



GEF

## Global Environment Facility

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### MEMORANDUM

DATE: July 19, 2000

TO: Mr. Lars Vidaeus, GEF Executive Coordinator, ENVGC

FROM: Mr. Kenneth King, Assistant CEO *Alan Muller for*

PHONE: 31075

**SUBJECT: MSP: Syria: Increasing the Efficiency of the Hydrocarbon Sector Using Waste Gas - Revised Version**

The GEF Secretariat has reviewed the revised version of the above-mentioned medium-sized project proposal and does not have any objection on the changes being recommended. It is understood that the revision does not alter the substance and original objectives of the proposal that was approved by the CEO on May 25, 1999.

# OFFICE MEMORANDUM

DATE: March 2, 2000

TO: Mr. Kenneth King, Deputy CEO  
GEF Program Coordination

FROM: Lars Vidaeus, Executive Coordinator, ENV

EXTENSION: 3-4188

SUBJECT: **Syria: Increasing the efficiency of the hydrocarbon sector using waste gas  
Submission of revised MSP project brief**

1. Please find attached the revised version of the medium-size project brief **Syria: Increasing the efficiency of the hydrocarbon sector using waste gas** for your review and comment. The original MSP brief was submitted under OP#5 approved by the GEF CEO on 8/31/99. The proposal also meets the criteria for climate change-short-term response measure. The revised version does not alter the substance and original objectives of the project. The key changes and the reasons for the revision are detailed below.

2. The revised version of the project brief has two main changes: the GEF contribution for the CNG vehicles has increased from zero (in the initial document) to \$145,000 towards the incremental cost of 12 large buses instead of the original 30 minibuses and pickups. An incremental cost analysis has been provided in the project brief as an annex. The second key change concerns the gas substitution study that has been scaled down from the original \$200,000 to \$50,000.

3. The revisions were mainly necessitated by changes in co-financing. Due to the Canadian cofinancing not materializing, the client (Ministry of Transport) decided that the GEF resources would be better utilized towards the vehicles rather than the study.

4. Please let us know if you are in agreement with these changes so that the country director may proceed to sign the grant agreement with the client at the soonest.

February 29, 2000

**Distribution:**

cc: Messrs./Mmes. Archambault (MNSID); Arif, Shetty, Pradel (MNSRE); Towsey, Aryal (ENV); ENVGC ISC, MNSRE GEF files.

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## Increasing the Efficiency of the Hydrocarbon Sector by Using Waste Gas

### PROJECT SUMMARY

PROJECT IDENTIFIERS	
<p><b>1. Project name:</b> Increasing the Efficiency of the Hydrocarbon Sector by Using Waste Gas</p>	<p><b>2. GEF Implementing Agency:</b> The World Bank</p>
<p><b>3. Country or countries in which the project is being implemented:</b> Syrian Arab Republic</p>	<p><b>4. Country eligibility:</b> Syria ratified the 1992 Framework for Climate Change Convention on January 4, 1996.</p>
<p><b>5. GEF focal area:</b> Climate Change</p>	<p><b>6. Operational program/Short-term measure:</b> This project has been prepared under the guidelines of GEF Operational Program Number 5: "Removal of Barriers to Energy Efficiency and Energy Conservation". It is also eligible under the Short Term Response Measures defined by GEF.</p>
<p><b>7. Project linkage to national priorities, action plans, and programs:</b> The project is one of the components of the National Environmental Action Plan (NEAP) and its implementation. The NEAP stresses the integration of global environmental concerns such as climate change along with the local and regional environmental issues. The Ministry of State for Environmental Affairs, as well as the Ministry of Finance, have shown a high degree of support for the proposed Project which has been identified as a priority for Syria.</p>	
<p><b>8. GEF national operational focal point and date of country endorsement:</b> Ministry of State for Environmental Affairs - GEF operational focal point Date of Endorsement: April 8, 1999</p>	
PROJECT OBJECTIVES AND ACTIVITIES	
<p><b>9. Project rationale and objectives:</b></p> <p><i>Rationale.</i> The Syrian Arab Republic has ratified the Framework for Climate Change Convention in 1996. The Government is considering the adoption of greenhouse gas (GHG) emission reduction measures while evaluating options to meet its energy demands. The use of alternate vehicle technologies requires a higher level of technology than is currently available in Syria to maintain, test and regulate vehicles. The importation of new technologies, the use of alternate fuels, the assessment of environmental impacts, and the setting of fuel price structures and equipment tariffs involve active participation of a number of government ministries.</p> <p>The transport sector is of particular concern. Syria has a rather restrictive import regime that limits the size of the vehicle fleet. With the expected continuation of an economic reform process, and an opening up to the global economy, the size of the</p>	<p><b>Indicators:</b></p> <ol style="list-style-type: none"> <li>1. New technology vehicles introduced in Syria for demonstration purposes.</li> <li>2. Taxes, duties, and other disincentives/incentives are <b>streamlined</b> so as to encourage new technology vehicles.</li> <li>3. Increased interest from other countries in the Middle East and North Africa Region in the Syrian demonstration project.</li> </ol>

