtained from local institutions with interest rate 18% and commercial banks with interest rate 3% and short-term payment for four years. The ratio of received loan of local institutions to commercial banks is 75 to 25 and Carbon share for to Iran and National Iranian Oil Products Distribution Company is 50% and for foreign company in project 50% in CDM. The price policy for each Ton of Carbon is 22\$, 7\$ and 3\$ based on Gj.

Financial support to eliminate carbon by selling carbon coupon credit with scenarios 22\$, 7\$ and 3\$ is investigated and the share of credit achieving of carbon for host country is investigated in various scenarios. The annual costs and monitoring are 15000 \$ per year and share of fund costs 0% and administrative affairs 5000\$ in year and income and annual costs are entered into Preform software. Discount rate is

12% as data and tax rate on final income is 10% and credit tax rate of carbon coupon sale is 10% and tax credit and depreciation is 5% and technology depreciation and high energy productivity is considered as 20 years. After entering all input data of Preform software, the investment cost is calculated for one unit 77000\$

and financial saving from the reduction of reservoirs and utilities maintenance for each unit as 1200\$.

The data of Preform software are presented in Table 1 and basic information in Table 2.

**Table 1-** The input information of Preform software in various scenarios

Carbon price in Dollar C US \$/Gj	Carbon price in Dollar B US \$/Gj	Carbon price in Dollar A US \$/Gj	The percent of carbon collection local to international ratio	Local to foreign loan ratio	Local loan interest rate	Foreign loan interest rate	Loan payment duration based on year	Fuel price US \$/Gj	Fuel type	Return by old applied tools Gj000	Return by new applied tools Goo	Scenario
3	7	22	0 -100	0 -100	0	%3	4	0.43	Natural gas	106	88	1
3	7	22	0 -100	0 -100	0	%3	4	1.13	Natural gas	106	88	2
3	7	22	100-0	100 - 0	%18	0	4	1.13	Natural gas	106	88	3
3	7	22	100-0	100 - 0	%18	0	4	0.43	Natural gas	106	88	4
3	7	22	100-0	50- 50	%18	%3	4	1.13	Natural gas	106	88	5
3	7	22	100-0	50-50	%18	%3	4	0.43	Natural gas	106	88	6
3	7	22	50-50	25 -75	%18	%3	4	1.13	Natural gas	106	88	7
3	7	22	50-50	25 -75	%18	%3	4	0.43	Natural gas	106	88	8
3	7	22	50-50	75 -25	%18	%3	4	1.13	Natural gas	106	88	9
3	7	22	50-50	75 -25	%18	%3	4	0.43	Natural gas	106	88	10

**Table 2-** The results of basic analysis information of project

Output analysis		Data input
National Iranian Oil Products Distribution Company		Project name
National Iranian Oil Products Distribution Company		Project sponsor
Azarbayjan Sharghi province		Project location
fossil fuel	Efficiency	Project type
Applied tools with high return		Project technology
20 years		Project operation age

## DISCUSSION AND RESULTS

CDM is full of doubts as it doesn't answer many elements. According to protocol rules and experiences in common activities, some elements can be raised, first CDM is direct result of common responsibility but it is different. This principle creates a problem of the collaboration between the developed or developing countries

to solve a global problem based on their different commitment in protocol. This reality should be considered that a part of CDM projects (CDM) is used to help the developing countries vulnerable to negative climate change effects.

Second, it is expected that CDM improves sustainable development in host countries and provides economical activities of climate change reduction for investors. One of the simplest ways

of these activities is effective technology transfer. Using Preform software is useful from environmental, management and economic issues and it is used for exact determination of effectiveness of activity in environment protection via reduction of greenhouse gas and CO<sub>2</sub> and exact determination of financial needs of project and project selection management based on reduction of gases and investment and applying suitable credit from international institutions for project implementation. Also, exact quota of carbon trading in specific industry between host and investor country is done. Based on the results, the best scenario for the country is the one in which global natural gas fuel is in dollar and capital return period shows the shortest time and net present value is positive and high. In this study, second and ninth scenarios in Preform analysis are the best scenarios in National Iranian Oil Products Distribution Company.

The worst scenario is the one with long capital return and negative net present value and carbon collection share for host country is zero and the investor country can collect the entire carbon share and the worst scenarios are sixth and fourth scenarios. In global trading markets, carbon can not be sold in host country.

The policy for each carbon ton is 22\$, otherwise CDM project is not economical in Iran. As global fuel price is not calculated, US considers 3 dollars for Iran and developing countries for each carbon ton. Kyoto protocol didn't respond to all these problems and it is better Iran don't participate in CDM.

The features of project inputs in Preform software

The general information is about the project features as project name, National Iranian Oil Products Distribution Company, the location Azarbayijan Sharghi and Tabriz town, project technology type and project sponsor. Preform software can analyze the projects including some technologies during efficiency projects analysis.

