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Project of the Government of the Islamic Republic of Pakistan
PROJECT DOCUMENT

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ACC/UNDP sector and subsector: 0600 Transport & Communication
0630 Land transport

Govt. sector and subsector: Environment, Road Transport

Govt. implementing agency: National Energy Conservation Centre (ENERCON)

Executing agency: Ministry of Environment, Urban Affairs, Forestry and Wildlife

Estimated starting date: April 1996

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UNDP and cost-sharing financing:

UNDP inputs:

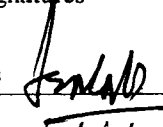
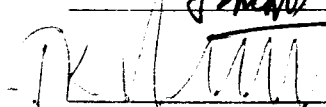
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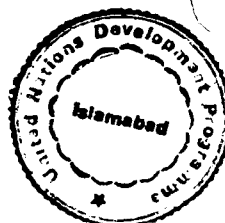
Others (GEF): \$7.00 million

Govt. or third party cost-sharing:

UNDP and cost-sharing: \$7.00 million

The project aims to reduce at source emissions of greenhouse gases and other pollutants by improving fuel efficiency of road transport vehicles in Pakistan. Considerable potential for fuel savings exists as standard of vehicle maintenance is poor, use of fuel efficient technologies is limited, and government policies do not directly address the fuel efficiency and emissions issues. The main objective of the project is to achieve a reduction in carbon emissions in the short-term through the introduction and promotion of state-of-the-art vehicle engine tune-up technologies in the country. Engine tune-up demonstration and training centres, ten for gasoline and five for diesel vehicles, will be established over the country. These centres will help in the development of service sector capabilities in diagnosis of engine performance and will stimulate the market for these services. A revolving loan fund will also be set up to finance the purchase of vehicle tune-up equipment. In addition to the short-term approach of reducing carbon emissions through vehicle engine tune-ups, special studies will be conducted to support the development of policies and strategies for achieving fuel savings in the long-term. These studies will cover such critical areas as the use of fuel efficient engines, modal shifts, and alternative fuel technologies. The project will rely primarily on market mechanisms and envisages a pivotal role for the private sector in the achievement of both short and long-term project objectives.

On behalf of	Signatures	Date	Name/Title
The Government	 	21 MAY 1996 21 MAY 1996	JAVED TALAT Secretary Economic Affairs Division Government of Pakistan Islamabad (Tel. 220679)
The UNDP			Robert England Resident Representative



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A. Context

Motorisation and its growing use has been a major factor in the increased mobility of people, goods and services, and consequent development and economic progress. While this phenomenon has brought immeasurable benefits, it has not been without deleterious effects. This has been primarily in terms of increased pollutants emitted into the atmosphere from motor vehicle exhausts, congestion, haphazard urban development and land use, oil dependency, and other related problems. A major issue of global concern is the increasing contribution of the transport sector to greenhouse gas emissions resulting from use of fossil fuels, and the consequential global warming and climatic change. World-wide advances in science and technology, and engineering have resulted in improved vehicle and engine design and maintenance technologies, aimed at minimizing fuel use, increasing speed and engine performance as well as enhancing its life. Such advances have also resulted in the application of newer methods to road construction and design, planned urban development, emphasis on cleaner burning fuels, improved means of public transport and related facilities for the transfer of goods and services. The result of this planning, optimization of resources, and application of scientific methods to address the problem of atmospheric pollution as a result of increased use of motor vehicles has generated positive results in industrialized countries, and presented viable options for addressing the problem.

The development and growth of the industrialized world, however desirable, has not been fully replicated in all spheres of socioeconomic activity in developing countries. Even though efforts are evident to duplicate the economic growth patterns of the developed world, the rate of expansion and utilization and development of resources has not occurred in a sustainable manner. While the industrialized countries have been able to create awareness and are currently addressing development-related and environmental issues, the developing world is still primarily concerned with the ever increasing needs of expanding economies. Concomitant with this, the transport sector in developing countries has barely been able to keep pace with the demands of industrialization. Measures to counter the ill-effects of large motor vehicle populations have been, and continue to be, assigned disproportionately low priorities in these countries as their immediate needs to satisfy transportation demands easily overwhelm any organized and planned approach to transportation management that would otherwise be considered appropriate.

The Global Environment Facility (GEF) was established as a cooperative venture among the national governments, the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), and the World Bank, to fund activities that benefit the global environment. "Increasing Fuel Efficiency in the Road Transport Sector" was identified as a viable project under the GEF programme for reduction of emissions of greenhouse gases to control global warming.

1. Description of Subsector

With stagnation in the railways, limited use of air transport due to low income levels, lack of inland waterways and rapid population growth, road transport has become increasingly

important as a means of communication in Pakistan. Between 1981-82 and 1991-92, route kilometers for railways remained unchanged, while total road kilometers increased by 85% and the number of vehicles on road increased by 280%. It is also interesting to note that the production of bicycles in the same period increased by only 20%. This reflects an almost complete dependence on the fuel operated road vehicles to meet the expanding transportation needs of the country. Salient features of the road transport system in Pakistan are discussed in this section.

Vehicle Population, Fleet Composition and Fuel Consumption

Exhibit 1 (Annex I) shows the total vehicle population in Pakistan and estimated growth rates. The two wheelers and motor cars account for 90% of gasoline driven vehicles. In the diesel driven vehicles, trucks account for 34% of the population, followed by station wagons, buses, heavy pick-ups and jeeps with respective shares of 20%, 19%, 15% and 12%. The number of vehicles has been increasing geometrically since the country gained independence in 1947 (Exhibit 2, Annex I), and the rate of growth has averaged at about 11% in the last five years. Although a high rate of population increase is partially responsible for this, the increase in the index of vehicles per capita (Exhibit 3, Annex I) suggests that increased motorisation has also been caused by rising economic prosperity, decreasing average real prices for mass produced vehicles, and, most importantly, inadequate facilities in the public transport sector to cater to the needs of the ever increasing population. The proportionally higher increases in the number of private cars and motor cycles represents a growing trend towards more individualized forms of transport. These trends are reflected in the growth rates for the past five years listed in Exhibit 1 (Annex I). The number of cars and motorcycles has grown at 10.3% and 13.8% respectively. The number of busses has increased at only 4.6%, while smaller passenger carrying vehicles such as light pickups and station wagons have increased at 18.4% and 16.9% respectively. Similarly, trucks have increased at 9.3%, while smaller freight carrying vehicles (heavy pickups) have increased at 18.4%.

Estimates for fuel use by vehicle type are shown in Exhibit 4 (Annex I). Currently, diesel accounts for 72% and gasoline for 28% of the transportation sector energy requirement. These estimates were developed on the basis of data on the number of vehicles on road (Exhibit 1, Annex I), and estimates on activity level in km/year/vehicle and fuel consumption in km/liter (Exhibit 5, Annex I). Calculated figures for fuel consumption were compared with data for the past five years, and were found to agree to within 10%. Gasoline is used mainly by private automobiles which account for about 40% of the demand, followed by 17% by two-wheelers and 13% by taxis. The demand for diesel is distributed by 60% for trucks, 27% for buses, 11% for passenger wagons, and 3% by other light freight vehicles. Projections for fuel use by vehicle type are also included in Exhibit 4 (Annex I), and were developed on the basis of activity targets set in the Seventh Five Year Plan. Passenger traffic is expected to grow at an average of 6% annually, while freight traffic is expected to grow at 8% annually.

Age Distribution of Vehicles

An estimate of age distribution of vehicles is given in Exhibit 6 (Annex I). While the figures in Exhibit 6 (Annex I) are based on a survey conducted in an urban area, they are indicative of the general pattern in the country. The age distribution of vehicles can be characterized as follows:

Automobiles: 48% of the vehicles are less than six years old, 28% are six to ten years old, and 24% are eleven years and older. The large fraction of new cars reflects relatively high income level of urban residents.

Motorcycles/Scooters: Only 25% of the vehicles are less than six years old. This pattern reflects the limited purchasing power of the middle income urban group.

Taxis: About 76% of the vehicles are older than ten years. Older vehicles that cost less and are cheaper to maintain are preferred for use as taxis. This pattern is now rapidly changing with induction of about 40,000 new taxis under a recent Government scheme.

Buses: The predominantly private vehicle fleet is relatively new, with 60% of the vehicles less than six years old. The few remaining government-operated buses for public transport are generally in extremely poor condition.

Trucks: Over 55% of the vehicles are over 10 years old. The freight capacity of new trucks is higher compared to the old models and this has slowed down the growth rate of the number of trucks added each year.

Emission reductions and fuel efficiency improvements are generally difficult to achieve in case of older vehicles. Considering vehicle age alone, private automobiles, taxis inducted into the vehicle fleet recently, buses, and the new high capacity trucks would constitute a target group that would respond to an emission reduction programme.

National Automotive Industry

Local production of vehicles has registered a brisk increase in the country, and the affordable range of domestic vehicles is bringing motor vehicle ownership within the reach of lower income groups previously excluded from this category as well as increasing the number of households possessing two or more vehicles. The Pakistan Automobile Corporation (PACO), under the Ministry of Production, has been the leading local producer of cars and trucks. Buses and trucks are also manufactured by a number of private sector companies. Barring a few exceptions, the engine and the drive train is imported, and most of the remaining parts including the body are manufactured locally. Recently, the car manufacturing unit of PACO has been given under the control of the Japanese licensors. Even though the local production of vehicles is increasing, imported vehicles still satisfy the bulk of the middle- and high-end market demand. Currently, 47% of cars are produced locally, compared to 36% for light carriage vehicles, 63% for motorcycles, and 60% for trucks and buses. Other major vehicle imports consist of motorcycles, agricultural tractors, and light commercial vehicles. In an attempt to address the general inadequacy of urban public transportation in the country as well as improve transport energy utilization, the Pakistan government has reduced taxes on the import of vehicles used for public and freight transport.

The growing local manufacturing capacity in the auto industry is offering an expanding middle class population with a lower cost means of private transportation. Already, demand for automobiles, especially the small-sized locally-produced models, far outstrips their production/assembly capacity in the country. Presently, average annual local production consists of approximately 25,000 automobiles, 2,500 four-wheel drives, 12,000 pickups, 20,000 agricultural tractors, over 60,000 motorcycles, 2,000 trucks, and 500 buses. Against this the current national demand is for 50,000 cars and LCVs, 25,000 tractors, 80,000 motorcycles, and 10,000 trucks and buses per annum.

Technology used in engines installed in locally manufactured and assembled vehicles has considerably lagged behind the prevailing international standards. In an effort to keep the prices of vehicles at a low level, the manufacturers avoid making investments in upgrading the production facilities to produce newer models based on more efficient engine designs. Two-

stroke engines are still used widely in locally manufactured motor cycles. The 800 cc Suzuki passenger car with biggest share of the local market until 1992-93 employed a two valve per cylinder design, compared to three to four valves per cylinder fuel efficient designs incorporated elsewhere in the world. The Bedford truck manufactured locally houses a diesel engine introduced over thirty years back. The engine technology for the bulk of the fleet, including cars less than five years old, cannot therefore be considered as efficient when compared with the state of the art technologies used by the leading car manufacturers in the world. This trend is now changing as competition among the manufacturers has increased and new local assemblers/manufacturers have entered the market with more efficient designs. There is still, however, considerable room for improvement of fuel efficiency of the vehicle fleet through induction of new more efficient engines.

Fuel Type and Quality

Gasoline available in the country is of regular and premium grades. The research octane number (RON) is 80 for regular gasoline and 87 for premium gasoline. The difference in market prices between the two grades is about 15%, which leads to the distributor practice of mixing regular gasoline into the premium grade. The lead content of gasoline is fixed at 0.42 grams per liter (gpl). Regular gasoline is consumed by motorcycles, scooters, three wheelers, and older models of light pickups equipped with two-stroke engines. Over 80% of the motorcycles are equipped with two-stroke engines. Most of the older cars and four-wheel drives (manufactured before 1965) equipped with low compression engines are also run on regular gasoline. The use of regular gasoline is slowly declining, but demand from motorcycles and three wheelers is expected to continue. With increasing demand for premium gasoline, introduction of single grade gasoline of 87 RON is being considered. This is also expected to check the adulteration of premium gasoline with the regular grade. With expected improvements in fuel quality, the fuel efficiency of engines is expected to gradually improve in the long run.

Vehicle Maintenance Practices

The quality of maintenance and upkeep that is accorded to a vehicle not only determines its life span and the frequency of major breakdowns but also its fuel efficiency. Maintenance practices, especially engine tune-ups and rebuilds, in addition, directly affect the level of emissions produced by the vehicle. The standard practice followed in the case of engine rebuilding depends largely on acquired experience and subjective measures rather than machining to specified tolerances and assembly using standard tools and torque wrenches. Approximately one third of the rebuilt engines can be considered as entirely substandard, resulting in high fuel consumption and continued loss of lubricating oil. The general practice in the country is to try to do things in an inexpensive way, with very little regard for quality output. Engine maintenance is generally carried out by technicians who have learnt the trade through on-the-job training, with insufficient educational and technical inputs. They go by the "feel" of the engine. This leads to low levels of consumer confidence in the service industry, and the result is that there is no systematic method of vehicle maintenance.

Simpler maintenance equipment such as computerized wheel balancing and wheel alignment have gained widespread acceptance, and these services are now readily available even in small towns in the country. The use of combustion analyzers and computerized diagnostics for engine tune-ups is very limited.

conservation plans. Activities of ENERCON have included training and education, information, outreach and awareness programmes, technical assistance to public and private sectors in implementation of energy conservation measures, and development of policies and formulation of legislation to support energy conservation. In the transport sector, ENERCON has set up and operated computerized automobile engine tune-up demonstration centres in Karachi, Islamabad/Rawalpindi, and Lahore, prepared and distributed information materials on improving fuel efficiency of road transport vehicles, provided technical assistance to fleet owners in management of fleets to improve fuel efficiency, and developed databases for diagnosis of end use fuel efficiencies of vehicles.

The issue of environmental and ecological damage has only recently gained recognition from policy makers in the Government of Pakistan. In the Ministry of Housing and Works a separate Environment and Urban Affairs Division (EUAD) was created in 1973, and the Environmental Protection Ordinance was promulgated in 1983. Under this Ordinance, the National Environmental Protection Council and the Pakistan Environmental Protection Agency (EPA) were established. The Council's main function is to provide policy guidelines for incorporating environmental protection considerations in the nation's development plans. The EUAD is assigned with the responsibility of making the policies and standards, while the responsibility of execution rests with the Provincial Governments and Provincial EPAs. The Pakistan EPA provides coordination between the Federal and Provincial ministries for policy implementation.

The Hydrocarbon Development Institute of Pakistan (HDIP), under the Ministry of Petroleum and Natural Resources, has been operating an experimental CNG fueling station for vehicles in Karachi since February 1982, and in 1991 opened a CNG station in Islamabad. The HDIP programme in Islamabad plans to convert approximately 2,000 cars, of 800 to 2600 cc engine capacity to CNG use. The Hydrocarbon Development Institute is also conducting a programme to convert diesel buses to CNG for the urban transport system to demonstrate the economic use of CNG. The promotion efforts of HDIP have resulted in attracting a number of private sector companies into the CNG business, with plans for installation of re-fueling stations throughout the country.