<p>vehicle fleet is likely to grow at a very high rate in the coming years. This situation presents a unique opportunity to introduce new technology vehicles with higher energy efficiency and reduced GHG emissions.</p> <p>A GEF supported project in the Syrian transport sector is likely to provide valuable lessons for many of the Middle East and North Africa countries with similar transport sector characteristics and policy regimes.</p> <p><i>Objectives.</i> The broad objective of the project is to lay the ground for a progressive reduction of the GHG emissions from the transport sector compared to the baseline scenario. The project will facilitate the introduction of CNG powered vehicles in Syria in the short term. The specific objectives would be to identify measures that need to be taken for the accelerated adoption of new technology vehicles.</p> <p>Another objective is to prepare Syria for the accelerated adoption of new technology vehicles in the medium to longer term, as cost of such vehicles declines, their viability is demonstrated, and their availability is increased, through identifying and removing market barriers and correcting distortions in the incentives regime, coupled with increased public awareness.</p>	
<p><b>10. Project outcomes:</b></p> <p>(a) Estimates of potential reduction in GHG emissions resulting from the adoption of new technology vehicles.</p> <p>(b) Identification of market penetration for new technology vehicles and the consequent reduction in cost due to increased demand for such vehicles.</p> <p>(c) Recommendations on taxes and tariffs so as to encourage the adoption of new technology vehicles.</p> <p>(d) Increased public awareness of the benefits in reducing pollutants and GHG emissions.</p>	<p><b>Indicators:</b></p> <p>a. Pilot demonstration project shows reduction in GHG emissions.</p> <p>b. Market barriers are eliminated, or at least reduced.</p> <p>c. Taxes, tariffs, and other disincentives for new technology vehicles are reduced.</p> <p>d. Current bias in favor of diesel fuel is eliminated, or at least significantly reduced.</p>
<p><b>11. Project activities to achieve outcomes:</b></p> <p>(a) Introduction of new technology vehicles (e.g. CNG powered urban buses), along with emissions measuring equipment (GEF contribution: \$320,000)</p> <p>(b) Study on incentives and market and institutional barriers for accelerated adoption of new technology vehicles and technical assistance to conduct demonstration tests (GEF: \$330,000)</p> <p>(c) Public awareness programs on new technology</p>	<p><b>Indicators:</b></p> <p>a.1 Institutional arrangements for the import of new technology vehicles.</p> <p>a.2 Procurement of new technology vehicles.</p> <p>a.3. Infrastructure arrangements for emissions testing and pilot demonstration.</p> <p>b) Study documenting existing market and institutional barriers, with recommendations on</p>

vehicles, global and local environmental issues, and options to reduce GHG emissions (GEF: \$100,000).	measures to overcome them. c) Number of workshops/seminars conducted.
<b>12. Estimated budget (in US\$):</b> PDF: nil GEF: \$750,000 (42%) Co-financing: \$1,030,000 (58%) TOTAL: \$1,780,000 (100%)	
<b>INFORMATION ON INSTITUTION SUBMITTING PROJECT BRIEF</b>	
<b>13. Information on project proposer:</b> Ministry of State for Environmental Affairs, Syrian Arab Republic.  <b>Date of establishment, membership, and leadership:</b> 1992, H.E. A.H. El-Mounajed, Minister of State for Environmental Affairs.  <b>Mandate/terms of reference:</b> To develop and implement environment programs for the benefit of the Syrian Arab Republic and for the benefit of the global community of which Syria is a member.  <b>Sources of revenue:</b> Budget allocation by the Government of Syria, through the Ministry of Finance, to the Ministry of State for Environmental Affairs.  <b>Recent activities/programs, in particular those relevant to the GEF:</b> <ol style="list-style-type: none"> <li>1. Implementing power sector efficiency reforms with UNDP technical assistance.</li> <li>2. Developing National and Local Environmental Action Plans.</li> <li>3. Developing a project on biodiversity.</li> </ol>	
<b>14. Information on proposed executing agency (if different from above):</b>	
<b>15. Date of initial submission of project concept:</b> May, 1998	
<b>INFORMATION TO BE COMPLETED BY IMPLEMENTING AGENCY:</b>	
<b>16. Project identification number:</b> PO58564 -SY-TRANSPORT	
<b>17. Implementing Agency contact person:</b> Eng. Yahia Awaidah	
<b>18. Project linkage to Implementing Agency program(s):</b> <ol style="list-style-type: none"> <li>(a) The project is an integral part of the Syrian Arab Republic's National Environmental Action Plan.</li> <li>(b) The project complements several of the World Bank's ongoing activities in Syria. It is consistent with the World Bank/UNDP-financed National Environmental Action Plan (NEAP) that is in the process of being finalized.</li> <li>(c) The World Bank is also associated with the UNDP in a project entitled "Strengthening National Capacity for Environmental Affairs in Syria" which involves the institutional strengthening of the Ministry of State for Environmental Affairs.</li> <li>(d) Under the Mediterranean Technical Assistance Program (METAP), the World Bank is financing a project which aims at strengthening the capacity of the regional environmental directorates.</li> <li>(e) There is no current CAS for Syria.</li> </ol>	

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# Syria: Increasing the Efficiency of the Hydrocarbon Sector by Using Waste Gas

## DETAILED PROJECT BRIEF

### PROJECT DESCRIPTION

1. This GEF-funded project is intended as a pilot project to demonstrate the use of cleaner fuels and new technology vehicles in the Syrian Arab Republic. Syria's hydrocarbon sector is characterized by low efficiency and high greenhouse gas (GHG) emissions, in particular from the flaring of natural gas<sup>1</sup>. Also the contribution to total carbon emissions by oil is larger than natural gas because the former has a higher carbon emission rate (21.1 kg/GJ) than the latter (15.3 kg/GJ). The current urban ambient air quality in Syria is significantly polluted, with high concentration of lead, particulate matters, sulfur oxides, and nitrogen oxides, as documented in the National Environmental Action Plan (NEAP)<sup>2</sup>. The project will take a first step toward improving this situation by demonstrating a potentially cost-effective way of putting currently flared gas to productive use.

2. The project will provide useful data on the technical issues associated with the adoption of such technologies, as well as insights on market barriers that could possibly act as a deterrent against their introduction in Syria. More specifically, the project will introduce compressed natural gas (CNG) vehicles on a demonstration basis. This type of vehicles has the potential to address environmental concerns when adopted on a national scale. The project will determine the conditions under which it could be possible to increase the market penetration of these new technology vehicles, which in turn would contribute to reducing their costs so that they would not be significantly more expensive than conventional technology vehicles. In the long term, the extensive use of new technology vehicles would have a significant impact on the reduction of flare gas and of GHG.

3. Syria could also consider other potentially attractive uses for waste gas, namely:

- *Use as a transport fuel.* While increased use of natural gas in the transport sector would potentially be attractive, market penetration of vehicles based on CNG is hampered by a number of barriers, including: (i) lack of experience; (ii) absence of sufficiently trained technicians; (iii) absence of a network of filling stations and engine repairs; and (iv) insufficient price incentives.
- *Small-scale consumption at household and enterprise level.* A gas pipeline could be built between Tishreen and Damascus. New connection of houses, filling stations and selected enterprises would then become an attractive

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<sup>1</sup> When methane present in natural gas is vented to the atmosphere and converted to CO<sub>2</sub> in the combustion process, it has a major impact on GHG emissions because methane is 11 times more effective than CO<sub>2</sub> at trapping heat in the atmosphere.