To add technology to analysis click "Add 2nd Technology".

Inputs of financial information of project in Preform software

In many developing countries, investment funding for new industrial projects needs local and foreign exchange. Local money sources are inconvertible and they are necessary for required local purchases and exchange as inconvertible to supply import and foreign purchase. Most of inconvertible money is mostly under the influence of inflation compared to convertible money. In addition, most foreign investors and bankers are not familiar with the value and changes of inconvertible money units and the financial predictions and data are analyzed based on major money.

We enter currency in dollar and exchange equality rate as 1 in Preform software and the inflation impact on investment costs namely those taking for many years is severe. To adapt financing plan with probable inflation, the estimation payments, annual, 6 month and sum of investment costs should be increased by estimating inflation index and inflation rate in Preform software input is 15% and fuel price for final consumer to local price is 0.43 in GJ per dollar. Or it is based on global price 1.13 GJ per dollar in Preform software. The fuel price increase rate is 10%. In investment structure, net asset share of total investment in the first year is 100% and the loans received of the country and abroad are 4 years with interest rate 18% and 3%. The sum of debt in percent during four years is investigated in some scenarios. The financial support to eliminate carbon by selling carbon coupon credits is investigated by the price of scenarios 22\$, 7\$ and 3\$ and the carbon credit achieving share for host country is investigated in various scenarios. Annual costs and monitoring of 15000\$ in year and the share of zero percent funds and administrative affair costs 5000\$ in year and annual costs and incomes entered Preform software. Discount rate is also

entered 12%. The tax on final income is 10% and credit tax rate of carbon coupon sale is 10% and tax credits and depreciation are 5% and technology depreciation and high energy productivity is 20 years. Energy productivity project should be based on financial consistency and economic evaluation. After entering all input data of Preform software, the investment cost is calculated for one unit 77000\$ and financial saving from the reduction of reservoirs and utilities maintenance for each unit as 1200\$.

**Outputs of Preform software**

After entering input data in Preform software, the results of analysis of Preform software are shown

as energy, financial and pollutant disposal. The first section is regarding the information of project and then the results of energy analysis are shown. For energy efficiency projects, Preform software calculates general energy kept by project as annual mean. Then, required capital, payment period, reduction of CO<sub>2</sub>, net present value, internal earnings rate of cash flow is calculated. Final section is about pollutant disposal of project.

The results of Preform software analysis regarding the software results by project inputs are shown Tables 4-9.

**Table 4-** The results of energy analysis of National Iranian Oil Products Distribution Company

Unit	Total project	Annual mean	
Gjoo	2160	108	Fuel consumption reduction

**Table 5-** Reduction of pollutants emission

Entire project	Annual mean	Pollutants (Ton)
120960	6048	Carbon dioxide
0	0	Sulfur oxide
76	4	Nitrogen oxide
0	0	Suspending particles
0	0	Methane gas
120960	6048	Total carbon dioxide

**Table 6-** The output data of investment based on ten scenarios

Co2 reduction in Ton in project age	CO2 reduction in ton in a year	Capital return without carbon return in year	Capital return based on 3% in year	Capital return based on 7% in year	Capital return based on 22% in year	Investment of applied tools with high return in dollar	Scenario
120960	6048	11.2	11.4	8.6	3.6	462	1
120960	6048	4.3	4.4	3.7	2.2	462	2
120960	6048	4.3	4.3	4.3	4.3	462	3
120960	6048	11.2	11.2	11.2	11.2	462	4
120960	6048	4.3	4.3	4.3	4.3	462	5
120960	6048	11.2	11.2	11.2	11.2	462	6
120960	6048	4.3	4.7	4.3	3.2	462	7
120960	6048	11.2	12.6	11.0	6.6	462	8