B. Project Approach and Justification

1. Problems to be Addressed; The Present Situation

According to The World Resources 1992-93 report of the World Resources Institute, motor vehicles cause more pollution than any other single human activity. They are a major source of a variety of atmospheric pollutants, contributing to nearly one half of the human-caused NO_x , two thirds of carbon monoxide, and about one half of hydrocarbon emissions in industrialized countries. A recent World Bank study concluded that cars in developing countries are 20-30% less fuel efficient than comparable cars in Europe, Japan, and United States because in developing countries vehicles tend to be older, less efficient, and poorly maintained. The emissions of carbon dioxide and NO_x , which are the leading contributors to the global greenhouse effect, are directly related to the fuel use. There is therefore a tremendous potential to reduce the emissions of greenhouse gases through fuel efficiency improvement programs in the developing countries.

In some of the developing countries, the impact of vehicle fleets on the air pollution has already reached an alarming level. In Bangkok, which accounts for 70% of the vehicles registered in Thailand, vehicle registrations grew at 14.6% per annum from 1984 to 1990, and the transportation system of the city is in crisis due to overcrowding. Severe traffic congestion has lead to excessive delays, enormous fuel wastage, and a high level of noise and air pollution. In Pakistan, energy use in the road transport sector has historically grown at a rate of 7.6% and road transport accounts for 47% of commercial fuel use (petroleum products and coal). While the overall situation in Pakistan is not as alarming as that in Thailand, introduction of programs to improve fuel efficiency and reduce vehicle emissions at this stage will greatly help in controlling the emissions of greenhouse gases in the long run, and in preventing the deterioration of air quality to levels harmful for health.

Estimates for the emissions of greenhouse gases and other pollutants from road transport vehicles in Pakistan in the period 1991-97 are summarized in Exhibit 8 (Annex I), which were developed on the basis of number of vehicles on road (Exhibit 1, Annex I), vehicle kilometers and fuel consumption (Exhibit 3, Annex I), emission factors for vehicles in urban centres elsewhere (Exhibit 9), and total vehicle kilometers (Exhibit 10, Annex I). Current level of emissions from road transport vehicles in Pakistan are summarized below:

	<i>Tonnes</i>
<i>Greenhouse gas emissions:</i>	
Carbon dioxide:	13,025,000
Hydrocarbons:	132,000
<i>Other emissions:</i>	
Sulphur dioxide:	64,416
Lead:	632
Nitrogen oxide:	176,000
Carbon monoxide:	914,000
SPM:	107,000

In terms of impact on fuel efficiency, the present policy environment can at best be considered as neutral. Price of petrol is maintained at approximately twice the level of diesel with the objective of maximizing tax revenues. The price of diesel is maintained at a lower level to control the cost of public transportation and freight. There are no comprehensive policies on providing and improving mass transit facilities in major urban centres. The quality of the railroad network and operating efficiency of the railroad system have consistently declined in the past. Improving fuel efficiency as such does not appear as a primary objective in the policies concerning the road transport sector.

2. Project Approach

Possible approaches for improving fuel efficiency and reducing greenhouse gas emissions in the road transport sector can be classified as follows:

Short-term Alternatives:

- Improvement in vehicle maintenance practices
- Improvement in driving practices
- Traffic management
- Improvement in fuel quality
- Rationalization of fuel prices

Medium and Long-term Alternatives

- Introduction of more efficient engines based on existing technologies
- Modal shifts
- Improved design of road and highway networks
- Use of alternative fuels

Introduction of engines with lower carbon emissions based on new technologies

Short-term Alternatives

The main issues, options and implications of the short-term alternatives are discussed individually below:

Improvement in Fuel Quality: A single grade of diesel fuel is sold in the country. The specifications of this fuel are acceptable from the standpoint of engine efficiency. For gasoline engines, a uniform grade of 87 RON is proposed to replace the existing two grade structure of 80 RON (regular gasoline) and 87 RON (premium gasoline). The choice of going to yet higher RON is also available to motorists in major urban centres, where HOBC (high octane blending compound) can be purchased separately to prepare custom blends. With the introduction of single grade gasoline and increasing the role of the private sector in marketing and distribution of fuel products, adulteration of gasoline with lower priced kerosene is expected to diminish with time. Adulteration of diesel is not an issue as the price of diesel is maintained close to that of kerosene, with no incentive left for mixing. In view of the steps already being taken, fuel quality is not expected to be a barrier in improving fuel efficiency of the transport fleet.

Rationalization of Fuel Prices: Gasoline is taxed heavily and the current high market price (\$0.45/litre) provides a strong incentive towards fuel efficiency. Diesel is not taxed in a comparable manner and is priced at about 50% of gasoline, at close parity with international market prices, to encourage its use in public transport. The economic and environmental impact of raising diesel prices has to be carefully examined to develop a rational policy approach towards diesel pricing.

Traffic Management: The National Transport research Centre (NTRC) has been active in testing approaches towards traffic management, and has undertaken several studies and projects to improve traffic management in major urban centres. Additional support to NTRC in this area can be considered.

Driver Training: ENERCON, the National Energy Conservation Centre, has prepared and distributed information on energy efficient driving practices through the media and is continuing to do so. In view of the low literacy levels among drivers in general, the impact of written materials remains limited, but is expected to improve as literacy levels improve in the country.

Improvement in Vehicle Maintenance Practices: Improved vehicle maintenance is an important alternative that offers immediate as well as a sustainable potential for improving fuel efficiency. Within vehicle maintenance, a number of simpler procedures such as wheel alignment and wheel balancing have already gained widespread acceptance. Engine maintenance can be classified into routine, including change of lubricants and filters, and specialized, including engine tuning and re-building. Routine maintenance is well understood by vehicle owners and is supported by a range of quality products and lubricants readily available in the market. Specialized engine maintenance, which requires a higher level of skills and understanding, has lagged behind, and the quality of services available in Pakistan in this area is generally poor. Engine re-building is technologically complex and highly capital intensive, both in terms of facilities required and spares needed, and is applicable to older vehicles only. Engine tuning (or routine professional service aimed at optimizing an engine's fuel consumption and other operational parameters) is therefore identified as an alternative that is implementable, and offers clear-cut incentives on both the service and customer side of the market.

Potential for Fuel Savings Through Instrumented Tune-ups

The potential for fuel savings and reduction of emissions by 1996-97 from the tune-ups of vehicles on the basis of data collected in the ENERCON Auto Tune-up Demonstration Programme, assuming an average sustained level of fuel savings at 6% is included in Exhibit 12 (Annex 1) and is summarized below:

Fuel Saved	359,230	tonnes
Value of Savings	55.48	\$ million
Customer Savings	3,117.04	Rs. million
Reduction in greenhouse gas emissions:		
CO ₂	1,116,000	tonnes
Hydrocarbons	36,000	tonnes
Reduction in other emissions:		
SO ₂	5,588	tonnes
Lead	52	tonnes
NO _x	15,000	tonnes
CO	506,000	tonnes
Suspended particulate materials	30,000	tonnes

Estimate of Market for Tune-ups and Capacity to be Created for Instrumented Tune-ups

The potential market for tune-ups can be estimated on the basis of number of vehicles and average number of tune-ups required per vehicle. Exhibit 1 (Annex 1) shows the total vehicle population of Pakistan and estimated growth rates. The recommended frequency of engine tune-ups is twice a year for gasoline engines, and once a year for diesel engines. Projected market for tune-ups calculated on this basis is shown in Exhibit 13 Annex 1. It is estimated that the current country-wide market for gasoline engine tune-ups is of the order of over 3 million per year and is expected to grow at an average rate of 6% annually for the next five years, while that for diesel tune-ups is currently at 0.23 million per year and will increase at 8% per annum on average over a similar period. These growth rates correspond to the projected growth rates for passenger and freight traffic in the Seventh Five Year Plan.

By the end of the project in 1996-97, the project will have trained some 600 auto mechanics and 360 workshop owners in conducting instrumented tune-ups, and capacity for conducting approximately 540,000 gasoline and 90,000 diesel engine tune-ups annually will have been created. Compared to the total estimated market for the tune-ups as detailed in Exhibit 13, Annex 1, the tune-up capacity to be created by the project is expected to be 13% for the automobile and 27% for diesel vehicles (Exhibit 14, Annex 1). Estimates for costs and benefits at the individual, domestic and global level are discussed below.

Approach Towards Reducing Transport Sector Greenhouse Gas Emissions in the Long-term

The vehicle tune-up demonstration and training programme will develop a market for engine tune-ups based on instrumented engine diagnostics. This approach will lead to a corresponding and immediate improvement in fuel savings and reduction in emissions of greenhouse gases. However, in the long-term a basic shift in the policies is required to benefit from technologies and alternatives that can help the country in developing sustainable, efficient and environmentally sound transport systems and practices.

The areas to be studied will include the following long-term measures recommended:

- a Introduction of more efficient engines based on existing technologies
- a Modal shift
- a Introduction of alternative fuel technologies
- a Introduction of engines based on alternative technologies

The scope of the studies will include:

- a Technical policy studies
- a Economic and financial policy studies
- a Tax and trade policy studies
- a Policies for technological development and transfer

These studies will include pre-investment and pre-feasibility analysis and will lead to identification of possible future joint ventures in the transport sector that could be established with the participation of the public and private sectors for addressing specific environmental and energy issues in the road transport system of the country.

The results of the special studies will be presented and discussed in dissemination workshops, with participation from policy makers, transport and vehicle maintenance sector. Recommendations of the studies and comments of the workshop participants will be compiled to provide inputs to the policy making process.

3. Incremental Costs and Benefits

The project will provide benefits at various levels. The vehicle owners will benefit from fuel savings and lower fuel bills. The workshop owners will benefit from the increased business in vehicle maintenance. The country will benefit from reduced fuel imports. The global environmental benefits will be in the form of reduced greenhouse gas emissions. Incremental costs and benefits at these levels are discussed below.

Incremental Costs and Benefits for the Vehicle Owners

At present, the cost of a non-instrumented tune-up for a gasoline engine is in the range of Rs. 50 to 60. While car manufacturers normally recommend a tune-up once every six months, the

general practice is to limit the tune-ups to about once a year. This reflects the low level of customer confidence in the non-instrumented tune-ups offered by the service industry. The price of an instrumented tune-up for gasoline engines is estimated at Rs. 150. This amount is being charged by a few workshops in the country that offer instrumented tune-ups, and takes into account the investment required in equipment and training for the instrumented tune-ups. For an individual vehicle owner the savings and return on investment in an instrumented tune-up are estimated as follows:

Average vehicle usage	15,000	km/year
Average fuel consumption	10	km/liter
Price of fuel	14.28	Rs./liter
Fuel cost	21,420	Rs./year
Savings @ 6% of fuel	1,285	Rs./year
Cost of instrumented tune-ups, 2 per year @ Rs. 150/tune-up	300	Rs./year
Baseline cost of non-instrumented tune-ups	55	Rs./year
Incremental cost to the vehicle owner	245	Rs./year

For an incremental annual cost of Rs. 245, annual savings for an individual car owner are estimated at Rs. 1,285. The above figures indicate a strong financial benefit for the car owners for switching to instrumented tune-ups.

For diesel engines, the tune-up presently is limited to servicing injectors of the fuel pump, and includes repair and calibration of injector nozzles. Vehicle owners and mechanics depend on their feel for engine performance to decide if the injectors need servicing. Typical practice is to get the nozzles serviced and calibrated once a year. The performance of the engine is not measured, before or after nozzle calibration. Servicing of the fuel pump is conducted once in two to three years, or when the engine is overhauled. Servicing of fuel pump includes calibration of injector nozzles, in addition to replacement of worn down parts of fuel pump. Charges for these services are summarized below:

	<i>Small Engines</i>	<i>Large Engines</i>
Small workshops	40	80
Large workshops	60	150

The larger workshops charge higher prices as they mostly use imported testing equipment for calibration of nozzles. Taking the average of charges for injector servicing for the large and small workshops, average cost of tune-up is estimated at about Rs. 80 annually.

For diesel engines, instrumented tune-up consists of evaluation of the engine performance under dynamic load conditions, combined with exhaust analysis using a smoke meter. The diagnosis is followed by calibration of injector nozzles if needed, or a complete overhaul of the fuel pump. At present, a few large workshops have diesel test benches available, but field surveys indicate that the test equipment is usually not in operating condition. Based on discussions with the workshops, the cost of engine diagnosis on the test bench is estimated at Rs. 500. Most of the smaller workshops use locally made test equipment for testing and calibration of injector nozzles, and charge an average of Rs. 60 for this service (Rs. 40 for small engines and Rs. 80 for large engines). It is not possible to maintain quality control using locally made testing equipment. Quality service for calibration and repair of injector nozzles requires standard testing equipment which has to be imported. Average cost for calibrating nozzles using imported test equipment is estimated to be closer to the prices charged by the larger workshops for this service, and is estimated at Rs. 105 (Rs. 60 for small engines and Rs. 150 for large engines). Total cost of engine diagnosis and proper servicing of injectors is thus estimated at Rs. 605, including Rs. 500 for engine diagnosis and Rs. 105 for servicing of injectors.

Incremental costs and benefits for owners of diesel vehicles are estimated as follows

Average vehicle usage	56,500	km/year
Average fuel consumption	3.72	km/liter
Price of fuel	6.40	Rs /liter
Fuel cost	97,204	Rs /year
Savings @ 6% of fuel	5,832	Rs /year
Cost of instrumented tune-ups, 1 per year @ Rs. 605/tune-up	605	Rs /year
Baseline cost of non-instrumented tune-ups	85	Rs /year
Incremental cost to the vehicle owner	520	Rs /year

For an incremental annual cost of Rs. 520, annual savings for an individual vehicle owner are estimated at Rs. 5,832. As in the case of car owners, the above figures indicate a strong financial incentive for the owners of diesel vehicles for switching to instrumented tune-ups.

Incremental Costs and Benefits for Workshop Owners

Workshop owners are presently charging in the range of Rs. 50 to 60 for a gasoline engine tune-up. The price of an instrumented tune-up for gasoline engines is estimated at Rs. 150, accounting for investment required in equipment and training for the instrumented tune-ups. For an individual workshop owner the savings and return on investment in an instrumented tune-up based on a Level II electronic engine analyzer are estimated as follows:

Daily tune-up capacity based on one analyzer	20	tune-up/day
Average number of tune-ups per day	15	tune-up/day
Average operating days per year	300	days/year
Number of tune-ups per year	4,500	tune-up/year
Additional revenue per tune-up (Rs. 150-55)	90	Rs /tune-up
Additional revenues per year	405,000	Rs /year
Cost of Level II analyzer (\$15,400 + 30% taxes @ Rs. 30/\$)	600,600	Rs.
Additional cost of maintenance and operation @ 15% of capital cost	90,900	Rs.
Gross profit per year (Rs 405,000-90,900)	314,100	Rs./year

For an investment of Rs. 600,600, gross profit for an individual workshop owner is estimated at Rs. 314,000. The above figures indicate a strong financial benefit for the workshop owners for offering instrumented tune-up service.

Annual cost of financing is estimated at 20% of the cost of equipment or Rs. 120,100 per year, keeping in view the current lending rates of the banks. Including the cost of maintenance and operation, annual fixed costs are estimated at Rs. 211,000. Break even level of business on this basis is estimated at about 8 tune-ups per day.

For diesel engines, average charges for a non-instrumented tune-up are estimated at about Rs. 80. Total cost of instrumented engine diagnosis and proper servicing of injectors is estimated at Rs. 605, including Rs. 500 for engine diagnosis and Rs. 105 for servicing of injectors. Incremental costs and benefits for owners of diesel workshops are estimated as follows:

Daily tune-up capacity based on one analyzer	12	tune-up/day
Average number of tune-ups per day	9	tune-up/day
Average operating days per year	300	days/year
Number of tune-ups per year	2,700	tune-up/year
Additional revenue per tune-up (Rs. 605-80)	525	Rs./tune-up
Additional revenues per year	1,417,500	Rs./year
Cost of Level II analyzer (\$78,000 + 30% taxes @ Rs.30/\$)	3,042,000	Rs.
Additional cost of maintenance and operation @ 15% of capital cost	456,300	Rs.
Gross profit per year (Rs 1,417,500-456,300)	961,200	Rs./year

For an investment of Rs. 3,042,000 gross profit for an individual workshop owner is estimated at Rs. 961,200. Average number of tune-ups both for gasoline and diesel engines have been conservatively assumed at about 75% of the capacity. The workshop owners will also get additional business by attracting new customers, which will further increase the profitability of their operations.