<sup>2</sup> Environmental Resources management for the World Bank/UNDP. National Environmental Action Plan for the Arab Republic of Syria. February 1998.



option. Key barriers preventing such a project are: (i) insufficient scale; (ii) lack of information about market demand; and (iii) lack of capacity to develop a long-term gas distribution strategy.

- *Power generation.* This is probably the most attractive initial use for natural gas as it could generate sufficient demand at a single point to justify the necessary upstream and pipeline investments. A gas-fired power generation station is in operation at Tishreen, and it is part of the baseline.

4. Given the relative merit of these options, the initial target of this project will be the transport sector and its potential contribution to the increase in efficiency of the energy sector through introduction of more efficient fuels, decrease in gas flaring, and removal of selected barriers related to gas distribution in general. Transport applications are an attractive starting point because they have the potential to address other environmental concerns when adopted on a national scale. The project will determine the conditions under which it could be possible to increase the market penetration of CNG vehicles, which in turn would contribute to reducing their costs so that they would not be significantly more expensive than conventional technology vehicles. Other possible uses for natural gas, in particular for power generation, will be explored in parallel.

5. The more widespread use of natural gas could have a significant impact on the reduction of GHG. A preliminary assessment of the carbon balance has been made, and it is included in the section: Incremental Cost Assessment in this project brief. From a domestic point of view, the project will help to reduce the emissions of lead, particulate matter, and sulfur oxides to insignificant levels. The adoption of such cleaner fuels and technologies on a national basis could thus substitute for other, potentially more costly policy measures that would be taken to reduce ambient pollution levels in the baseline.

## **PROJECT JUSTIFICATION AND RATIONALE**

6. This project has been prepared under the guidelines of GEF Operational Program Number 5: "Removal of Barriers to Energy Efficiency and Energy Conservation". It is also eligible under the Short Term Response Measures defined by GEF. Calculations show that the GEF contribution translates into a cost of US\$5.60 per ton of carbon.

7. The Syrian Arab Republic has ratified on January 4, 1996 the Framework for Climate Change Convention of 1992. As such, the Government of Syria is considering the adoption of GHG emissions reduction measures while evaluating options to meet its energy demands. To achieve these objectives, the Government will need to develop capacity to address technical, policy and other issues. The capture of natural gas and its use in alternate vehicle technologies requires a higher level of technology than is currently available in Syria. The importation of new technologies, the use of alternate fuels, the assessment of environmental impacts, and the setting of fuel price structures and equipment tariffs involve active participation of a number of government ministries. This project offers a unique opportunity for the ministries to work together towards an international goal, and to coordinate their efforts in order to address local environmental issues.

8. Syria has a high energy intensity of 0.9 kg of oil equivalent per dollar of GDP, compared to about 0.35 for the U.S. and 0.2-0.3 for most other OECD countries. By introducing new technologies, overcoming existing institutional and market barriers for

their accelerated adoption, and improving policy and planning, significant energy efficiency improvements, and associated GHG and local air pollution reductions, can be achieved in all major sectors in Syria. The hydrocarbon and transport sectors are of particular concern. With the expected continuation of an economic reform process, and an opening up to the global economy, the size of the vehicle fleet is likely to grow at a very high rate in the coming years, the more so since Syria presently has a rather restrictive import regime that limits the size of the vehicle fleet. This situation presents a unique opportunity to introduce new technology vehicles with higher energy efficiency and reduced GHG emissions. In addition, the proposed project is likely to provide valuable lessons for many of the Middle East and North Africa countries with similar sector characteristics and policy regimes.

9. The use of electric vehicles was examined as a possible option to reduce GHG emissions. However it was shown that such vehicles would generate a larger quantity of carbon emissions than conventional diesel vehicles, respectively 8.6 and 7.0 tonnes of carbon per 50.000 km for urban buses, due to the fact that electricity is presently generated in Syria by relatively inefficient diesel-fired power plants.

### PROJECT OBJECTIVES

10. The main objective of this project is to develop and demonstrate at a pilot stage the capacity of the Syrian Arab Republic to meet GHG reduction commitments. That is, a global environmental issue will be integrated with local decision-making processes and policy development and implementation. Although any reduction in emissions due to the alternate vehicles may be quite small, the potential benefits of integrated, informed policy and regulatory development are very great.

11. Beyond GHG mitigation, the project would have the following domestic objectives:

- reduce emissions of lead, particulate matter, sulfur oxides, nitrogen oxides, hydrocarbons, and carbon monoxide;
- reduce the need to import diesel fuel, as is presently the case;
- introduce the technology of alternate fuelled vehicles; and ultimately

reduce GHG emissions and cause improvements in the air quality of the urban environment in Syria.

### CURRENT SITUATION

12. **Geography, population.** The Syrian Arab Republic lies on the eastern coast of the Mediterranean Sea, bounded by Turkey on the north, Iraq on the east, Jordan on the south, and Lebanon on the west. It has a population of about 13 million and a land area of 185,000 square kilometers of which one-third is arable land and forest. Close to 2,9 million people live in the Greater Damascus Area. Other major cities are Aleppo (population of about 2,9 million in the Greater Metropolitan Area) and Homs (population of 1,3 million). The climate of the Mediterranean sea generally prevails in the populated areas, with a rainy winter and a hot dry summer, and two transitional seasons in between.

13. **Recent performance of the economy and short term perspectives.** Since 1990, Syria's GDP has shown a steady growth at an average of 7.3 percent per year in real terms. The population growth rate is estimated at 3.3 percent. Growth has been strong across all sectors except for government services. The transport and communications sector has shown one of the highest annual growth rates of about 10 percent with a 12 percent share in the GDP in 1995. According to the NEAP report, the per capita income in 1995 in Syria was around US\$800. The environmental degradation is estimated to be equivalent to 4 to 5 percent of GDP.