120960	6048	4.3	4.7	4.3	3.2	462	9
120960	6048	11.2	12.6	11.0	6.6	462	10

**Table 7-** Financial analysis of percentage rate of increasing carbon coupon price in dollar in Ton

Internal return rate percent after tax scenario 3	Internal return rate percent after tax scenario 7\$	Internal return rate percent after tax scenario 22\$	Internal return rate percent before tax scenario 3\$	Internal return rate percent before tax scenario 7\$	Internal return rate percent before tax scenario 22\$	NPV after tax scenario 3\$ (000)	NPV after tax scenario 7\$ (000)	NPV after tax scenario 22\$ (000)	NPV before tax scenario 3\$ (000)	NPV before tax scenario 7\$ (000)	NPV before tax scenario 22\$ (000)	Scenario
%10.47	%14.18	%29.21	%10.82	%14.69	%30.65	\$(68)	\$95	\$705	\$(56)	\$125	\$803	1
%28.66	%32.15	%46.74	%29.78	%33.53	%49.34	\$962	\$124.1	\$734.1	\$1.088	\$1.269	\$269.1	2
%28.92	%28.92	%28.92	%30.06	%30.06	%30.06	\$974	\$974	\$974	\$1.102	\$1.102	\$102.1	3
%10.75	%10.75	%10.75	%11.12	%11.12	%11.12	\$(55)	\$(55)	\$(55)	\$(42)	\$(42)	\$(42)	4
%28.92	%28.92	%28.92	%30.06	%30.06	%30.06	\$974	\$974	\$974	\$1.102	\$1.102	\$102.1	5
%10.75	%10.75	%10.75	%11.12	%11.12	%11.12	\$(55)	\$(55)	\$(55)	\$(42)	\$(42)	\$(42)	6
%27.40	%29.09	%35.83	%28.43	%30.23	%37.49	\$901	\$982	\$287.1	\$1.102	\$1.111	\$405.1	7
%9.10	%10.93	%18.1	%9.41	%11.30	%18.72	\$129	\$(47)	\$258	\$(123)	\$(123)	\$306	8
%27.40	%29.09	%35.83	%28.43	%30.23	%37.49	\$901	\$982	\$287.1	\$1.102	\$1.111	\$405.1	9
%9.10	%10.93	%18.01	%9.41	%11.30	%18.72	\$129	\$(42)	\$258	\$(123)	\$(33)	\$306	10

**Table 8-** Financial analysis of lack of carbon coupon sale

% IRR After tax	% IRR Before tax	NPV After tax US\$(000)	NPV Before tax US\$(000)	Scenario
%10.75	%11.12	\$(55)	\$(42)	1
%28.92	%30.06	\$974	\$102.1	2
%28.92	%30.06	\$974	\$102.1	3
%10.75	%11.12	\$(55)	\$(42)	4
%28.92	%30.06	\$974	\$102.1	5
%10.75	%11.12	\$(55)	\$(42)	6
%28.92	%30.06	\$974	\$102.1	7
%10.75	%11.12	\$(55)	\$(42)	8
%28.92	%30.06	\$974	\$102.1	9
%10.75	%11.12	\$(55)	\$(42)	10

**Table 9-** Tax credit income before and after carbon sale in dollar per ton

Net present value after tax 3 dollars US\$(000)	Net present value after tax 7 dollars US\$(000)	Net present value after tax 22 dollars US\$(000)	Net present value before tax 3 dollars US\$(000)	Net present value before tax 7 dollars US\$(000)	Net present value before tax 22 dollars US\$(000)	Scenarios
\$(12)	\$150	\$760	\$(14)	\$167	\$844	1
\$(12)	\$150	\$760	\$(14)	\$167	\$844	2
-	-	-	-	-	-	3
-	-	-	-	-	-	4

-	-	-	-	-	-	5
-	-	-	-	-	-	6
\$ (73)	\$ 8	\$ 313	\$ (82)	\$ 9	\$ 348	7
\$ (73)	\$ 8	\$ 313	\$ (82)	\$ 9	\$ 348	8
\$ (73)	\$ 8	\$ 313	\$ (82)	\$ 9	\$ 348	9
\$ (73)	\$ 8	\$ 313	\$ (82)	\$ 9	\$ 348	10

Based on the results among various scenarios, Preform software is used for CDM. The best scenario for the company is the one in which natural gas fuel price is based on global prices and capital return period shows that shortest time and it has high and positive NPV and in this study, second and ninth scenarios were the best in oil products distribution industry in Tabriz by Preform software.

The results showed that price policy should be based on each ton carbon as 22\$, otherwise CDM project is not economical in Iran. As fuel price is not calculated based on global prices, US considers 3 dollars for each carbon Ton for some countries as Iran and other developing countries. Kyoto protocol didn't respond many problems and based on the costs of Kyoto protocol, it is better Iran participates after creating required infrastructures in CDM projects.

#### Recommendations

To reduce the density of greenhouse gas and avoiding the outcomes of extra gases in Atmosphere and activation of CDM in developing countries, it is proposed to conduct similar projects for other industries. In these projects, besides steam container as compressor, electromotor and other parts. Other capabilities of preform software are used in financial analyses and identification of fuel change projects, trash landfill, electricity and heat production at the same time, renewable energy and electricity and new energy generation. Saving potentials can be identified in various sectors of energy consumption in industries in Iran and they can be analyzed form financial and economic analysis from economical issues as CDM project by the aid of energy and environment engineers based on international criteria. One of the requirements of projects and

CDM is having a good DNA in host country to have the required abilities and specialization for execution, supervision and approval of proposed projects of CDM to be consistent with national sustainable development criteria and validity of calculations of energy and reduction of emission. It is proposed that the governments improve the knowledge of people and attract public participation in developing countries to achieve minimum greenhouse gas with increasing economic growth. Also, the governments can provide a good ground to implement CDM projects and absorb active investors in this field by governments and NGOs in developing countries.

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