Annual cost of financing is estimated at 20% of the cost of equipment or Rs. 608,400 per year, keeping in view the current lending rates of the banks. Including the cost of maintenance and operation, annual fixed costs are estimated at Rs. 1,064,700. Break even level of business on this basis is estimated at about 7 tune-ups per day.

Incremental Costs and Benefits for the Country

In the baseline situation, there is no investment being made in the instrumented tune-ups. There is therefore no baseline cost, and C_b is 0. Total cost of the project, is \$7.00 million, which is the alternative capital cost. Assuming annual operating and maintenance cost at 15% of the equipment component of \$3.94 million (\$3.00 million under the first cycle of revolving loan fund and \$0.94 million through the demonstration and training centres), operating costs for an equipment life of fifteen years are estimated at \$4.50 million. A discount rate of 10% is assumed. Total cost of the project, C_a , is therefore estimated at \$11.50 million.

Data on fuel savings and emission reductions resulting from non-instrumented tune-ups in the base case is not available. Estimates for improvement in fuel efficiency and reduction of emissions at the end of the project period in 1996-97 reported in Exhibit 15 in Annex 1 are summarized below:

Savings in gasoline	12,929	tonnes/year
Savings in diesel fuel	71,300	tonnes/year
Value of savings at domestic market prices	623	Rs million/year
Value of savings at import prices	13.22	\$ million/year

Assuming an equipment life of fifteen years, and assuming a discount rate of 10%, domestic benefits (Db) are estimated at \$100.55 million.

The above figures are based on measurements made after instrumented tune-ups were conducted on the existing vehicles which had been subjected to non-instrumented tune-ups according to the prevailing market practice. These estimates were appropriately discounted for deterioration in vehicle performance between two consecutive tune-ups, and therefore represent incremental benefits from the project.

In addition to financial and economic benefits associated with fuel savings, there will be reduction in emissions of other pollutants which will help in improving the air quality at the local level. These are:

	<i>Tonnes/year</i>
Sulfur dioxide	1,478
Suspended particulate matter	5,342
Carbon monoxide	67,000
NOx	3,912

4. Global Benefits and Rationale for GEF Support

The development objective of increasing fuel efficiency in the road transport sector and reducing exhaust emissions was identified as one of several proposed funding projects under the World Bank/UNDP Global Environment Facility (GEF) programme by a visiting mission of the UNDP who, together with a local consultant, visited several concerned agencies in Pakistan for a first-hand assessment of the feasibility and potential benefit of each of the proposed activities.

The rationale for GEF support for this project is specifically provided for on the basis of a short term approach to emissions reduction in the transport sector which has as its main objective the buying down of carbon in the immediate term. This approach is fully consistent with UNDP/GEF strategy for interventions in the climate change focal area from the pilot phase and the guidance provided by STAP. However, the project also provides for medium and longer term strategic approaches to emissions reduction, for which the project will establish a revolving loan fund for financing of investments in emission reduction technologies, and undertake special studies to address strategic issues such as modal shifts in transportation, and switch to alternate fuel technologies.

Estimated reduction in emissions from the project at the end of the project period in 1996-97 are given in Exhibit 15 in Annex 1, and are summarized below:

	<i>Tonnes/year</i>
CO ₂	262,040
Hydrocarbons	5,659

Taking equivalency factors of 1 for carbon dioxide and 11 for hydrocarbons (assumed to be same as that for methane), annual reduction in emissions in equivalent weight of carbon dioxide are estimated at 0.32 million tons. Assuming equipment life of fifteen years, global benefits in terms of equivalent weight of CO₂ are estimated at 4.86 million tonnes.

Incremental costs and direct benefits for the project are summarized in the Table below:

	<i>Total Cost (million \$)</i>	<i>Domestic Benefits (mill \$ at import prices)</i>	<i>Global Benefits (million T CO₂ equivalent.)</i>
Alternative (instrumented tune-ups)	11.50	100.55	4.86
Baseline (non- instrumented tune-ups)	0.00	0.00	0.0
Incremental	11.50	100.55	4.86

The above estimate of 4.86 million tonnes of carbon dioxide is associated with incremental project investment of \$ 11.50 million, which consists of equipment cost of \$ 3.94 million, expenses incurred on project management, and training and awareness programmes, and cost of maintenance and operation of the equipment. The project will encourage even greater benefits in the following years by helping to finance additional tune-up stations in the private sector from a proposed revolving loan fund of \$ 3.00 million to be set up during the project and by encouraging a preference for proper instrumented tune-ups in the country. While it is difficult to predict the disbursement rate in the later years, keeping in view the combined impact of training and awareness programmes and availability of capital, reduction in carbon dioxide emissions can be conservatively doubled from 4.86 million tonnes to about 10 million tonnes over a period of fifteen years.

Over the long term, through the special studies and technical assistance, the project will provide strategic inputs for reduction of greenhouse gas emissions and fuel efficiency improvements to the government agencies involved in transport sector planning, fuel use, vehicle inspection and emissions control. This will result in introduction of technologies and practices that will lead to sustained patterns of lower greenhouse gas emissions.

5. Target Beneficiaries

The benefits of this project will accrue to the environment in the form of a dampened growth of vehicle exhaust emissions of greenhouse gases and other pollutants into the atmosphere. As a result of reduction in vehicle emissions, air quality will improve and there will be a direct effect on the health of the general population in the short run. In the long run, dampened growth of greenhouse gas emissions will help in controlling the present trends towards global warming. Thus, the main impact of the project will be improved quality of life.

Possibilities of type of businesses where the tune-up demonstration centres can be located are as follows:

1. Individually owned existing workshops.
2. Authorized workshops of vehicle manufacturers and distributors.
3. Workshops attached to petrol stations owned by oil marketing companies or operating under franchise of oil marketing companies.
4. Individually owned new workshops.

The six tune-up demonstration centres operated under the ENERCON Tune-up Demonstration Programme were set up in individually owned existing workshops. The ENERCON programme concentrated on building awareness among the vehicle owners, and the role of workshop owners in providing and maintaining quality of service was ignored. The programme was therefore not very successful in maintaining quality control and promoting awareness among workshop owners.

To enhance the impact of the project, location of centres in authorized workshops of vehicle manufacturers and distributors and workshops attached to petrol stations associated with oil marketing companies offer special advantages. Instrumented tune-ups can be offered as a standard part of the after sales service offered by the major manufacturers and distributors through their customer service network in the country. Similarly, the oil marketing companies can strengthen their position and image in the market by offering an instrumented tune-up service to their customers. It is expected that the vehicle manufacturers, distributors, and the oil marketing companies will incorporate quality tune-up service into their marketing strategy. They will maintain the quality of the service through their franchise agreements and established quality control systems, in the interest of providing better service to their customers. Discussions with the Indus Motor Company, manufacturers and distributors of Toyota cars in Pakistan, and Shell Pakistan indicate a strong interest on the part of these companies to participate in tune-up training and demonstration programme. While this approach offers definite advantages, it is important that the training be made freely available and accessible to all workshops and mechanics including those at the lower end of the market, irrespective of their affiliation or association. Guarantees to this effect can be included in the agreements with the workshop owners and companies under which the tune-up training and demonstration centres are set up.

Establishment of demonstration centers in new workshops is not advisable as the coverage with respect to vehicle owners will be limited, and facilities required for operating the training programme such as class room space is not likely to be adequate. Lack of experience of such workshops in providing customer services can also increase the risk in maintaining quality of service offered to the customers. However, financing for purchase of tune-up equipment can be offered to the owners of new workshops under the revolving loan fund. The risks would also be lower as the demonstration programme by then would have created a market for the instrumented tune-up service, and a pool of skilled technicians trained under the programme would be available.

The tune-up demonstration centers will be located in the major cities of the country to provide adequate regional and population coverage, and to serve the major vehicle population and maintenance centres in the country. As the market gets established and skills to operate the

tune-up equipment are developed, diffusion into smaller cities is expected through financing under the revolving loan fund.

Selection of Participating Workshops

The selection of participants for Phase I of the project will be based on standard criteria, such as those used by ENERCON for similar programmes in the past. These include:

1. The interest of prospective candidates or companies in the programme.
2. Their financial strength and credit worthiness as certified by their respective banks.
3. Their management capabilities to institute and maintain quality control.
4. The number and technical capabilities of personnel employed by them, and their ability to handle sophisticated electronic equipment.
5. The infrastructure and facilities in the shape of building space and support equipment available with them.
6. Their location and its suitability for the proposed services as well as ease of access to potential vehicle-owning clients.
7. The volume of business presently handled by them as an indicator of the possibilities for market penetration offered by them.
8. Their willingness to share costs on publicity and awareness campaigns.
9. The likelihood of the workshop to acquire demonstration equipment under the loan programme at the end of the demonstration period.

To ensure fairness and broad participation in the selection process, the programme will be advertised through the newspapers. The process of selection will be designed to ensure that each station supported directly will lead to the purchase of instrumented tune-up equipment by other stations in the private sector. The selection plan will involve a bidding process which will also document the amount of financing to be contributed by the participating stations. The selection will be entrusted to a Project Advisory Committee with representation from ENERCON and UNDP/GEF.

Type of Equipment to be Used

The equipment recommended for tune-up centers for gasoline engines can be classified into the following three categories based on the level of sophistication and price:

- | | |
|------------|---|
| Level I: | Computerized diagnostic equipment for "intelligent" analysis. |
| Level II: | Computerized diagnostic equipment for automatic analysis. |
| Level III: | Electronic diagnostic equipment. |

The above three categories of equipment will cater to different segments of the market. Level I equipment is designed for major garages and authorized distributors and service agents for the well known makes of vehicles. The non-intelligent and less expensive Level II and Level III

type of equipment will be suitable for the owners of smaller workshops with limited financial resources and business volume, who will have the option of procuring under the revolving loan fund in the Phase II of the project

The proposed tune-up training and demonstration centers to be set up will include Level I type of equipment. Level I or "Intelligent" analysis involves adjustment of original engine specifications to compensate for wear of the engine. Tune-up specifications as provided by the manufacturers of vehicles are applicable to new engines. As the vehicle is used, deposits build up and clearances increase as the parts wear down, and tuning a used vehicle to the original manufacturers specifications does not give optimum results. It is common for the customers to complain that the engine performance is not adequate, and the results obtained from the instrumented tune-up are no better compared to those from the ordinary non-instrumented tune-up. Level I type of equipment is increasingly being used worldwide and is gradually replacing the older type of diagnostic equipment. Data gathered through the use of level I type of equipment will be used to develop tune-up specifications for older vehicles. The specifications thus developed for older vehicles will serve as guidelines for mechanics and operators using Level II and Level III type of equipment.

The equipment for the diesel demonstration stations is more expensive and requires a higher level of expertise for operation. An approach of introducing equipment of varying level of complexity as in the case of gasoline tune-up equipment is not possible for the diesel equipment. The performance of the diesel engine will be assessed on the diesel test bench, followed by a measurement on the smoke meter to get an indication of the level of emissions. On the basis of problems diagnosed on the diesel test bench, the performance of the diesel pump and the injection nozzles will be evaluated on the diesel pump tester and the injection nozzle tester respectively.

Quality Assurance and Control

As elaborated in Section B.2 "Incremental Costs and Benefits for Vehicle Owners", in case of gasoline engines an incremental annual investment of Rs. 245 in instrumented tune-ups results in incremental fuel savings worth Rs. 1,285. In case of diesel engines, the incremental savings are estimated at Rs. 5,832 for an incremental investment of Rs. 520. These rates of returns are sufficiently attractive in themselves to generate a strong demand for instrumented tune-ups. Assuming that the instrumented tune-up service is readily available and the customer awareness is adequate, the response of the customers and the demand for instrumented tune-ups in the long run will depend on the reliability of service provided by the workshops offering instrumented tune-ups. Quality assurance and reliability have been incorporated as an integral part of the project, through a strong emphasis on training, and active supervision during the initial stages of the project. Since the engine maintenance services are primarily provided by the private sector in the country, the project is designed to involve the private sector in all the stages of implementation. This will strengthen the service capabilities in the private sector, and develop a base that is critical for sustaining the capabilities in the long run.

Financial Terms for Participation in the Demonstration Programme

Participating firms will be required to make an initial payment of 20% of the value of the equipment towards the cost of the machine, being provided and another 30% on half-yearly payment basis. The deposit will be refunded after the completion of the demonstration programme, and the participating firms will be given the option to purchase the equipment under the revolving loan fund provided they meet the criteria of the lending institutions. A

suitable depreciation allowance, in the range of 15% to 20% will be applied on the initial value of the demonstration equipment.

Pricing of Tune-ups During the Demonstration Phase

The amount charged by the workshop for the tune-up will be regulated to account for the cost of the equipment provided to the workshop owner under the project. In this manner, the price of the tune-up demonstration for the customers will be reduced, which will help in developing the market for instrumented tune-ups.

Selection of Equipment Suppliers

Equipment to be used in the demonstration centers will be selected in consultation with the participants from more than one supplier in order to encourage competitiveness in terms of features and prices and avoid the possibilities of unfair advantages which might hamper the subsequent growth of this service sector. The suppliers will also be required to provide operator training and assistance for quality control, and maintain a stock of essential spares as a condition for selection.

Balance of Diesel and Gasoline Capacity

Demand for diesel fuel in the transport sector in 1993-94 is estimated at 3.5 million tonnes, compared to 1.4 million tonnes for gasoline. In view of this demand pattern, the project is designed with an emphasis on diesel vehicles. The project aims to develop a capacity to cover 13% of the gasoline tune-up market and 27% of the diesel tune-up market in the first three years of the project. A total of five tune-up demonstration and training centres are proposed for diesel vehicles, and 10 for gasoline vehicles, and a similar pattern is expected in the equipment to be purchased under the revolving loan programme. Gasoline engines require two tune-ups in a year, while for diesel vehicles one tune-up a year is sufficient. The number of diesel vehicles is less than that of gasoline vehicles, so even with half the number of stations a higher level of market penetration is achieved. Furthermore, equipment for one gasoline tune-up station costs \$26,000, while that for a diesel tune-up station costs \$ 78,000.

Design and Management of Training Programme

Training programmes will target garage owners and mechanics with the intent of creating a managerial and technical skill base required for the Tune-up Demonstration and Training Programme. The training programmes for garage owners will focus on development of skills needed for managing engine tuning business. For the mechanics, the focus will be on developing technical skills. Salient features of training programmes to be offered are discussed below.

Design of Training Programmes

The Tune-up Demonstration and Training programme relies on the participation of garage owners and filling stations on whose premises the tune-up centres will be established. The garage owners and filling stations are also potential borrowers from the revolving loan fund proposed for financing of procurement of engine tune-up equipment by the garage owners and filling stations. The participation of garage owners and filling stations is therefore critical for the success of the first phase of the project. A series of two-day workshops will be held in the demonstration centres in which garage owners and filling stations will be educated on the benefits of using instruments and diagnostic equipment and to publicize the programme's

various elements. The garage owners will also be trained in the business aspects of the tune-up business, covering evaluation of the profitability of investments in engine tune-up services, marketing strategies, customer handling, and quality control. These workshops will aim to involve the garage owners in the programme at an early stage.