14. **Environmental issues.** The key environmental issues identified in the NEAP report include: (i) depletion of water resources; (ii) land degradation and desertification; (iii) pollution of surface and ground water including that resulting from agriculture, sewage discharge, and industrial effluents; (iv) urban air pollution (including that resulting from the emissions of lead, particulate matter, sulfur oxides, and nitrogen oxides); and (v) pollution of land by domestic and industrial wastes.

15. The Ministry of State for Environmental Affairs (MSEA) has among its functions to coordinate the efforts of other Ministries and governmental organizations in improving air quality in the country as a whole, and in its major cities in particular. However, the flow of information is lacking in comprehensiveness, despite the creation of various committees to oversee the implementation of the environmental regulations. Only partial information is available on vehicle fleet and on pollution levels. There is no information on actual emissions levels from various types of vehicles and various age categories, and international factors based on American or European experience are of little use due to major differences in the composition of the vehicle fleets, their respective average age, and levels of maintenance.

16. **Air Quality.** The air quality in urban areas is adversely impacted by vehicle emissions, in part because the vehicle fleet is old and in part because of the lack of vehicle emissions control regulations. MSEA has recently concluded that human health is undoubtedly affected by air pollution and provided the following data:

- Ozone, formed largely as a result of vehicle emissions, reaches an average level in Damascus of 0.07 ppm, which is about 70 percent of the draft Syrian standard of 0.1 ppm.
- Sulfur dioxide daily average concentrations in Damascus, Aleppo, Homs, Tartous, and Baniyas reaches 0.1 ppm which is twice the draft Syrian standard of 0.05 ppm.
- Nitrogen oxides, also predominantly from vehicles in non-industrial areas, reach a daily average of 0.3 ppm in Damascus and 0.5 ppm in Aleppo, which is significantly higher than the draft Syrian standard of 0.21 ppm, itself directly comparable to North American standards.
- Carbon monoxide 8-hour average readings exceed the draft Syrian standard of 26 ppm about 38 percent of the time.
- The fine fraction of particulate matter (PM10) and hazardous organic components are strongly related to diesel emissions. Levels of both PM10 and total particulate matter are significantly high in all cities investigated by

the Ministry of Health. All PM10 measurements reported in the National Environmental Action Plan exceed the 24 hour WHO guideline of 70 µg/m<sup>3</sup>.

- Leaded gasoline accounted for 90 percent of gasoline sales in Syria in 1997; lead in Syrian fuel is normally at concentrations of 0.5 g/l, but occasionally reaches 1.2 g/l.
- Diesel fuel typically contains 0.7 percent sulfur, and represents an important source of sulfur dioxide in urban areas. Sulfur dioxide reaches about twice the proposed Syrian standard in urban areas and the sulfur in diesel fuel also contributes to the formation of fine particulate matter in the exhaust.

17. The draft ambient air quality regulations of Syria are comparable to those of North America and the European Union. However, the emission regulations, including those for mobile sources, need to be developed and properly enforced.

18. **Emissions Regulation.** The urban air in Syria has been shown to contain unacceptably high levels of contaminants associated with motor vehicles. As Syria modernizes, the growth of the vehicle fleet will further degrade the quality of the air. Syria currently has no standards for emissions from motor vehicles. However virtually all stakeholders in the automotive industry and the government recognize that control measures and vehicle standards are necessary and inevitable. The Ministry of Transport claims jurisdiction over any future regulations, but its capacity to develop or enforce such regulations requires development. MSEA is also limited in means to enforce any environmental regulations. On the other hand, since Saudi Arabia and Iran, among others, have adopted ECE regulations for vehicle emissions, a future harmonization of Syria's regulations with those of other Middle East countries and the European Union may be anticipated.

19. In order to implement such regulations, several measures will have to be implemented. Some measures that are being considered include: (i) acquisition of vehicle testing equipment by the Ministry of Transport - this is being currently pursued; (ii) demonstration of testing equipment along with staff training - this is also ongoing; (iii) introduction of lead-free gasoline in the country to address ambient lead pollution problem; (iv) introduction of CNG filling stations; (v) drafting of emission regulations for gasoline and diesel; and (vi) introduction of catalytic converters to address NOx pollution problem.

20. **Vehicle Fleet.** The vehicle fleet in Syria is much older than in most countries in part because of the high import duties and the restrictive policy on vehicle import. There exists a strong and growing demand for private vehicles and it is likely that strengthening of the economic conditions would increase the demand. The growth of the vehicle fleet was about 8 percent in the period 1990-1995, and that of the microbus fleet, the prime mode of public transport, 25 percent per year. The next most rapid growth rate is in pick-up trucks. Similar information is not meaningful for larger urban buses because of their relatively small numbers, but they could be the most appropriate target for the project because they are: (i) highly visible, therefore good demonstration vehicles; (ii) "high-mileage" vehicles, helping to compress the testing; (iii) operated as part of a fleet, therefore likely to be maintained by a facility with expertise and equipment that are above the average; and (iv) likely to be tracked fairly well in terms of maintenance and cost.

21. Vehicles imported without any emissions control equipment are capable of operating on leaded fuels. This, plus the advanced age of the vehicle fleet, has prevented the upgrading of the maintenance system to cope with technological advances in engines and emission controls. There are no formal educational or certification requirements for mechanics, nor is there opportunity to learn except through training at the workplace. These workplaces range in size from individual operators to maintenance facilities with over a hundred employees. These larger facilities are properly equipped for the level of technology that they handle, but would require additional equipment and training to deal with European or North American technology. These facilities are good candidates for building capacity to repair more advanced conventional fuelled vehicles (that is, those with emission controls) as well as alternate technology vehicles.

22. The Ministry of Petroleum and Mineral Resources has proposed to convert 10,000 gasoline-fuelled taxis to CNG, by fitting a gas conversion kit on existing engines at a unit cost of US\$1,500 per vehicle. This proposal entails the construction of a 55-km pipeline from the Tishreen Power Plant to Damascus, and the construction of three filling stations in Damascus, at a total cost of US\$12.0 million. The project would use only a small portion of the existing capacity of the pipeline that feeds the power plant, i.e. approximately 260,000 cubic meters per day, compared to a capacity of 4.0 million cubic meters per day. This proposal was floated more than three years ago, but has not received substantial support from the Government. For this reason, it could not be used as a baseline course of action for the current GEF project.