The workshops for garage owners and filling stations will be followed by a series of three-week courses for mechanics which will cover basic motor vehicle engine functioning, understanding of engine performance specifications, evaluation of engine performance, procedures for conducting tune-ups, and procedures for the use of electronic and computerized equipment for tune-ups. These mechanics will form the initial pool of skilled labour that will be used in operation of the equipment at the demonstration centres, and at the workshops that obtain the equipment through the revolving loan fund.

Phasing of Training Programmes

A diesel and a gasoline tune-up demonstration centre will be first set up in Islamabad. The expatriate quality control supervisors will initially conduct "training of the trainers" at these centres in which a core group of the project staff will be trained in the use of the tune-up equipment. This phase of the project is expected to be of critical importance in product development, testing and trouble-shooting, before the service is introduced on a nation-wide scale. Close supervision by the expatriate quality control supervisors will ensure that the tune-up service is introduced into the market in a sound manner. Subsequently, the quality control supervisors and the trained staff will monitor the quality of service in demonstration centres to be set up in other cities. Limited assistance in setting up quality control systems and monitoring will also be provided to the centres set up under the revolving loan programme.

Awareness Campaign

A nation-wide publicity and awareness campaign aimed at vehicle owners will be launched parallel to the establishment of the tune-up demonstration centres. The purpose of the campaign will be to develop the market for instrumented tune-ups. The campaign will be based on information materials and media messages to inform the vehicle owners on the benefits of instrumented tune-ups. Vehicle distributors and oil marketing companies will be involved in these campaigns and their retail outlets will be used for distribution of information materials. Possibilities of cost sharing with participating vehicle distributors and oil marketing companies will also be explored.

Establishment and Operation of Revolving Loan Fund

The revolving loan fund will be managed by private commercial banks and leasing companies in Pakistan. The fund should be considered as part of a programme to promote the automobile services industry and not just providing capital. The financial institutions should therefore, have a developmental output consisting of providing finance as well as required technical assistance. The following is a list of financial institutions which may be considered along with other likely to be contenders for management of the revolving loan fund.

Banks:

Muslim Commercial Bank

Allied Bank

Leasing Companies:

Orix Leasing Pakistan

Development Finance Institutions:

Regional Development Finance Corporation

Small Business Finance Corporation

The above organizations have interest and experience in handling small loans. Detailed discussions were held with Orix Leasing Pakistan and Muslim Commercial Bank. Orix Leasing Pakistan is presently managing the Microenterprise Project financed by the World Bank (\$26.0 million) and co-financed by the Government of Netherlands (\$2.8 million). Muslim Commercial Bank has recently been privatized, and is interested in diversifying its lending portfolio. Special aspects of the revolving loan fund are discussed below:

General Administrative Arrangements: Grant for the revolving loan fund will be provided to the Government. The Government will on-lend the loan through an administering institution (e.g. Bankers Equity Ltd.) to eligible banks and leasing companies according to a rate to be agreed upon between the Government and the UNDP/GEF. The administering institution will be allowed approximately 0.5% per annum for administration cost.

Interest Rates and Repayment Periods: It is envisaged that all the lending will be on commercial terms, and no subsidies will be provided. The workshop owners in the country generally do not have access to capital, and it is expected that availability of credit will greatly accelerate the adoption of advanced engine diagnostic technologies by the private sector. Multi-tiered interest rate structures are not recommended as experience shows that the lending agencies come under strong pressure to lend at lower interest rates, which results in inefficient use of capital and high rate of losses. The interest rates presently applicable for commercial loans are 18% to 20%, with an additional mark-up of 7% for leasing. The Project Advisory Committee will have the authority to conduct the discussions and to finalize the interest rates at which the funds will be lent to the prospective borrowers. The interest rates will be established taking into account the opportunity cost of capital, administrative costs, provision for losses, and provision for generating net annual surplus for growth of the fund. Re-payment periods will range from three to five years, depending on the size of the loan.

Selection of Banks and Leasing Companies: The administering institution will ensure that the participating banks and leasing companies have:

1. A sound organizational structure suited for managing a large number of relatively small value loans or leases in a cost effective manner.
2. A marketing apparatus geared to addressing the lease financing needs of an informal class of enterprises.
3. Strategic corporate objectives that are compatible with the objectives of the Project.

Lending Criteria: The criteria to be followed by the banks and leasing companies, based on present practice and banking regulations should require that:

1. For loans above \$17,000, in addition to collateral, present banking regulations require the borrowing organization to maintain audited book of accounts.
2. The concern should be profitable and have an operating history of three years.
3. New concerns should submit a feasibility report with income projections for at least three years.
4. The assessment of the profitability of concern will be made by the banks or leasing companies through a thorough review of the accounts.
5. If the company does not maintain the accounts, as is often the case with small borrowers, the banks or the leasing companies as part of their credit marketing programmes will assist the companies in formalizing the accounts.
6. A 10% advance deposit of the total cost, a front end evaluation and processing fee of 1%, and rental payments on monthly basis.
7. The equipment and machinery shall be purchased at a reasonable price, taking into account other relevant factors such as time of delivery, efficiency and reliability of the goods, and availability of maintenance facilities and spare parts. ENERCON, through the Project Advisory Committee, can provide an approved list of manufacturers and suppliers.
8. The workshop owner and the mechanics of the borrowing concern should have attended training courses offered by ENERCON, or equivalent courses offered by elsewhere by the suppliers of machinery and equipment.
9. The lessee will maintain insurance on the equipment leased.
10. The responsibility of recovery of loans will be that of the lending institutions who will also determine the eligibility of the candidates.

Limits on Loan Amounts: Upper limits for the size of the loans will be established keeping in view the prevailing market prices. In general, the size of the loans may range from about \$8,000 for Level III type equipment for gasoline tune-ups to \$78,000 for a complete set of equipment for diesel tune-ups.

Special Studies

Special studies will be conducted in collaboration with other organizations associated with the road transport sector. These studies will build upon the experience and resources made available by the project in areas of concern to road transport vehicles in Pakistan and will be aimed at putting the information gained through specific project activities to subsequent use in planning, policy and legislation formulation, and market evaluation for the sector. Specifically, the studies will be conducted with the following objectives:

- a. To collect baseline data and information required for policy analysis.
- a. To develop and test policies and economic incentives for promotion of fuel efficiency.
- a. Capacity building, education and training in the design and implementation of economic incentives.

- a Creation of awareness in the government and general public on the nature and benefit of economic incentives.

Depending on the type of the study, technical assistance will be obtained from or provided to these organizations to support this and other projects on improvement of fuel efficiency and reduction of emissions. The results of the studies will be discussed in seminars and roundtables with participation from the business, government and general public with a view to provide input to policy formulation and implementation. Following is a list of some of the organizations that are likely to participate in conducting the studies and developing policy recommendations. A brief description of the scope of activities of these organizations is also included.

- a The Federal and Provincial EPAs: The Federal EPA has the responsibility for setting up vehicle emission standards and enforcing them in the Federal Capital Territory. The Provincial EPAs are responsible for enforcing the standards in the provinces.
- a National Transport Research Center (NTRC): NTRC, in the Ministry of Planning and Development, compiles statistics and conducts research on vehicle fleet characteristics, traffic volumes, and traffic planning.
- a The Energy Wing, Ministry of Planning and Development: The Energy Wing is responsible for short- and long-term energy planning, and development of energy policy. The Energy Wing also compiles statistics and conducts studies on energy demand and supply at sectoral and sub-sectoral levels.
- a National Logistics Cell (NLC): NLC is a part of the Army, and operates the largest fleet of freight vehicles in the country for moving basic commodities such as food grains, fertilizer, and oil products. The NLC has an organized maintenance base that can be used for development of model fleet management programmes for the trucking industry in the country.
- a Sustainable Development Policy Institute (SDPI): SDPI is an independent NGO engaged in investigating and analyzing policy issues and preparing recommendations for environmentally sound development strategies.
- a Motor Vehicle Examiners: Motor Vehicle Examiners are responsible for checking the road worthiness of vehicles.
- a Pakistan Automobile Corporation (PACO): PACO, under the Ministry of Production, owns several automobile, bus and truck assembly units, and is responsible for bulk of the local production of vehicles.

A list of studies was proposed by participants of the round table meeting held on November 30, 1992 to discuss the project and to solicit inputs from organizations concerned with fuel efficiency in the road transport sector. Based on the suggestions of the participants, the following is a list of proposed study areas:

- a Evaluation of efficiency of engines used in local manufacture and assembly.
- a Rationalizing the price of diesel to remove disincentives for improving efficiency and to account for environmental impacts of fuel wastage.

- Options for introduction of advanced engine technology in local manufacture and assembly of vehicles.
- Assessment of current levels of fuel efficiency in the road transport sector
- Setting up a framework for establishment of fuel efficiency and emission standards and targets for road transport sector
- Evaluation of local engine re-building practices.
- Evaluation of local engine maintenance practices.
- Impact of fuel quality on fuel efficiency.
- Study of economics of current vehicle operating and maintenance practices.
- Fleet audits and technical assistance for implementation of fleet management programs.
- Fuel cells

Participation of Consultants

Relevant consultants will be hired for carrying out activities requiring skills and resources beyond the present capabilities of ENERCON. These consultants, comprising of firms/individuals with experience of implementing programs of a similar nature and having familiarity with the local automotive maintenance and transport industry, will carry out activities in close collaboration with ENERCON and other government ministries and agencies concerned. Preparation of information materials and design and implementation of publicity campaigns will be subcontracted to companies specializing in providing such services. Subcontracting arrangements will also be used in conducting special studies, and will be used as a mechanism for providing special assistance to government and private organizations towards meeting the broader objectives of the project.

Alternative Project Strategies

An alternate strategy would have involved the setting up of new instrumented demonstration centers from the funds available rather than placing them within existing workshops and garages. Such a scheme would entail several serious drawbacks owing to the fact that the centers, being funded entirely from grant funding, would have to be established and operated by the Government. Not only would this result in greatly increasing the initial capital investment needed to provide all the associated facilities, such as land, buildings, and personnel, but would also create problems in providing adequately trained and motivated staff to offer quality service on a long-term basis given the Government's restrictive employment terms. Most importantly, such a strategy would completely by-pass the private sector, whose willingness and ability to participate is essential in transforming the character of the local maintenance industry which it dominates.

The possibility of involving institutions owning large fleets of vehicles was also examined. Large vehicle fleets exist mainly in the public sector, and examples are city and inter-city transport systems, and National Logistics Cell. Taxis are generally individually owned in Pakistan, and car hire firms account for a very small population of the vehicle fleet. Trucks

are mostly individually owned, and there are a very few large fleets of trucks and buses in the private sector. Experience in the ENERCON programme and another programme to promote fuel savings (the CNG project of HDIP) indicates that such vehicle fuel saving programmes are not successful in public sector institutions. The public sector organizations usually do not operate on commercial basis, and the standard of maintenance is generally poor. In the private sector, the financial benefits are expected to generate market interest.

7. Reasons for Assistance from UNDP

The field of environmental protection figures prominently in the UNDP's Governing Council theme areas and the proposed project corresponds sufficiently with the UNDP's development assistance priorities. UNDP support for environmental projects can be gauged from the fact that it has played an advocacy role in environmental protection and been an active supporter in the formulation of the NCS for Pakistan. In partnership with the Government, IUCN and IIED, UNDP has helped in the preparation of the Pakistan report to UNCED and will provide support in building capacity to implement Agenda 21. The Fifth UNDP Country Programme for Pakistan explicitly commits "support to the management of the environment and natural resources in accordance with the National Conservation Strategy." Specifically, UNDP cooperation will be focused on national initiatives directly related to natural resource management, energy efficiency improvements, and stemming the production of environmental pollutants.

While the National Conservation Strategy adopted by the government includes fuel efficiency improvements in all sectors as a very desirable objective, there is a shortage of capacity, particularly qualified manpower, to undertake such development related projects. In such instances Pakistan has sought the cooperation and support of multilateral agencies to provide the necessary technical assistance and funds.

Thus, the proposed project closely follows UNDP's preferred strategy for cooperation, i.e. the channeling of assistance for the development of national programs in the theme areas, mobilizing and coordinating donor inputs, and development of management systems required to coordinate implementation and monitoring and evaluation of such programs. The Fifth Country Programme aims to concentrate UNDP assistance to a smaller number of key programs, and the proposed project qualifies on this account as well: it represents the only planned project activity of its kind in Pakistan in the important area of transportation-related environmental and energy issues and can go a considerable distance in focusing the attention of the government, market forces, and individual motorists on the potential monetary and material rewards of an efficient transport machinery. Thus the project will help define and promote this sector as a critical element in sustainable development planning, a vital concern of the UNDP's future development assistance strategy.

8. Special Considerations

One of the main outcomes of the proposed project will be a reduction of the contribution of motor vehicle exhausts to atmospheric pollution. On the local level, this would constitute a necessary step in protecting the environment against potentially harmful combustion products, and on a global level it will help mitigate the threat of global warming by reducing the emission of greenhouse gases such as carbon dioxide.

The project aims to achieve this by involving the vehicle maintenance business, essentially a small-scale industry, consisting of largely self-owned garages and workshops in the private

sector. At the outset a series of workshops and demonstrations will be conducted to educate their workers on proper tune-up and diagnostic techniques and to encourage them to use such methods by facilitating their access to financing of investments in the equipment. For this purpose, several tune-up and demonstration centers are to be set up in collaboration with selected garages in different cities where vehicle tune-up services will be initially provided on a subsidized basis for introducing the technology to both the industry as well as motor vehicle owners. The experience gained in the project will be valuable in designing similar programs in other developing countries, many of which have a subsectoral profile similar to that of Pakistan.

9. Coordination Arrangements

ENERCON will be responsible for coordination and communication with other Government organizations, and industry and trade associations.

10. Counterpart Support Capacity

The key government counterpart agency providing institutional support and data for this project will be ENERCON, the National Energy Conservation Center. Institutional capabilities of ENERCON and resources to be provided by ENERCON in project implementation are discussed in this section.

Institutional Capabilities and Strengths of ENERCON

The National Energy Conservation Centre (ENERCON) is an autonomous federal agency under the Ministry of Environment, Urban Affairs, Forestry and Wildlife. It is charged with promoting greater energy efficiency throughout Pakistan. Established in 1986, ENERCON plans, demonstrates and executes energy conservation programs in all the main energy-consuming sectors. During its initial phases, ENERCON collected data, undertook various forms of field research, and initiated a number of outreach, training and public awareness activities with external support. ENERCON's comprehensive approach to energy conservation targets all sectors of the economy is unique among developing countries, and applies a combination of strategies, including technical assistance, awareness campaigns and financial incentives. This approach has contributed to the success of ENERCON's initial phase of field research and pilot demonstration activities and has made Pakistan's energy conservation effort a model for other developing countries to follow. Some of the representative accomplishments of ENERCON are given below:

ENERCON's Accomplishments

<i>Industry</i>	
Preliminary Energy Surveys	80
Detailed Energy Surveys	52
Feasibility/ Special Studies	20
Boiler/Furnace Tune-ups	600
Combustion Analyzers Loaned	50
Burner/ Boiler Replacement Surveys	100
Electrical Systems Surveys	700
Steam Systems Surveys	100
Demonstration Projects	20
<i>Building</i>	
Preliminary Energy Surveys	85
Detailed Energy Surveys	54
Demonstration Projects	6
Building Energy Code prepared	
<i>Agriculture</i>	
Preliminary Tubewell Audits	154
Detailed Tubewell Audits	500
Tubewell Retrofits	300
Demonstration Projects	2
<i>Transport</i>	
Auto Tune-ups	2,000
Demonstration Projects	10
<i>Training/Outreach/Information</i>	
Persons trained in workshops	5,000
Newsletter Circulation	10,000
International Symposium	3
Women trained through Home Energy Conservation Program	10,000

At present, the majority of ENERCON's resources continue to be channeled into technical programmes designed to identify the potential for real energy savings in the five main energy-consuming economic sectors; industry, power, buildings, agriculture and transport. These sectoral activities are supported by eight functional areas: planning, policy development, database development, training and education, information and outreach, investment promotion, and monitoring and evaluation. Funding for ENERCON's operations was initially provided by USAID. In the nine years of its existence, ENERCON has worked to identify opportunities that would yield over Rs. 1,500 million (US \$50 million) in energy savings and the implementation of specific energy conservation measures in various sectors has already realized savings of Rs. 500 million (US \$17 million).

ENERCON has begun extending the scope of its activities from research and pilot demonstration projects to national-level implementation of large-scale energy efficiency improvement and conservation programs which require increased support in terms of international assistance and greater involvement of the private sector. In the coming years, ENERCON's role will increasingly evolve into that of a catalyst with the long term goal of

creating an energy efficiency industry in Pakistan by progressively introducing state-of-the-art technology into successive segments of energy consumers.

In parallel, the government is taking legislative action to enact an Energy Conservation and Management Bill that would establish a firm legal and organizational framework for the National Energy Conservation Program in the country. The government plans shortly to submit the bill on the proposed law to the Parliament for ratification.

When enacted, the proposed law would provide legal backing for the establishment of a Pakistan Energy Conservation Council (PECC), which would have the authority to enforce regulations on energy efficiency. However, the bill also stipulates that before resorting to regulation as a means of promoting greater efficiency of energy use, the PECC would endeavor to ascertain the efficacy of non-regulatory measures such as (a) incentives to encourage investment by the public and private sectors in energy conservation; (b) alleviating bottlenecks to the free operation of the market regarding energy conservation and management services, including deregulation if necessary; (c) strengthening collaboration with other institutions to the maximum extent practicable with a view to achieving national goals of energy conservation; and (d) using information dissemination techniques, continuing education programs, and other relevant services to promote energy conservation by end-users.

Under the provisions of the proposed law, ENERCON would be transformed into an executive agency, and accordingly, it would be charged with responsibilities that hitherto had been outside the center's mandate, including (a) developing schemes to mobilize and channel financing for energy efficiency investments, including the creation of a National Energy Conservation Fund; (b) implementing technology transfer schemes in the field of energy efficiency; and (c) developing or revising equipment performance specifications to incorporate minimum energy efficiency standards for procurement by public sector organizations.

The joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP) has assisted ENERCON to prepare a long term strategy and an Action Plan which would transform ENERCON into a sustainable autonomous organization that can fully meet the challenges of energy conservation and the environmental protection in the years to come. The main objectives of ENERCON's Action Plan are:-

1. to strengthen ENERCON's capabilities to promote the nationwide dissemination of energy efficiency improvement measures.
2. to promote private sector participation in delivering energy management services to local enterprises and organizations based on cost recovery principles.
3. to encourage Pakistan's financial intermediaries to provide the necessary financing to local industrial and commercial enterprises so commercially viable and environmentally sound investments in improved energy efficiency can be made
4. to upgrade the capacity of ENERCON and other Government agencies to establish minimum energy performance standards for industrial and commercial enterprises, and to monitor compliance with those standards.

Following from ENERCON's Action Plan is its key strategic goal to leverage local resources and expertise (including) private consulting firms, contractors, NGO's, manufacturers and suppliers and financial intermediaries) to deliver energy efficiency improvement services in a cost effective and commercially viable manner. It will serve as a springboard for the nationwide

dissemination of commercially viable and environmentally sound energy efficiency programs covering all sectors. The following programs are illustrative of the kinds of programs that ENERCON will undertake to meet public and private sector energy conservation targets.

- a. Lighting Energy Efficiency Improvement Program.
- a. Boiler and Steam Systems Efficiency Improvement Program.
- a. Municipal Pumpsets Efficiency Improvement Program.
- a. Agricultural Tubewells Efficiency Improvement Program.
- a. Fuel Efficiency Improvement in Road Transport Vehicles.

In line with the recommendations of the Phase-I of ESMAP technical assistance program, the Deputy Chairman, Planning Commission, has directed for the following:

1. Greater participation of private sector in the Executive Committee of Pakistan Energy Conservation Council.
2. Implementation of the recommendations of ESMAP regarding Energy Management Bill; and
3. Bringing of ENERCON professionals on a permanent footing.

The Prime Minister through a special order of supplementary grant has increased ENERCON's budget from Rs. 1.8 to 10 millions. Budget for 95/96 has also been approved. In addition, ENERCON staff have been taken on Revenue Budget and thus made permanent.

In late 1993 the Prime Minister appointed a Special Task Force to review energy policy options for Pakistan, and to develop an action plan to relieve bottlenecks in the implementation of the energy sector development strategy for the Eight Five Year Plan. Among the recommendations stressed by the Task Force was for early passage of Energy Conservation and management Bill to establish a firm legal basis for speedy and sustainable implementation of energy conservation projects identified and formulated by ENERCON.

Phase II of ESMAP's technical assistance to ENERCON was initiated in end 1995. In this phase, ESMAP, with ODA funding is providing assistance to transform ENERCON into a financially and operationally autonomous agency for the Pakistan Energy Conservation Council (PECC) and into the lead agency to promote energy efficiency and conservation measures in Pakistan.

Phase-II objectives are specifically tailored to provide ENERCON with technical assistance in (i) institution building to strengthen its capacity to manage and step up its core function of designing and coordinating the implementation of programs and projects, especially those such as Training and Outreach Services which have been the mainstay of ENERCON's operations since its establishment, and (ii) implementing the GEF-UNDP project on 'Fuel Efficiency in the Road Transport Sector' since ENERCON has been selected as the national execution agency for this project.

Role and Contribution of ENERCON in Project Implementation

In addition to coordination and communication with other Government organizations, and industry and trade associations, ENERCON has already taken a number of steps to prepare the ground for the project. ENERCON initiated the process of involving various stakeholders in the project by holding a roundtable on the project in November, 1992. The project concept was presented to the participants, followed by a discussion on objectives and strategy. Since then, ENERCON has continued discussion on various aspects of the project with vehicle manufacturers, oil marketing companies, representatives of associations of petroleum distributors, dealers, and vehicle fleet owners. ENERCON is also in active contact with government organizations that are of concern at the project review and approval stages, and are likely to be involved in the implementation stage. These include the Ministry of Planning and Development, Ministry of Petroleum and Natural Resources, the Environment and Urban Affairs Division, and the office of the Vehicle Examiner. ENERCON has also recently advertised for consultants that could assist ENERCON in project implementation and conducting special studies.

The project will be housed in the existing ENERCON office premises. ENERCON has agreed to establish a dedicated project team and office for this work. Some ten to twelve professionals, including the necessary support staff, will be recruited by the organization specifically for this purpose and involved in all aspects of the programme. ENERCON's project team will be involved in the detailed design of the project, the selection of participants for Phase I, and in working out the modalities for loan disbursement and selection criteria for Phase II of the project. It will also be assigned the task of monitoring and evaluation of the project, and its past experience of working with major vehicle service centers and commercial dealerships will be utilized in the proper selection and evaluation of loan recipients.

Details of inputs to be provided by ENERCON and value of the inputs are included in Section E of this document.

11. Administrative Arrangements

For the proposed project, ENERCON, through its Managing Director, will have the overall responsibility for management and implementation. A Project Advisory Committee consisting of the MD ENERCON, representatives of the ministries of Water and Power, Environment, Urban Affairs, Forestry and Wildlife, Planning and Development, Petroleum and Natural Resources and each province; and two representatives appointed by UNDP/GEF will advise ENERCON on key aspects of project management including:

1. Finalization of criteria for selection and selection of firms at whose premises the Tune-up Training and Demonstration centres will be located.
2. Financial arrangements under which the equipment is given to the firms for Tune-up Demonstration and Training Centres, including initial deposit and price to be charged for the tune-up.
3. Selection of professional and administrative personnel listed in this Project Document.
4. Administration, management and monitoring of the revolving loan fund during the first three years of the project, including selection of the Adminstrating Institution,

establishment of criteria for selection of participating leasing companies and banks, and establishment of interest rates and lending criteria for the borrowers and lessees.

5. Selection of machinery and equipment suppliers and approval of procurement orders for machinery and equipment.
6. Award of subcontracts and consultancies.

The PAC will opt for advisors from the private sector and the Banking Council, as and when necessary.

A project implementation team consisting of specialists and experts in technology, information and outreach, evaluation and project administration will be organized under a Project Director. Details of organization under the Project Director are included in Annex V. The ENERCON staff will work in close collaboration with these experts and specialists, and will provide inputs to the project based on previous experience in implementation of energy conservation programmes on a nation-wide scale. The experience of ENERCON in development of energy conservation policies will be particularly valuable in establishing priorities for special studies and in coordinating the project activities with other government agencies. ENERCON will also provide office space and will be responsible for its administrative control, including provision of support staff and facilities. It will also undertake to arrange for the printing of all materials required for the publicity and training purposes of the programme as well as for media campaigns at any concessionary rates available to it.

After termination of the demonstration phase of this project, ENERCON staff will continue to monitor the operation of the revolving loan fund set up under the project. ENERCON will also continue to maintain contact with the vehicle maintenance industry, the vehicle manufacturers, and other government agencies associated with the road transport sector and fuel pricing and quality control. Through the experience gained in this project, ENERCON will be in a strong position to advise the government on development of policies to sustain and improve fuel efficiency in the road transport sector.

C. Development Objective and its Relation to the Country Programme

The project aims to reduce at source emissions of greenhouse gases and other pollutants by improving fuel efficiency of the road transport vehicles. Conservation and efficient use of energy in all sectors is the stated objective of the 7th Five-Year Plan of the Government of Pakistan. The technologies being promoted in this project have the potential to reduce fuel consumption in the transport sector by an average of 6% over current levels. In addition, the 7th Plan strategy for the road transport sector includes formulation of environmental quality standards. This project will provide the necessary technological platform for establishing emission standards and legislative measures to monitor and control vehicle exhaust emissions.

The field of environmental protection figures prominently in the UNDP's Governing Council theme areas and the proposed project corresponds sufficiently with the UNDP's development assistance priorities. UNDP support for environmental projects can be gauged from the fact that it has played an advocacy role in environmental protection and been an active supporter in the formulation of the NCS for Pakistan. In partnership with the Government, IUCN and IIED, UNDP has helped in the preparation of the Pakistan report to UNCED and will provide support in building capacity to implement Agenda 21. The Fifth UNDP Country Programme for Pakistan explicitly commits "support to the management of the environment and natural resources in accordance with the National Conservation Strategy." Specifically, UNDP cooperation will be focused on national initiatives directly related to natural resource management, energy efficiency improvements, and stemming the production of environmental pollutants.

The proposed project also closely follows UNDP's preferred strategy for cooperation, i.e., the channeling of assistance for the development of national programs in the theme areas, mobilizing and coordinating donor inputs, and development of management systems required to coordinate implementation and monitoring and evaluation of such programs. The Fifth Country Programme aims to concentrate UNDP assistance to a smaller number of key programs, and the proposed project qualifies on this account as well as it represents the only planned activity of its kind in the important area of transportation related environmental and energy issues.

D. Immediate Objectives, Outputs, and Activities

The immediate objectives of the project are as follows:

1. Development of a market for instrumented tune-ups through tune-up demonstration and training Centers.
2. Establishment of a revolving fund for financing the purchase of tune-up equipment.
3. Conducting special studies to identify long-term options and to prepare policy recommendations for sustaining fuel efficiency in the road transport sector.

1. Objective 1: Development of a Market for Instrumented Tune-ups Through Tune-up Demonstration and Training Centers.

The Tune-up Training and Demonstration Centers will assist in developing demand for instrumented tune-ups, awareness among the workshop owners of the need for such equipment and standards to provide better services to their customers, and training for routine operations. Publicity materials and media campaigns will be undertaken to inform the general vehicle-owning population of the benefits of properly conducted instrumented tune-ups.

Establishment of 10 Gasoline and 5 Diesel Tune-up Demonstration Centers

Ten Tune-up Training and Demonstration Centers for gasoline vehicles will be set up. These will be located in Rawalpindi/Islamabad, Lahore, Karachi, Peshawar, Faisalabad, Multan, Hyderabad, Quetta and Gujranwala. The equipment required for diesel tune-up is comparatively expensive, and the level of skills required is also higher. The frequency of diesel tune-ups is only once a year, compared to twice a year for gasoline engines. The number of centers proposed is therefore limited to five, all located in major road transport centers in Rawalpindi/Islamabad, Lahore, Karachi, Peshawar and Quetta.

Procurement of Equipment

Detailed technical specifications for procurement of equipment will be prepared. The technical capability and financial capacity of the local service sector to operate and maintain the equipment will be kept in view while selecting the equipment. Standard UNDP procedures will be followed for procurement of equipment. Preference will be given to the suppliers that have local representation and have an established track record in delivering and providing after sales service to the customers.

Selection of Demonstration Center Sites

The centers will be located taking into account provincial representation, vehicle population, and existing infrastructure for maintenance of vehicles in the area. Criteria for selection of participating firms will be developed. Proposals for participation will be solicited through

advertisements in the newspapers. Annex VI outlines the selection criteria established by the CDWP at the time of project approval.

Installation of Equipment and Operation of Demonstration Programme

The tune-up equipment will be installed and commissioned at the workshops selected under the supervision of technical experts. The first gasoline and diesel centers will be set up in Islamabad, where the project staff will be given hands-on training by the technical experts on the use of the tune-up equipment. The experience gained in setting up the Islamabad centers will help in improving the project planning and strategy before moving on to the other cities. Following the Islamabad centers, nine gasoline and four diesel tune-up centers will be setup at other selected locations.

Training of Workshop Owners and Mechanics

A series of two day workshops will be held for the owners of garages in the Tune-up Demonstration Centers. A total of 20 workshops will be held, to be attended by 360 persons. The benefits of using instruments and diagnostic equipment will be explained to the owners, and the potential advantages of instrumented tune-up will be elaborated. Management aspects of an instrumented tune-up service including quality control, importance of trained mechanics, and techniques for building customer confidence and marketing will be discussed. The two day workshop for the owners will be followed by 50 three week courses for mechanics, in which 600 mechanics will be trained. These courses will cover basics of engine functioning, understanding of engine performance specifications, evaluation of engine performance, procedures for conducting tune-ups, and procedures for use of electronic and computerized equipment for tune-ups. Training materials and aids such as manuals and user instructions will be developed to support the training programs. It is expected that the mechanics after completing this course will have a capability to independently operate the tune-up equipment and conduct the tune-ups.

The courses for workshop owners will aim to expose the participants to state-of-the-art technology and practices for the maintenance of engines and provide them information on market potential and business opportunities associated with instrumented tune-ups. The courses for mechanics will cover the basics of engine functioning and maintenance, understanding of engine specifications, and use of tune-up equipment.

Preparation of Training Materials

Training manuals and course materials will be prepared to support the training programs. Materials will be prepared in Urdu and English, and will take into account the educational background and needs of the participants.

Training of Core Instructors

Twenty core instructors will be trained by foreign experts to conduct the training programs. These instructors will then conduct the initial training sessions under the supervision of the foreign experts to ensure the quality of the training programme.