23. *Price of energy.* About 48 percent of all Government revenues are generated from the extraction of oil and gas: this illustrates the importance of that sector on the economy. Syria only exports crude oil: the total production of its refineries is used for internal consumption. Unleaded fuel accounts for approximately 10 percent of gasoline supply. There is currently an imbalance in the refinery production, and the Government has to import diesel that is used in the transport as well as in the housing sectors. Import of diesel is not presently subsidized by the Government <sup>3</sup>, but it is a drain on the foreign exchange balance of the country. The Ministry of Finance would only agree to proposals to reduce transport related emissions through new technology vehicles provided they procure the same level of revenues as the existing situation. They recognize however that the only sensible way to achieve that goal would be to raise taxes on diesel, to make it competitive with leaded or unleaded gas at the current price levels.

24. The price of fuel (July 1998) is shown in the following table.

	Gasoline	Diesel	Natural Gas
Source	Domestic	Imported	Domestic
Border Price	\$0.1125/litre	\$0.0860/litre	\$0.044/m <sup>3</sup>
Retail Price	\$0.453/litre	\$0.140/litre	\$0.022/m <sup>3</sup>

Source: Ministry of Petroleum and Mineral Resources

25. Electricity costs to the commercial user (July 1998) are \$0.035/kWh.

<sup>3</sup>It is estimated that diesel fuel may be subsidized when the international price fluctuates above US\$150 per tonne (in August 1998, it was US\$100 per tonne).

## EXPECTED PROJECT OUTCOMES

26. The expected outcomes of this project are:

- increased capacity of the Syrian Government to deal with global issues as factors in local decision making;
- minimized waste and emissions of flaring natural gas resources;
- adoption of a large number of alternate fuelled vehicles;
- conversion of numerous vehicles to use the excess natural gas capacity;
- improvements in urban air quality;
- reductions in human health impacts; and

growth of local capacity to work with the higher and cleaner technology of alternate fuels.

27. The first three of these outcomes can be measured directly over a relatively short time frame. The remaining outcomes can be monitored on the longer time scale, but can also be adequately estimated from the first three.

28. Gas production is currently 6.0 billion cubic meters per year, and approximately one-third of that production is flared<sup>4</sup>. Fifteen percent is injected to the wells to maintain pressure. The flared quantity of gas is approximately equal to 2.4 billion litres of gasoline, or roughly the annual energy consumption of one million pick-up trucks in moderate service. The pilot project will use a fraction of this gas that would otherwise be wasted to fuel directly the CNG vehicles.

29. It is expected that the alternate technology vehicles will be shown to be feasible alternatives for the gasoline or diesel powered vehicles in use. The training program will provide the mechanics with fundamental understanding of the pilot vehicles and with a greater capacity for the repair of conventional fuelled vehicles. MSEA will benefit from an active role in a pilot program which is an important first step in the reduction of GHG and toxic contaminants. Workshops will allow a large number of mechanics and stakeholders to learn from the project.

30. The current differences in the respective prices of diesel and CNG vehicles and the pricing of fuels that promote diesel over natural gas are a major factor explaining why CNG vehicles are not competitive on the Syrian market. Changes that could be effected during the next three years will probably not be sufficient to modify drastically the current imbalances in favor of diesel vehicles. However, over a longer period of time, it is quite possible that price distortions will have been greatly reduced and it is expected that alternative vehicles (CNG-based, but also electric vehicles) will become serious competitors to diesel or gasoline powered vehicles.

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<sup>4</sup> The Ministry of Petroleum and Mineral Resources is presently conducting a technical, financial and economic study on the recovery of flared gas.

## ACTIVITIES AND FINANCIAL INPUTS NEEDED

31. The project will be implemented over a period of three years, including two years for monitoring the operation of new technology vehicles in actual use. A detailed description of the various activities is included as Annex 2. Total cost of the project is estimated at US\$1,5 million, and the GEF funding requirement at US\$750,000. All cost figures have been derived from actual costs observed in Syria. Details of costs are shown in a following section: Incremental Cost Assessment.

32. **Vehicles.** (expected cost of US\$1,074,000 and expected GEF contribution of US\$142,000). This component entails the acquisition of twelve CNG-powered urban buses and the cost covers their operation and maintenance over a two-year period <sup>5</sup>. In the particular context of Syria, the use of natural gas provides immediate and major benefits to the urban air quality and also results in significant GHG emissions reduction. The demonstration program will consist of the simultaneous operation of CNG and conventional diesel buses over directly comparable routes with detailed performance monitoring. The vehicles will be monitored over a two-year period to determine their cost of operation, reliability, and performance with regard to net emissions of GHG to the atmosphere. The GEF contribution will fund the incremental costs of acquiring and operating CNG buses over standard diesel buses.

33. The following unit prices for buses are based on current prices in Syria, exclusive of import duties and taxes. The annual operating costs are based on an average of 60,000 km/year/vehicle. Operating costs are based on border prices for fuel.

	Unit Price, US\$	Operating Costs	
		US\$/km	US\$/year
Diesel	60,000	0.0465	2,790
CNG	75,000	0.0382	2,293

34. **Instrumentation.** (expected cost of US\$100,000 and expected GEF contribution of US\$75,000). Required equipment to monitor the performance of different vehicles during the demonstration phase include a stationary dynamometer, vehicle emissions test equipment, computer hardware and software, and driving cycle measurement equipment and vehicle tracking equipment through GPS. MSEA has proposed to acquire various monitoring equipment that would be made available to the project.

35. **Fuel Facilities.** (expected cost of US\$131,000 and expected GEF contribution of US\$103,000). To make CNG readily available to fill vehicle tanks, and assuming that the works will be done at the Tishreen power plant, there will be a need to install a compressor and a storage tank at the end of the pipeline, plus the necessary equipment to fill vehicle tanks. The cost includes supplies and installation and assumes an in-kind contribution from the operator of the power plant.