Implementation of Training Workshops

The core group of instructors will conduct courses for owners and mechanics. The courses will be held at various tune-up and demonstration centers setup throughout the country. The

courses will be preceded by an appropriate publicity campaign. Participants will be selected according to defined criteria, and part of the cost of the courses will be borne by the participants to ensure serious participation and to reduce the recurring cost of the programme.

Promoting Awareness on Instrumented Tune-ups

For the programme to be successful it is essential that the awareness on the benefits of instrumented tune-ups be developed among vehicle owners, workshop owners and mechanics. While the demonstration centres themselves will achieve this objective, this process is expected to be very gradual in view of the limited number of demonstration centres that can be set up from the resources available under this project. An awareness campaign will accelerate the development of the market and take it to the "take off" stage. The demand thus created will be ultimately met by the tune-up centres to be set up under the revolving loan fund, and by the equipment to be supplied independently by the private suppliers.

Development of a Communications Strategy and Preparation of Publicity Materials

A communications strategy will be first prepared taking into account the structure of the market, customer background and psychology, established norms and practices, decision systems, cultural preferences, and real incentives offered by instrumented tune-ups. Fuel savings, prolonged life of engine, and reduction of emissions to improve the air quality will be emphasized in the promotional efforts. Publicity materials on the tune-up demonstration and training programme including newspaper and television advertisements, and brochures and booklets aimed at customers, garage owners and mechanics will be prepared.

Awareness Campaign to Publicize the Instrumented Tune-up Service

A publicity campaign will be launched through newspapers, and television if necessary. Other publicity materials such as brochures and information booklets will be printed and made available through the demonstration centres and through other outlets such as gasoline stations.

Institutional Strengthening and Capacity Building

ENERCON, the government counterpart agency for the project, has the sole responsibility of promoting energy conservation and efficiency improvements in all sectors of the economy at the national level. As such, the role of this institution in designing, implementing, and facilitating improvements in motor vehicle fuel efficiency on a national scale is of vital importance to successfully meeting the long-term objectives of this project. ENERCON's capabilities in these respect must therefore be enhanced through its total participation in all phases of this project so that the institution can continue to provide the necessary support and guidance to sectoral improvements in the future. The project will further strengthen the capability of ENERCON to plan and implement energy conservation projects in the private sector on a national scale, obtain better information on the status of the industry and current practices, build a core capability of technical expertise on modern instrumented methods of engine analysis, and develop its position as the premier organization responsible for energy efficiency improvements in the road transport sector in the country.

Project Planning and Implementation

The project is to be implemented in close coordination with concerned government agencies. In particular, ENERCON staff is to be augmented with some five to seven specialists specifically for this purpose and trained in the operation and maintenance of test equipment, holding of

training workshops, customer relations and publicity, administration of loan fund, liaison with dealerships, garage owners, and technicians, and evaluation of project progress. These capabilities will ensure that similar projects can be implemented independently by the concerned agencies with minimal external support.

A Detailed Work Plan will be prepared by the Project Director at the start of the project, and submitted to the Project Advisory Committee for approval. Subsequently, annual work plans and budgets will be prepared and submitted to the Project Advisory Committee for review and approval.

2. Objective 2: Providing Financing for the Purchase of Tune-up Equipment

It is expected that the services provided to the vehicles at the Tune-up Demonstration and Training Centers combined with programme promotion will create a wider demand for instrumented tune-ups. A revolving loan fund for the purchase of tune-up equipment by workshop owners and mechanics is proposed to support the market in its initial stages of growth. The revolving loan fund will facilitate purchase of advanced tune-up and diagnostic equipment by the private sector.

Establishment of Revolving Loan Fund

An amount of \$3.0 million is proposed for initial disbursement under the revolving loan fund. The amounts recovered against the loans are proposed to be re-utilized to finance further purchases of tune-up equipment. Based on the initial planned outlay for this purpose, the loan facility will continue to provide necessary funding for its objectives for a period of 10 to 12 years. At the end of this period, the amount remaining in the fund will revert to the government under terms to be mutually agreed between the UNDP and the government. The policies and rules of UNDP with regard to the administration of revolving loan funds and loan guarantees in view of GEF's emerging financial policies will be examined and considered for designing the financing programmes for the project.

Formulation of Procedures and Modalities for Disbursement

Disbursement of credit based on funds originating from the international donor agencies is regulated by the Government through the State Bank of Pakistan. Guidelines and procedures for the disbursement of the credit will be worked out in consultation with the local banks, leasing companies, and finance institutions, and necessary approvals and agreements will be obtained from the concerned government agencies. Precedents already exist, such as the World Bank Microenterprise Project, for providing lease financing to small and medium scale organizations. Capabilities and experience of the banks, leasing companies and finance institutions in handling small and medium sized loans will be evaluated, and allocation of funds will be made to selected organizations. Criteria for monitoring the efficiency of credit utilization will also be developed.

Disbursement of Loans

Loan funds will be disbursed to finance purchase of tune-up equipment for approximately 90 gasoline and 25 diesel tune-up stations. The exact number of disbursements will depend on the market demand. The disbursement will be managed by the selected banks and leasing companies, and equipment will be supplied and serviced by private-sector companies. The

project will provide technical support to the workshop owners acquiring equipment under the loan programme, such as training of the mechanics. It is expected that the first round of disbursement of the amount of \$ 3.0 million allocated will begin in the second year of the project and will be completed within the project period of three years.

Monitoring of the Revolving Loan Programme

During the first three years of the project, the Project Advisory Committee will be responsible for monitoring the revolving loan programme. After this period, ENERCON will continue to monitor the level of disbursement and recoveries. The Project Administrator will assist ENERCON in this activity through years 4 and 5 of the project.

3. Objective 3: Development of Options for Sustaining Fuel Efficiency

In order to extract optimum benefit from the large amounts of useful information to be generated by the project activities on the current state of automobile fleet conditions, engine maintenance and overhaul practices, vehicle manufacturing technology, and exhaust emissions, and to utilize such information for future improvements in policy formulation, planning and project design, and legislative and regulatory reforms, a number of specialized studies are proposed to be undertaken in the final phase of this project. The results of these studies will be presented to the Government of Pakistan for both specific policy changes as well as for defining the future activities of the various agencies involved in the motorized road transport sector in Pakistan.

Studies on Policy Options for Sustaining Fuel Efficiency

Facilities for measurement of fuel efficiency and exhaust emissions are presently not available in the country. The equipment and facilities in the demonstration centres will be used to conduct a series of studies for improving fuel efficiency through policy, legislative, and technological measures. ENERCON, through local consultants and specialists, would be responsible for coordinating these studies.

Identification of Areas in which Policies have to be Developed

Inputs on type of policy measures required were provided by the participants in the first round-table meeting on the project held by ENERCON in November 1992. Follow-up meetings will be held with the concerned government agencies, NGOs, and private sector institutions and fleet owners to define policy-related issues and to work out the scope of special studies.

Conducting Special Studies

Approximately 15 special studies will be conducted in close association with the concerned government agencies, NGOs, and private sector institutions and fleet owners. The studies will be conducted by consultants, and where possible resources will be provided to other organizations that have capabilities and experience in conducting the studies.

Following is the list of areas proposed to be studied, which includes the studies suggested by participants of the round table meeting held on November 30, 1992 to discuss the project and to solicit inputs from organizations concerned with fuel efficiency in the road transport sector:

- a. Modal shift including introduction of viable alternative mass transit systems for goods and people.

- a Location of transit depots at the edge of cities for the transfer of goods from diesel trucks to smaller, environmentally-friendly vehicles for inner-city transport.
- a Transport engineering management, land use planning and zoning measures to stimulate greater fuel efficiency.
- a Alternative fuel technologies including technical and policy analysis and testing of alternative fuels such as CNG, LPG and lead-free gasoline.
- a Rationalizing the price of diesel to remove disincentives for improving efficiency and to account for environmental impacts of fuel wastage.
- a Setting up a framework for urban transport pollution control and establishment of fuel efficiency and emission standards and targets for road transport sector.
- a Impact of fuel quality on fuel efficiency.
- a Introduction of more efficient engines based on existing technologies.
- a Introduction of engines based on alternative technologies such as fuel cells.
- a Evaluation of efficiency of engines used in local manufacture and assembly.
- a Options for introduction of advanced engine technology in local manufacture and assembly of vehicles.
- a Assessment of current levels of fuel efficiency in the road transport sector.
- a Evaluation of local engine re-building practices.
- a Evaluation of local engine maintenance practices.
- a Study of economics of current vehicle operating and maintenance practices.
- a Fleet audits and technical assistance for implementation of fleet management programs.

The scope of the studies will include:

- a Technical policy studies
- a Economic and financial policy studies
- a Tax and trade policy studies

Figure 2: Key components of transport studies

These studies will also include pre-investment and pre-feasibility analysis and will lead to identification of possible future joint ventures in the transport sector that could be established with the participation of the public and private sectors for addressing specific environmental and energy issues in the road transport system of the country.

Dissemination Workshops

Dissemination workshops will be conducted to present and discuss the results of the policy studies. The workshops will be attended by the policy makers, and representatives of the public and private sector transport businesses, vehicle maintenance industry, vehicle manufacturers and distributors, and oil marketing and distribution companies. Recommendations of the studies and comments of the workshop participants will be compiled to provide inputs to the policy making process. Approximately ten workshops will be conducted in the second and the third year of the project.

E. Inputs

1. Host Government Inputs

The Government of Pakistan will contribute in kind an amount of Rs. 10.353 million through the existing ENERCON staff and facilities. This will include salaries of ENERCON officers and staff involved in the project, administrative and general support, and office space provided to the project. ENERCON will also provide vehicles already available with the organization for local and inter-city transport. Detailed breakdown of the Government contribution is included in Section J, "Budgets". A summary of Government contribution is as follows:

<i>Project Personnel</i>	<i>Staff-Months</i>
Managing Director	8
Deputy Chief (Transport)	48
Specialist I (Training)	36
Specialist (Database)	36
Specialist I (Info. and Outreach)	36
Specialist (Planning and Eval.)	36
Specialist (Transport)	36
Specialist II (Training)	36
Specialist II (Info. and Outreach)	36
<i>Support Staff:</i>	
Accounts Officer	36
Secretary/Typist	216
Photocopy Operator	36
Helpers	180

In addition, the Government will contribute an amount of Rs. 5.383 million for office expenses associated with procurement of furniture, telephone and utilities, stationery and supplies, travel for the Government staff, and office rent.

2. UNDP Contribution

The UNDP/GEF will contribute \$ 7.00 million to the project. This contribution will be used for procurement of equipment for the demonstration centres, salaries of expatriate consultants and local experts and staff for establishment and operation of demonstration centres, preparation of training materials, conducting training courses, and preparation and release of

publicity materials. An amount of \$3.00 million is proposed for establishment of the revolving loan fund. Following is a description of the items to be contributed by UNDP/GEF:

3. Equipment for Tune-up Demonstration Centres

The price break-up of components of the gasoline and diesel tune-up equipment is:

Gasoline Engine Programme

<i>Basic Equipment for one Demonstration Centre</i>	<i>Cost (\$)</i>
Engine Analyzer (Level I)	20,000
CO analyzer	1,000
Timing Lights	500
Dwell/Tachometers	500
Tools & Spares	4,000
Total	26,000

A detailed description of the engine analyzer proposed is included in Annex II. Total cost of equipment for 10 centres at above rates is estimated at \$ 260,000.

Diesel Engine Programme

<i>Basic Equipment</i>	<i>Cost, \$</i>
Diesel Test Bench	50,000
Smoke Meter	10,000
Injector Tester	4,000
Compression Recorder	1,000
Diesel Timing Unit	6,000
Accessories & Spares	7,000
Total	78,000

Total cost of equipment for 5 centres at above rates is estimated at \$ 390,000.

4. Personnel

A brief description of staff positions, and experience and background required in each case is included in Annex III. The anticipated level of effort is summarized below:

	Number Reqd	Total Staff Months
<i>International Consultants:</i>		
Technical Advisors *	as needed	12
Training and Quality Control Specialists	2	24
<i>Local Consultants:</i>		
Project Director	1	36
Project Administrator	1	60
Project Managers	2	72
Project Engineers	8	240
Workshop Supervisors	8	240
Info. and Outreach Specialist	1	36
Database Specialist	1	30
<i>Support Staff:</i>		
Accounts Assistant	1	36
Secretary	1	36
Drivers	2	72

* Technical Advisors may be foreign or local. The number of advisors and duration of individual assignments will depend on project requirements.

5. Revolving Loan Fund

The amount allocated under the revolving loan fund will be disbursed to selected workshop owners. It is estimated that in the first round of disbursement the following equipment will be purchased by the workshop owners:

Auto tune-up equipment:

Description	Cost per Set, \$	Total Cost, \$
15 sets of Level 1 equipment	28,600	429,000
25 sets of Level 2 equipment	15,400	385,000
40 sets of Level 3 equipment	7,700	308,000

The description of equipment required for the tune-up are listed in Annex II

Diesel tune-up equipment:

- 20 complete sets are expected to be disbursed, valued at \$78,000 each, having a total value of \$1,560,000.

- After completion of the training programme, the equipment in the 10 auto tune-up and the 5 diesel tune-up training and diagnostic centers will also be disbursed to selected individuals.

6. Special Studies

An allocation of \$375,000 has been made for conducting special studies. These amounts will be used to hire the services of consultants for conducting the studies, and to purchase special items of equipment, accessories or consumable that may be required. For an estimated 15 studies, the cost per study is estimated at \$25,000 each.

7. Contribution of the Private Sector

The owners of workshops participating in the Tune-up Demonstration and Training Programme will contribute by providing space for setting up the equipment and for conducting training programmes. In addition to paying 50% of the cost of the equipment, the participating workshops will also provide mechanics for operation of the equipment, and will be responsible for other overhead expenses such as utilities. The value of this input is estimated at Rs. 5-6 million, and is detailed in Section J, "Budgets".

F. Risks

A number of potential risk areas were defined in the early stages of the project development. These risk areas were thoroughly investigated, and alternative strategies were evolved to control these risks. Following is a discussion of the risk areas and mitigation strategies that were given a detailed consideration.

Lack of Vehicle Owner Response to Instrumented Tune-ups:

The likelihood of lower than projected end-user demand is low generally, but likely to be higher in the near term for diesel tune-ups where current loading practices in the freight sector discourage operating vehicles at recommended specifications.

Vehicle tune-up is an established service in the market, and the benefits are recognized in terms of increased fuel efficiency, better engine performance, reduction in vehicle operating costs and increase in revenue kilometers. The consumers, be they private motor vehicle owners or fleet owners of trucks, buses and wagons/pick-ups, will benefit from increased fuel savings, better engine performance. As detailed in Section 2.1, For the individual vehicle owners the financial benefits from an instrumented tune-up are enormous. As such the vehicle owners do not require much persuasion to make use of such facilities.

The most critical factor in customer response is the quality of service available, or the market soundness of the "tune-up" product offered. Initially, the product will be developed and offered in the tune-up demonstration centres under the close supervision of the project staff. This will ensure that any problems associated with local conditions such as vehicle age and characteristics, quality of fuel available, ambient weather conditions, driving conditions, and other customer preferences are addressed before the product is launched commercially on a country-wide scale.

The most likely segment of the sector that would have resisted the importation of newer and more efficient methods of engine maintenance, repair and overhauling i.e. the mechanics and technicians will be the direct beneficiaries of the project. They will be provided with better training and facilities to improve the quality and volume of their business, and in the process gain access to more cost-efficient technology and the financing for acquiring it.

In case of diesel vehicles, the composition of the fleet is undergoing a gradual change as the old Bedford truck with a rated capacity of below five tons are being replaced with bigger Japanese and European made carriers of over ten ton capacity. As the new highways under construction come on stream, the fleet composition and operational practices will approach those in the countries with more developed road transport systems, i.e. faster road movement with bigger loads. In this configuration, the vehicles need to be operated in the "as designed" condition, and the support from modern engine diagnostic techniques assumes relevance. It is felt that in view of ongoing changes in fleet composition and operational practices, this project is well timed to support the developing market for tune-up of diesel engines. Once the owners of large fleets of trucks and buses, who have a large stake in the transport market, change their

operating policies in favor of running fuel efficient and well maintained vehicles this will influence other transport owners to follow suit.

Failure of Publicity Campaign to Create Adequate Awareness Levels:

This project is based on the experience of ENERCON in establishing such tune-up centers at two locations each in Islamabad/Rawalpindi, Lahore and Karachi under USAID funding for a limited period, of which one center in Lahore is still operational. The results of this pilot project were extremely encouraging in all respects: the garage operators on whose premises the tune-up demonstrations were set up showed a great keenness in acquiring and providing such service to their clients, the response from vehicle owners was so great that each center had advance bookings of the order of weeks. Based on past experience with publicity campaigns in this subsector, the likelihood of failure of campaigns is expected to be low. This risk will further be reduced through involvement of oil marketing companies and dealers and distributors of major makes of vehicles in development and implementation of the publicity campaigns.

Lack of Adequate Policy and Legislative Measures on Emission Standards:

It must be recognized that irrespective of the market conditions or financial constraints which influence business decisions, fuel economy or environmental factors, maintaining vehicles in optimal mechanical conditions is not possible without very stringent and effectively enforced statutes and laws, not only in Pakistan but in any country. A first step has been taken by the Government, and vehicle exhaust emission standards were recently introduced, however, the institutional capacity to enforce these standards has yet to be developed. It is evident that in the absence of enforcement, and if the road transport sector is free of all legal responsibility and not subjected to penalties for operating vehicles at predetermined standards of performance, both the small as well as the large fleet owners would be decidedly indifferent to laws for ensuring the implementation of the project since it involves changes and investment to long held methods of conducting business. As an effective inducement the motor vehicle and other regulatory authorities need to focus on the enforcement of punitive laws in the country so that no vehicle could ply on the roads and highways without a certificate from approved centers to the effect that the vehicle conformed to certain predetermined standards of performance. Such regulatory mechanisms are unavoidable, and without such controls no effective transportation and environmental control policies are effective.

The introduction of vehicle and fuel standards will require the creation of an enforcement and regulation system, consisting of inspection, certification, and control functions. Given the extent to which such roles can be assigned to existing agencies, such as the police and the excise and taxation departments, additional manpower and resources will be required for introducing new vehicle testing and certification procedures in the automotive manufacturing and trade businesses, fuel production and retail outlets, annual evaluation of the existing fleet, imposition of penalties, and so on. Such a regulatory system will entail a major revision of the existing situation and a careful formulation of additional legislative, fiscal, economic, and administrative policies. This can at best be regarded as a long-term strategy for which the ground work must begin now.

Through discussions with the Federal EPA, it is felt that this project will greatly contribute to development of a monitoring and enforcement capability in the country. All the tune-up demonstration centres will be equipped with equipment to measure exhaust gas emissions. The staff of the EPAs can be trained in use of emissions monitoring equipment, and data collected on emissions can be used to formulate rational and realistic emission control standards. Facilities to be set up in the course of the project could also be used by the enforcement

agencies as certification centres for vehicles. The project will thus create, by commissioning several exhaust emission testing centers throughout the country, the necessary technological and infrastructural capacity for the gradual enforcement of emission standards, and support the activities of the enforcement agencies in the long run by offering such services at internationally accepted standards

Decline in Quality of Service and Skills Over Time:

In the ENERCON demonstration programme, the tune-up service was very closely supervised in the initial stages to ensure quality of service and customer satisfaction. As the level of ENERCON supervision was reduced, the quality of service was observed to deteriorate, and customer complaints increased. A certain degree of quality control, retraining and investment will be required by private workshops to adopt the proposed techniques and those willing to do so will gain a definite competitive advantage over those who fail to benefit from the opportunity. In the initial stages, the project staff will conduct inspection visits to ensure that quality control is maintained. In the longer run, the suppliers of tune-up equipment and the participating oil marketing companies, vehicle manufacturers and dealer networks are expected to take over the function of standardization of the service, as it will be in their clear commercial interest to do so. The involvement of these private sector organizations in the early stages of the project will ensure quality control after the demonstration programs are completed. After the project period, it is anticipated that the commercial success of instrumented tune-ups will ensure that the project-trained personnel will be easily absorbed by the private-sector operators and that their skills and expertise will be utilized in maintaining the quality of service.

Inability of Local Suppliers to Provide Adequate Support and Service for the Tune-up Equipment:

Although the earlier ENERCON demonstration centers met with considerable success in terms of participation, operator and client satisfaction, there were some difficulties faced with the provision of equipment spares. In this project, these issues should not recur due to the increased number of testing centers to be set up which will enable an adequate stock of equipment spares to be maintained economically. In addition, equipment to be used in the demonstration centers will be selected from more than one supplier in order to encourage competitiveness in terms of features and prices and avoid the possibilities of unfair advantages which might hamper the subsequent growth of this service sector. These suppliers will also be required to provide operator training as a condition for selection.

Inefficiencies in Management of Loan Facility Resulting in Low Recovery Rates:

Until recently, the banking sector was completely in the control of the Government. This resulted in huge losses in the financial sector as a large number of loans were given on political grounds, and a significant fraction of loans were "written off" without taking any action against the defaulters. The interest rates and terms on the loans were also regulated by the Government. In view of the recent privatization of the banking sector and liberal policies introduced by the Government, especially the incentives offered to the private sector for more viable participation in the economy, it is now possible to set up flexible lending programs in which the risks associated with losses can be shared and the banks can be provided incentives to minimize the losses. The option of leasing is also available, and a number of leasing companies are active in providing services for small to medium size investments. The leasing companies and the banks active in managing small loans advise against subsidies on credit, and maintain that if the decision to determine the credit worthiness of potential borrowers is left to them, they can assure a high level of recoveries through their internal controls and procedures.

One of the leasing companies also has experience in dealing with the vehicle maintenance sector including medium scale workshops, and reports positive results in terms of credit utilization and recoveries. Operating through the private banks and leasing companies, as specified in this project will therefore minimize the risk of low recovery rates.

Inaccessibility of the Loan Facility to Certain Sectors of the Market:

It is generally observed that small workshops and businesses are ignored by the lending institutions in view of the high cost of managing the loan and the inability of the borrowers to meet the financial criteria of the lending institution. The lending institutions, particularly the leasing companies have shown willingness to negotiate terms of the loan package with a disbursement plan that accounts for making the credit available to small borrowers.

G. Prior Obligations and Prerequisites

1. Prior Obligations

ENERCON will be the coordinating counterpart agency for the project on behalf of the government. It has been assigned the sole responsibility of promoting energy conservation and efficiency improvements in all sectors of the economy at the national level and has considerable experience in implementing such projects. ENERCON has previously carried out a pilot project along the lines of the present proposal and will continue to support such a scheme in the future.

A recent ESMAP review of ENERCON recommended certain institutional changes to ENERCON. These should be implemented before project initiation. ESMAP's proposal included a number of specific measures to improve ENERCON's overall performance to fulfill its mandate to introduce energy efficient technology and practices and to make them commercially viable. Thus, it is required to reorient its corporate structure and governance principles, establish a mechanism to ensure its financial sustainability, and strengthen its in-house management and administration. The principal recommendations are:

- a The National Energy Conservation Center (ENERCON), currently operating in the Ministry of Environment, Urban Affairs, Forestry and Wildlife, should be reconstituted, through resolution, as an autonomous quasi-governmental agency, under the general policy direction of the Pakistan Energy Conservation Council.
- a ENERCON's current policy and operational focus should be expanded from data collection and the development and implementation of pilot energy conservation sub-projects towards facilitating the establishment of a commercially viable national infrastructure which supports the dissemination of new energy conservation technology. In this regard, ENERCON's revitalized mission would include:
 1. The development of energy efficient improvement programs for specific end-users, and
 2. Facilitating the establishment of an indigenous energy efficient industry.
- a To ensure the long-term sustainability of ENERCON, an externally administered "Trust" should be established to serve as an "endowment" for the Center's activities. The principal of "full cost recovery" must be applied to the entire scope of ENERCON's operations.
- a Separate Investment Revolving Funds (IRF) should be established to support ENERCON's commercially viable programs. The primary role of these funds, which would operate in parallel with the Trust Fund, would be to stimulate both the demand for and supply of energy efficient services.
- a These funds are designed to provide a sustainable source of financing that would be administered on behalf of the Government and ENERCON by one or more financial

institutions that have established a solid record in managing innovative financial mechanisms which involve the purchase and turnkey installation of equipment in industrial and commercial enterprises (e.g. a Development Finance Company). The resources in the Investment Revolving Funds would be disbursed through a variety of financial intermediaries in Pakistan so as to create and demonstrate innovative arrangements to support the implementation of energy efficiency improvement schemes.

- a ENERCON should undertake a substantially enhanced programme of systems and professional staff development to support the Center's revitalized policy and operational missions.
- a The Project Document will be signed by UNDP and UNDP assistance to the project will be provided only if the prior obligations stipulated above have been or are likely to be met to UNDP's satisfaction.

2. Prerequisites

This project is to be implemented by ENERCON in close coordination with concerned government agencies. In particular, ENERCON staff will be increased by some five to seven key specialists, along with the necessary support staff, who will be specifically assigned for this purpose, and involved in all aspects of the project. These personnel will be trained in the operation and maintenance of test equipment, coordination of training workshops, customer relations and publicity, administration of loan fund, liaison with dealerships, garage owners and technicians, and periodic evaluation of project progress. These individuals will also be assigned the task of ensuring quality standards and that similar projects can be implemented independently by the concerned agencies with minimal external support.

ENERCON's project team and infrastructure support for this project will include the detailed design of the project, the selection of participants for the tune-up training and demonstration aspect, and the modalities for loan disbursement and selection criteria and evaluation of loan recipients.

In addition to ENERCON, relevant consultants, comprising of one to three firms with experience of implementing programs of a similar nature and having familiarity with the local automotive maintenance and transport industry, will work in close collaboration with ENERCON and other relevant government agencies. ENERCON will also arrange for the printing of all materials required for the publicity and training purposes of the programme as well as for media campaigns at any concessionary rates available to it.

The project document will be signed by UNDP, and UNDP assistance to the project will be provided, subject to UNDP receiving satisfaction that the pre-requisites listed above have been fulfilled or are likely to be fulfilled. When anticipated fulfillment of one or more pre-requisites fails to materialize, UNDP may, at its discretion, either suspend or terminate its assistance.

H. Project Reviews, Reporting and Evaluation

1. Monitoring and Evaluation Methodology

Monitoring and evaluation of the project will focus on the following:

1. The extent to which the primary objectives of the project are achieved, i.e., improvement in fuel efficiency and reduction in emissions of greenhouse gases.
2. The extent to which the physical targets of the project are achieved, such as number of tune-up demonstration and training centres installed, tune-ups conducted, persons trained, amounts disbursed under the revolving loan funds, and policy studies completed.
3. The quality and impact of project activities, such as tune-up service, training programmes, awareness campaigns, revolving loan fund, and policy studies.

Detailed procedures for monitoring and evaluation will be developed through the course of the project, and will be consistent with the GEF and UNDP monitoring and evaluation procedures. Guidelines to be followed in each of the above areas are outlined below.

Reduction in Greenhouse Gas Emissions

Direct impacts will be estimated on the basis of data collected through the course of the project on emissions and fuel efficiency improvements. A baseline will be established at the start of the project, covering existing level of emissions and fuel use based on laboratory assessment of actual fuel saved using sound experimental techniques, and effectiveness of existing tune-up practices. Future comparisons will be made against this baseline and the targets for reduction of emissions.

Achievement of Physical Targets

A detailed work programme will be prepared at the start of the project. This work programme will include schedule for individual activities, targets and milestones to be achieved. Progress of activities will be measured and variance will be reviewed on a periodic basis. Detailed records of tune-ups provided will be maintained.

Quality and Impact of Project Activities

1. Specific criteria for measurement of quality of tune-up services will be developed. A system of inspection procedures will be set up, and inspection will be carried out on a random basis or otherwise according to defined schedules. A baseline will be developed to document the assessment of current instrumented tune-up facilities.
2. The degree to which the project is able to stimulate private sector participation will be estimated. This will include evaluation of the extent to which the selection of

participating stations leads to other stations buying into the process. Preliminary estimates of benefits from the economic incentives proposed will also be developed.

3. The training programmes will be evaluated in terms of knowledge gained by participants, retention of knowledge gained over a period of time, quality of course contents, and impact on the skills, outputs and actions of the participants in the context of project objectives.
4. The revolving loan fund will be reviewed in terms of level of disbursements, recovery rates and defaults, and disbursement profile including loan amounts, geographical distribution, type of equipment purchased, and financial impacts on borrowers.

Staffing for Monitoring and Evaluation

A permanent position as a Specialist for Monitoring and Evaluation has been designed to meet the monitoring and evaluation requirements of the project. This position would be funded by the Government of Pakistan. Further, the duties of the Project Administrator's position which is for 5 years should be revised in the 4th and 5th year of the project to put more emphasis on monitoring, evaluation and reporting. A special study/evaluation shall be carried out in the fifth year of the project.

2. Project Reviews and Reports

The project will be subject to tripartite review (joint review by representatives of the government, executing agency and UNDP) at least once every 12 months, the first such meeting to be held within the first twelve months of the start of full implementation. The Project Director shall prepare and submit to each tripartite review meeting a Project Performance Evaluation Report (PPER). Additional PPERs may be requested, if necessary, during the project.

A project terminal report will be prepared for consideration at the terminal tripartite review meeting. It shall be prepared in draft sufficiently in advance to allow review and technical clearance by the executing agency at least four months prior to the terminal tripartite review.

Baseline data for evaluation of the project will be collected in the first year of the project. The project shall be subject to first evaluation 12 months after the start of full implementation. The first evaluation will focus on the review of the baselines, adequacy of the project strategy, and initial customer response. The organization, detailed terms of reference and timing will be decided after consultation between the parties to the project document, plus any associated agency. The second mid term evaluation will be conducted at the beginning of the third year of the project, approximately by the end of an eighteen month period after the establishment of the baseline data. This review will focus on the reduction of GHG emissions as a result of the project, and the extent to which the private sector has adopted the technologies introduced. A survey of private sector workshops will be carried out to assess whether they are buying new tune-up equipment and if they are already using such equipment to ascertain the condition of the existing equipment. The results of reduction in GHGs will be compared with the national GHG emissions inventory now under preparation. The review will also cover the progress in market development, special studies, and loan disbursement under the revolving loan fund. Necessary changes in the project's design to achieve the project goals will be discussed and agreed upon with the government.

The project will be subject to review according to UNDP monitoring procedures. ENERCON will be responsible for reporting on project progress on quarterly basis. The project will be nationally executed, therefore the guidelines for national execution including quarterly financial reporting and submission of accounts annually, duly audited by a firm approved by the Auditor General of Pakistan. The project terminal report will be prepared at least two months before the end of the project.