36. **Consultant Services.** (expected cost of US\$280,000 and expected GEF contribution of US\$280,000). The project will be conducted by an international

<sup>5</sup> It is intended that the Damascus Public Transport Company (DPTC) will operate the CNG buses as part of its regular services.

consultant to be retained by MSEA. The consultant will be selected in a two-stage, two-envelope process, i.e. by first evaluating the technical quality of the proposal and then its cost. The financial proposals will be opened in public in the presence of the consultants who will have attained the minimum technical qualifying mark, as per the Bank's Guidelines for the Selection of Consultants. Terms of reference have been prepared and are included as Attachment A. The Consultant will:

- review the current operation of the Damascus Public Transport Company (DPTC) and make recommendations as to the most suitable institutional arrangements to ensure the successful integration of CNG buses within its existing fleet;
- refine the analysis of any barriers or constraints - market, technology, institutions - that could prevent the rapid adoption of CNG vehicles in Syria, examine the issues of fuel availability, price structures, and demand, and prepare a report on the findings;
- prepare bidding documents and assist MSEA in carrying out the bidding process, in evaluating the bids for the vehicles, and in preparing contracts;
- arrange a series of training workshops to train DPTC technicians, and design the program for monitoring and reporting the results of the pilot program; and
- provide monthly and quarterly follow up reports to the Project Director for his review.

37. ***Gas Substitution Study.*** (expected cost of US\$50,000 and expected GEF contribution of US\$50,000). The transport sector in Syria, with about 1.3 million tons of carbon emissions every year, expected to increase to 2.9 millions tons by the year 2010 in the absence of any measure to increase its efficiency, is a major contributor to GHG. With about 10 percent of the total energy used in Syria, there is a considerable scope for fuel savings and for substituting gas where oil is presently used. This study will also analyze options for the wider distribution of natural gas in Syria for both transport and non-transport purposes, and will assist the authorities in the development of a long-term gas substitution strategy.

38. ***Public Awareness Program.*** (expected cost of US\$30,000 and expected GEF contribution of US\$30,000). During the course of the project, a series of workshop will be organized and hosted by MSEA. In addition, one would expect in kind contribution from interested manufacturers and suppliers. The Consultant will be responsible for their technical content:

(a) Technical Workshops. These workshops will be directed at fleet owners, vehicle importers, and environmental agency personnel, and will inform them of the performance of alternate vehicles in Syria. In addition to the vehicles and public awareness, there will be a training component oriented toward mechanics and service center managers to ensure that the vehicles are fully maintained.

(b) Policy Maker Workshops. A workshop to disseminate the project findings and to develop the strategies for policy making will allow policy makers the



opportunity to evaluate the technology, its implications, and the changes that may be necessary in the regulations and policies.

39. ***Project Implementation Unit (PIU)***. (expected cost of US\$85,000 and expected GEF contribution of US\$70,000). The PIU will be comprised of a Project Director who will report to the Ministry of State of Environmental Affairs through a Steering Committee, and of support staff, essentially a secretary and a driver. Project funds will be used to reimburse the Project Director's fees for the duration of the project, estimated at US\$2,000 per month: it is assumed that both he and the driver will spend a third of their time on this project, while the secretary would be employed full time, to provide day-to-day liaison between the various stakeholders. In addition, project funds will be used to acquire one vehicle, two telephone sets, one facsimile machine, two computers and one printer, and one photocopier. The Government of Syria will reimburse incidental expenses, estimated at US\$5,000 per year.

## **SUSTAINABILITY ANALYSIS AND RISK ASSESSMENT**

### Factors for success

40. Absent any barriers, the use of CNG vehicles would be considered to be a 'win-win' process because it is feasible on technical, economic, and environmental bases. In addition to the direct benefits derived from the use of CNG vehicles, the indirect benefit of reducing the flaring of the natural resource will contribute to the national reduction of GHG emissions.

41. The use of CNG vehicles will have a positive impact on urban air quality. The project is funded and designed to address GHG emissions, but the technology, training, instrumentation and public awareness programs will also result in significant reduction of the pollutants that are harmful to public health.

42. The use of CNG will result in a reduction of hazardous organic compounds of over 90 percent.

### Risk Factors

43. ***Macroeconomic policies***. The relative prices of diesel, gasoline and natural gas are important variables in the economic analysis of alternate vehicle technology. The revenues earned by the Syrian government through the sales of conventional fuels, particularly gasoline, can deter the Ministry of Finance from supporting the conversion of the vehicle fleet. The restructuring of prices, however, may alleviate these concerns, and could become more attractive in terms of other economic factors. The current imports of 600,000 tonnes/year of diesel fuel, at a cost of US\$60 million, represent a major loss of foreign currency<sup>6</sup>. The Syrian government is aware of the potential for natural gas to replace this fuel supply. The project includes, in the first year, a study of the market opportunities and barriers that will, in large part, address the issue of sustainability of the conversion of the vehicle energy sources.

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<sup>6</sup> The project would result in a net decrease of import diesel valued at US\$13,000 per year. On the other hand, if the 800 urban buses currently operating within the Governorate of Damascus were converted to CNG, it would represent a net saving of more than US\$1.0 million per year.

44. **Sector Policies.** Surplus natural gas is currently flared, because that gas is not needed. It is likely that the gas would be redirected for other use if the price structure and distribution system were adequate and available. This pilot project will provide the information necessary before investment in a distribution system can occur.

45. **Government Administrative Capacity.** The project may require numerous changes from the way the Syrian Government and its executing agencies implement their projects, from procurement to disbursement to auditing procedures. Even if MSEA is engaged in a number of projects with other international agencies, it may find it hard to follow this project with the proper attention it requires due to its innovative status.

46. **Private sector response.** The demonstration of cost-effective technological changes is likely to generate considerable interest in the private sector<sup>7</sup>, even if the Government of Syria has expressed doubts on the feasibility of private sector participation in the project. Vehicles are expensive relative to the return through the current fare structure. The highly competitive and low-return nature of the sector suggests that investments with short payback periods may be more successful in generating private sector interest. The market barrier study will address these issues, and the pilot project results will provide quantitative data for the evaluation.

47. **Counterpart funding.** A significant portion of counterpart funding can be considered baseline funding, since DPTC has to buy vehicles for its own use, both to renew its fleet and to add new vehicles to cope with the increasing demand. MSEA intends to acquire during the year 2000 pollution monitoring equipment, some of which could be used by the project to monitor urban bus emissions.

#### STAKEHOLDER INVOLVEMENT AND SOCIAL ASSESSMENT

48. **Stakeholder Involvement.** The involvement of government agencies starts at the beginning of the project, and their close participation is essential to its success. The public awareness program will reach out to direct and indirect stakeholders. Major stakeholders, and their respective interest in the project, include:

- **Government of Syria** – to fulfill commitments with respect to GHG emissions reduction, to realize environmental improvements, and to find means of reducing foreign expenditures for fuel importation.
- **Ministry of State for Environmental Affairs** – to attain major improvements in urban air quality as a result of vehicle emissions reduction.
- **Ministry of Transport** – to gain knowledge and experience in alternative vehicle technology and in emissions measurement and control, and to facilitate the participation of its subsidiary DPTC in the project.
- **Ministry of Petroleum and Mining Resources** – to support the use of natural gas for surface transport vehicles.

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<sup>7</sup> During project preparation, three major joint public-private firms in the automotive sector, namely Nahas Entreprises, Mimosa Tours, and Nevas, have expressed enthusiastic support for the project and their readiness to be involved in its implementation, should this possibility arise.

- **Governorate of Damascus** – to become partners in the execution of the project, where feasible.
  - **Universities in Damascus** - to participate in the pilot demonstration project through data collection and analysis.
  - **Parastatal Companies** – to prepare for major changes in the production and distribution of CNG.
- Fleet operators** – likely to benefit from lower operation costs and higher reliability.
- **Mechanics** – to gain expertise in newer and alternate vehicle technology.
  - **Residents of urban areas** – to benefit from significant improvements in air quality and reduction in adverse health impacts.

49. **Social Assessment.** The project is not expected to have any direct effect on the daily lives of the Damascenes. Participation issues involve mainly the need for the national private sector to be able to participate in all the phases of the project. There is no social impact and assessment needed at this stage.

50. **Gender Issues.** This project is gender-neutral.

#### **LESSONS LEARNED AND REFLECTED IN THE PROJECT DESIGN**

51. The GEF portfolio already contains a small number of energy efficiency projects in the Middle East as well as several projects dealing with efficiency in the gas sector or with transport issues, most importantly: (i) Iran: Tehran Transport Emissions Reduction Project (World Bank); (ii) China: Sichuan Gas Transmission and Distribution Rehabilitation (World Bank); and (iii) Egypt / Palestinian Authority: Energy Efficiency Improvements (UNDP).

52. Many of these projects are in an advanced state and lessons can be drawn. The Implementation Completion Report for the Iran project identified the need to: (i) avoid implementation delays by addressing up-front any capacity constraints and lack of familiarity with Bank procurement and disbursement procedures; (ii) develop a database over as long a period of time as possible to monitor sector development and project success; and (iii) better recognize the needs of the recipient by building synergies between domestic development goals and the global environment objectives. These lessons are taken into account in the design of the project.

#### **INCREMENTAL COST ASSESSMENT**

53. The total cost of this project, including Preparation and Implementation, is anticipated to be US\$1,4 million, as shown on the following table:

	<b>Baseline Scenario US\$000</b>	<b>Proposed Alternative US\$000</b>	<b>Incremental Costs US\$000</b>
<b>Preparation (P)</b> "Block A" and others	27	27	0
<b>Implementation (I)</b>			
Vehicle Costs	932	1074	142
Consulting Services	0	280	280
Gas Substitution Study	0	50	50
Instrumentation	25	100	75
Public Awareness	0	30	30
PIU	15	85	70
Fuel Facilities	28	131	103
<b>Total Implementation</b>	<b>1,000</b>	<b>1,750</b>	<b>750</b>
<b>TOTAL (P+I)</b>	<b>1,727</b>	<b>1,777</b>	<b>750</b>
<b>Distribution</b>	<b>57.8%</b>	<b>100%</b>	<b>42.2%</b>

54. A preliminary assessment of carbon emissions has been conducted with a view of identifying the advantages of new technology vehicles over conventional ones. Carbon emissions factors were derived from North American experience for similar sources of energy as used in Syria. The GEF scenario shows a reduction of 2,1 tonnes of Carbon per year and per bus, compared to the Baseline Case (net of leakage), because of CNG advantage over diesel. In addition, because the gas that will be used is presently flared, the average annual gas consumption of 18,000 m<sup>3</sup> per bus is equivalent to a load of approximately 14.4 tonnes of Carbon that will not be emitted in the atmosphere<sup>8</sup>. Assuming that the entire fleet of 800 urban buses would eventually be converted as a result of this project, carbon savings would amount to 132,000 tonnes over the expected average lifetime of the fleet (10 years). This translates into a cost of US\$5.60 per ton of carbon for GEF contribution.

Type of Vehicle	Carbon Emissions, tonnes/60,000 km	Number of Vehicles	
		Baseline Case	GEF Scenario
Diesel Buses	14.1	12	--
CNG Buses	12.0	--	12
Annual Carbon Emissions, tonnes		169.2	144.0

#### IMPLEMENTATION BUDGET

55. The breakdown of costs by budgetary component is the following:

<sup>5</sup> Even if one argues that the gas fields where the gas is presently flared are far removed from Damascus, the potential reduction is not negligible, and would be higher than the reduction obtained through the substitution of diesel in favor of CNG.

<b>Project Component</b>	<b>GEF Funding US\$000</b>	<b>Local Support US\$000</b>	<b>Other Donors US\$000</b>	<b>Total US\$000</b>
Project Preparation	0	2	25	27
Goods	320	985	0	1,305
Project Management and Coordination	100	15	0	115
Technical Assistance	330	0	0	330
<b>TOTAL</b>	<b>750</b>	<b>1,002</b>	<b>25</b>	<b>1,777</b>
	42.2%	56.4%	1.4%	100%

## PROJECT IMPLEMENTATION PLAN

56. **Steering Committee.** A Steering Committee appointed and headed by MSEA <sup>9</sup> will oversee the execution of the project and facilitate the exchange of information between the different ministries and governmental agencies involved in the project, in particular the DPTC, the Governorate of Damascus and other interested parties.

57. **Project Implementation Unit (PIU).** MSEA will appoint a Project Director to report through the Steering Committee. This appointment is subject to the Bank's non objection and it has to be in effect at the start of the project. The Project Director will supervise the work of the Consultant and of its sub-contractors, and facilitate communications between the Consultant and the various ministries and other governmental agencies involved in the project. He is expected to keep abreast of the progress of the study, and be familiar with its technical contents. He will also prepare quarterly and annual reports on the technical and financial status of the project.

58. The implementation of the project will occur over a three-year period. Based on a projected effectiveness date of July 1, 2000, the test program could begin in April 2001 and terminate in March 2003.

59. **Public Awareness Program.** The proposed program would seek to enlist the support of the population in introducing new vehicle technology in Syria. This initiative, through training programs and workshops, would complement the project in enabling activities for global climate change.

60. **Procurement.** Procurement of vehicles and equipment financed by the GEF grant will follow International Competitive Bidding (ICB) procedures and the Bank's Standard Bidding Documents for Goods and Standard Bid Evaluation Form for the Procurement of Goods and Works. The selection of Consultants and contract process will follow World Bank's procedures, namely: (i) Guidelines – Selection and Employment of Consultants by World Bank Borrowers, January 1997 and revised January 1998; (ii) Standard Request for Proposals using the Quality and Cost – Based (QCBS) selection method; and (iii) Standard Contract for Consultant's Services: Complex Time – Based Assignments.

<sup>9</sup> Its composition is not yet known, but it would most probably comprise representatives from the following ministries: Finance, Economy and Foreign Trade, Petroleum and Mineral Resources, and Transport, as well as the State Planning Commission, the Governorate of Damascus and DPTC.

61. **Reporting.** Financing reporting and audit reports will be done according to the Bank's Guidelines for Financial Reporting and Auditing of Projects. Disbursements will be made according to LACI procedures.

#### **MONITORING AND EVALUATION PLAN**

62. At each stage, the Steering Committee will be called upon to assess the evolution of the project and to take any action that would be beneficial to the project.

63. Major indicators and milestones are the following:

- Signing of a contract with an international consultant within 6 months of GEF approval of the project.
- Acquisition of vehicles and other required equipment within 12 months of GEF approval.
- Report on market barriers within 6 months of consultant's signing of the contract.
- Interim report on the monitoring of the test vehicles after one full year of operation.
- Interim report after the second full year of operation.
- Final report on the pilot program within 3 months after the closing of the monitoring phase.

64. Project monitoring and evaluation activities will be carried out during Bank supervision missions. Monitoring activities will include regular reporting every six months on the activities related to each component of the project. An Implementation Completion Report will be prepared at project completion by the Recipient and by the Bank to take stock of project performance and extract lessons for future operations.

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Discounted Cash Flow for Various Options

	YEAR	1	2	3	4	5	6	7	8	9	10
	Units										
<b>Conventional Fleet</b>											
Diesel urban buses											
Number operated	#	12	12	12	12	12	12	12	12	12	12
Number purchased	#	12	0	0	0	0	0	0	0	0	0
Per vehicle cost	\$	60,000.00									
Total annual purchase price	\$	720,000.00	0	0	0	0	0	0	0	0	0
Annual per vehicle mileage	km	60,000									
Per Kilometre Maintenance	\$/km	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Fuel mileage	km/l	4	4	4	4	4	4	4	4	4	4
Fuel costs	\$/l	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086
Per kilometre fuel	\$/km	0.02150	0.02150	0.02150	0.02150	0.02150	0.02150	0.02150	0.02150	0.02150	0.02150
Annual operating cost per vehicle	\$	2,790.00	2,790.00	2,790.00	2,790.00	2,790.00	2,790.00	2,790.00	2,790.00	2,790.00	2,790.00
Annual per vehicle costs	\$	62,790.00	2,790.00	2,790.00	2,790.00	2,790.00	2,790.00	2,790.00	2,790.00	2,790.00	2,790.00
Total costs for diesel buses	\$	753,480.00	33,480.00	33,480.00	33,480.00	33,480.00	33,480.00	33,480.00	33,480.00	33,480.00	33,480.00
Discounted cash flow (12%)	\$	931,869.80									
<b>Alternative Vehicle Purchase</b>											
<b>CNG Vehicles - urban buses</b>											
Number operated	#	12	12	12	12	12	12	12	12	12	12
Number purchased	#	12	0	0	0	0	0	0	0	0	0
Per vehicle cost	\$	75,000.00									
Total annual purchase price	\$	900,000.00	0	0	0	0	0	0	0	0	0
Annual per vehicle mileage	km	60,000									
Per Kilometre Maintenance	\$/km	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Fuel mileage	km/m3	3.33	3.33	3.33	3.33	3.33	3.33	3.33	3.33	3.33	3.33
Fuel costs	\$/m3	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044
Per kilometre fuel	\$/km	0.01321	0.01321	0.01321	0.01321	0.01321	0.01321	0.01321	0.01321	0.01321	0.01321
Annual operating cost per vehicle	\$	2,292.79	2,292.79	2,292.79	2,292.79	2,292.79	2,292.79	2,292.79	2,292.79	2,292.79	2,292.79
Annual per vehicle costs	\$	77,292.79	2,292.79	2,292.79	2,292.79	2,292.79	2,292.79	2,292.79	2,292.79	2,292.79	2,292.79
Total costs for CNG buses	\$	927,513.51	27,513.51	27,513.51	27,513.51	27,513.51	27,513.51	27,513.51	27,513.51	27,513.51	27,513.51
Discounted cash flow (12%)	\$	1,074,112.39									
<b>Discounted Cash Flow Analysis</b>											
Discounted cash flow											
Discount Rate		12%									
Baseline Program		931,870									
Augmented Project		1,074,112									
GEF Increment		142,243									