In addition to the quarterly progress reporting, the project will submit an annual report which will form the basis of the annual monitoring reviews by UNDP. The first monitoring visit will take place during 1996 and will consider the progress reports prepared by the concerned agencies, and made available at least one month before the date fixed for the review. The review report thus prepared will be presented to the Government of Pakistan.

I. Legal Context

The following types of revisions may be made to this project document with the signatures of the UNDP Resident Representative only, provided he or she is assured that the other signatories of the project document have no objections to the proposed changes:

1. Revisions in, or additions of, any of the annexes of the project document;
2. Revisions which do not involve significant changes in the immediate objectives, outputs or activities of a project, but are caused by the rearrangement of inputs already agreed to or by cost increases due to inflation;
3. Mandatory annual revisions which rephase the delivery of agreed project inputs or increased expert or other costs due to inflation or take into account Agency expenditure flexibility.

**STANDARD ANNEX TO PROJECT DOCUMENTS FOR USE IN COUNTRIES
WHICH ARE NOT PARTIES TO THE STANDARD BASIC ASSISTANCE AGREEMENT**

Supplemental Provisions to the Project Document: The Legal Context

General responsibilities of the Government, UNDP and the executing agency

1. All Phases and aspects of UNDP assistance to this project shall be governed by and carried out in accordance with the relevant and applicable resolutions and decisions of the competent UN organs and in accordance with UNDP's policies and procedures for such projects, and subject to the requirements of the UNDP Monitoring, Evaluation and Reporting System.
2. The Government shall remain responsible for this UNDP-assisted development project and the realization of its objectives as described in this Project Document.
3. Assistance under this Project Document being provided for the benefit of the Government and the people of (the particular country or territory), the Government shall bear all risks of operations in respect of this project.
4. The Government shall provide to the project the national counterpart personnel, training facilities, land, buildings, equipment and other required services and facilities. It shall designate the Government Co-operating Agency named in the cover page of this document (hereinafter referred to as the "Co-operating Agency"), which shall be directly responsible for the implementation of the Government contribution to the project.
5. The UNDP undertakes to complement and supplement the Government participation and will provide through the Executing Agency the required expert services, training, equipment and other services within the funds available to the project.
6. Upon commencement of the project the Executing Agency shall assume primary responsibility for project execution and shall have the status of an independent contractor for this purpose. However, that primary responsibility shall be exercised in consultation with UNDP and in agreement with the Co-operating Agency. Arrangements to this effect shall be stipulated in the Project Document as well as for the transfer of this responsibility to the Government or to an entity designated by the Government during the execution of the project.
7. Part of the Government's participation may take the form of a cash contribution to UNDP. In such cases, the Executing Agency will provide the related services and facilities and will account annually to the UNDP and to the Government for the expenditure incurred.

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8. Prior to completion of UNDP assistance to the project, the Government, the UNDP and the Executing Agency shall consult as to the disposition of all project equipment provided by the UNDP. Title to such equipment shall normally be transferred to the Government, or to an entity nominated by the Government, when it is required for continued operation of the project or for activities following directly therefrom. The UNDP may, however, at its discretion, retain title to part or all of such equipment.

9. At an agreed time after the completion of UNDP assistance to the project, the Government and the UNDP, and if necessary the Executing Agency, shall review the activities continuing from or consequent upon the project with a view to evaluating its results.

10. UNDP may release information relating to any investment oriented project to potential investors, unless and until the Government has requested the UNDP in writing to restrict the release of information relating to such project.

Rights, Facilities, Privileges and Immunities

1. In accordance with the Agreement concluded by the United Nations (UNDP) and the Government concerning the provision of assistance by UNDP, the personnel of UNDP and other United Nations organizations associated with the project shall be accorded rights, facilities, privileges and immunities specified in said Agreement.

2. The Government shall grant UN Volunteers, if such services are requested by the Government, the same rights, facilities, privileges and immunities as are granted to the personnel of UNDP.

3. The Executing Agency's contractors and their personnel (except nationals of the host country employed locally) shall:

(a) Be immune from legal process in respect of all acts performed by them in their official capacity in the execution of the project; and

(b) Be immune from national service obligations;

(c) Be immune together with their spouses and relatives dependent on them from immigration restrictions;

(d) Be accorded the privileges of bringing into the country reasonable amounts of foreign currency for the purposes of the project or for personal use of such personnel, and of withdrawing any such amounts brought into the country, or in accordance with the relevant foreign exchange regulations, such amounts as may be earned therein by such personnel in the execution of the project; and

(e) Be accorded together with their spouses and relatives dependent on them the same repatriation facilities in the event of international crises as diplomatic envoys.

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4. All personnel of the Executing Agency's contractors shall enjoy inviolability for all papers and documents relating to the project.

5. The Government shall either exempt from or bear the cost of any taxes, duties, fees or levies which it may impose on any firm or organization which may be retained by the Executing Agency and on the personnel of any such firm or organization, except for nationals of the host country employed locally, in respect of:

(a) The salaries or wages earned by such personnel in the execution of the project;

(b) Any equipment, materials and supplies brought into the country for the purposes of the project or which, after having been brought into the country, may be subsequently withdrawn therefrom;

(c) Any substantial quantities of equipment, materials and supplies obtained locally for the execution of the project, such as, for example, petrol and spare parts for the operation and maintenance of equipment mentioned under (b) above, with the provision that the types and approximate quantities to be exempted and relevant procedures to be followed shall be agreed upon with the Government and, as appropriate, recorded in the Project Document; and

(d) As in the case of concessions currently granted to UNDP and Executing Agency's personnel, any property brought, including one privately owned automobile per employee, by the firm or organization or its personnel for their personal use or consumption or which after having been brought into the country, may subsequently be withdrawn therefrom upon departure of such personnel.

6. The Government shall ensure:

(a) prompt clearance of experts and other persons performing services in respect of this project; and

(b) the prompt release from customs of:

(i) equipment, materials and supplies required in connection with this project; and

(ii) property belonging to and intended for the personal use or consumption of the personnel of the UNDP, its Executing Agencies, or other persons performing services on their behalf in respect of this project, except for locally recruited personnel.

(Pak Rs. in Million)

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Budget for UNDP/GEF Contribution

Budget Line	Description	(US\$ in Million)											
		Total		1996		1997		1998		1999		2000	
		m/m	US\$	m/m	US\$	m/m	US\$	m/m	US\$	m/m	US\$	m/m	US\$
10.	PROJECT PERSONNEL												
11.	International Experts:												
11.01	Technical Advisor	12	0.210	3	0.053	4	0.070	4	0.070	1	0.018		
11.03	Training. & Q.C. Specialist (Diesel)	12	0.180	4	0.060	6	0.090	2	0.030				
11.03	Training. & Q.C. Specialist (Gasoline)	12	0.180	4	0.060	6	0.090	2	0.030				
11.99	Subtotal: experts/consultants	36	0.570	11	0.173	16	0.250	8	0.130	1	0.018		
13.	Administrative Support												
13.01	Accounts Assistant	36	0.018	9	0.005	12	0.006	12	0.006	3	0.002		
13.02	Secretary/Typist	36	0.014	9	0.004	12	0.005	12	0.005	3	0.001		
13.03	Drivers	72	0.014	18	0.004	24	0.005	24	0.005	6	0.001		
13.99	Subtotal: admin. support	144	0.047	36	0.012	48	0.016	48	0.016	12	0.004		
15.	Duty Travel												
15.01			0.120		0.030		0.040		0.040		0.010		
16.	Mission Costs												
16.01			0.125		0.031		0.042		0.042		0.010		
17.	NPPP												
17.01	Project Director	36	0.090	9	0.023	12	0.030	12	0.030	3	0.008		
17.02	Project Administrator	60	0.135	9	0.020	12	0.027	12	0.027	12	0.027	3	0.007
17.03	Project Manager (Diesel)	36	0.050	9	0.013	12	0.017	12	0.017	3	0.004		
17.04	Project Manager (Gasoline)	36	0.050	9	0.013	12	0.017	12	0.017	3	0.004		
17.05	Project Engineers	240	0.192	36	0.029	84	0.067	96	0.077	24	0.019		
17.06	W/Shop Supervisors	240	0.196	36	0.014	84	0.034	96	0.038	24	0.010		
17.07	I & O Specialist	24	0.024	4	0.004	12	0.012	6	0.006	2	0.002		
17.08	D. Base Specialist	32	0.032	6	0.006	12	0.012	12	0.012	2	0.002		
17.99	Subtotal NPPP	704	0.670	118	0.121	240	0.215	258	0.224	73	0.076	12	0.027
19.	Personnel component total:	884	1.532	165	0.307	304	0.563	316	0.451	86	0.118	12	0.027
20.	SUB-CONTRACTS												
21.	Preparation of information materials		0.021		0.016		0.005						
22.	Printing of information materials		0.022		0.016		0.005						
23.	Programme promotion		0.540		0.056		0.244		0.199		0.041		0.010
24.	Special studies		0.375		0.038		0.075		0.181		0.066		0.005

Budget Line	Description	Total		1996		1997		1998		1999		2000		2001	
		m/m	US\$	m/m	US\$	m/m	US\$	m/m	US\$	m/m	US\$	m/m	US\$	m/m	US\$
30. TRAINING															
32.01	Training of Trainers		0.008				0.008								
32.02	2 day W/Shop for Owners		0.007				0.007								
32.03	3 week W/shops Mechanics		0.120				0.080		0.040						
39. Component Total			0.135				0.095		0.040						
40. EQUIPMENT															
41. OTHER EQUIPMENT															
42. Expendable Equipment			0.024		0.008		0.010		0.005		0.002				
42. Non-expendable equipment															
Gasoline Program:															
42.01	Engine Analyser (10)		0.220		0.110		0.110								
42.02	CO Analyser (20)		0.022		0.011		0.011								
42.03	Timing Lights (20)		0.011		0.006		0.006								
42.04	Dwell/Techometers (20)		0.011		0.006		0.006								
Diesel Program:															
42.05	Diesel Test Benches (5)		0.275		0.138		0.138								
42.06	Smoke Meters (5)		0.055		0.028		0.028								
42.07	Injector Testors (5)		0.022		0.011		0.011								
42.08	Compression Recorders (5)		0.006		0.003		0.003								
42.09	Diesel Timing Units (5)		0.033		0.017		0.017								
42.10	Training Aids		0.150		0.075		0.075								
42.11	Insurance and Other Import Charges		0.115		0.058		0.058								
49. Component Total			0.943		0.467		0.476		0.305		0.002				
50. MISCELLANEOUS															
51.	Operation and maintenance of equipment		0.083		0.030		0.040		0.008		0.005				
52.	Reporting cost		0.060		0.015		0.020		0.020		0.005				
53.	Supplies		0.012		0.003		0.004		0.004		0.001				
54.	Disinfection Workshops		0.067						0.050		0.017				
55.	Field Office Overheads		0.210		0.053		0.070		0.070		0.018				
59. Component Total			0.432		0.100		0.134		0.152		0.045				

[illegible]

Estimate of Contribution of Private Sector

		(Pak Rs. in Million)											
		Total		1996		1997		1998		1999		2000	
		m/m	Rs.	m/m	Rs.	m/m	Rs.	m/m	Rs.	m/m	Rs.	m/m	Rs.
10. PROJECT PERSONNEL													
10.01 Mechanics (Gasoline Engines)	120	0.600				90	0.480	30	0.120				
10.02 Mechanics (Diesel Engines)	120	0.600				90	0.480	30	0.120				
10. Component total	240	1.200				180	0.960	60	0.240				
40. DEMONSTRATION TUNE-UP EQUIPMENT													
Gasoline Equipment	4.427		1.771				1.771		0.885				
Diesel Equipment	5.530		2.212				2.212		1.106				
Component total	9.957		3.983				3.983		1.991				
43. PREMISES													
Gasoline Stations	1.200		0.360				0.600		0.240				
Diesel Stations	1.200		0.360				0.600		0.240				
49. Component total	2.400		0.720				1.200		0.480				
50. MISCELLANEOUS													
Utilities (Gasoline Stations)	0.360		0.108				0.180		0.072				
Utilities (Diesel Stations)	0.360		0.108				0.180		0.072				
59. Component total	0.720		0.216				0.360		0.144				
Grand Total	246	14.277		4.919		180	6.563	60	2.833				

K. Annexes

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Annex I Vehicle Fleet, Emission and Savings from Tune-ups

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Exhibit 1

Total Vehicle Population and Growth Rates

Vehicle Population	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97
Petrol Vehicles											
Motorcycles/Scooters	630,277	704,033	778,219	815,083	883,449	932,353	988,294	1,047,592	1,110,447	1,177,071	1,247,699
Motor Cars	270,829	315,713	363,563	382,666	415,490	454,410	481,675	510,575	541,210	573,682	608,103
Jeeps	5,268	5,189	5,634	5,693	6,390	6,261	6,637	7,035	7,457	7,905	8,379
Motor Cabs/Taxis	21,610	20,967	21,168	23,156	25,849	24,051	25,494	27,024	28,645	30,364	32,186
Motor Cabs/Rickshaws	35,860	30,527	31,403	31,243	31,963	32,132	34,060	36,104	38,270	40,566	43,000
Delivery Vans	20,968	21,214	22,479	23,819	25,240	26,745	28,884	31,195	33,691	36,386	39,297
Light Pickups	36,389	39,579	45,368	45,582	48,357	71,465	77,182	83,357	90,025	97,227	105,005
Total Petrol Vehicles	1,021,200	1,137,222	1,267,834	1,327,242	1,436,738	1,547,417	1,642,226	1,742,881	1,849,745	1,963,204	2,083,668
Diesel Vehicles											
Buses	30,995	32,205	32,004	34,921	39,768	37,117	40,086	43,293	46,757	50,497	54,537
Trucks	52,571	59,254	63,657	67,396	71,831	75,649	81,701	88,237	95,296	102,920	111,153
Station Wagon	23,313	27,790	32,299	35,577	41,331	43,560	46,174	48,944	51,881	54,993	58,293
Heavy Trucks	24,259	26,384	30,246	30,388	32,238	47,643	51,455	55,571	60,017	64,818	70,004
Jeeps	21,070	20,756	22,534	22,772	25,561	25,045	26,547	28,140	29,829	31,618	33,516
Total Diesel Vehicles	152,209	166,391	180,740	191,049	210,729	229,014	245,963	264,186	283,779	304,847	327,503

Source: Economic Survey, 1990-91 for historical data

(Continued)

Exhibit 1 (Cont.)

Vehicle Growth Rates	1987-88	1988-89	1989-90	1990-91	1991-92	Cum. Grow 1987-1992	Proj.-ted Growth
Petrol Vehicles							
Motorcycles/Scooters	11.70%	10.54%	4.74%	8.39%	5.54%	10.28%	6.00%
Motor Cars	16.57%	15.16%	5.25%	8.58%	9.37%	13.81%	6.00%
Jeeps	-1.49%	8.57%	1.05%	12.25%	-2.02%	4.41%	6.00%
Motor Cabs/Taxis	-2.98%	0.96%	9.39%	11.63%	-6.96%	2.71%	6.00%
Motor Cabs/Rickshaws	-14.87%	2.87%	-0.51%	2.30%	0.53%	-2.71%	6.00%
Delivery Vans	5.96%	5.96%	5.96%	5.96%	5.96%	6.27%	8.00%
Light Pickups	8.77%	14.63%	0.47%	6.09%	47.79%	18.38%	8.00%
Total Petrol Vehicles	11.36%	11.49%	4.69%	8.25%	7.70%	10.95%	
Diesel Vehicles							
Buses	3.90%	-0.62%	9.11%	13.88%	-6.67%	4.61%	8.00%
Trucks	12.71%	7.43%	5.87%	6.58%	5.32%	9.53%	8.00%
Station Wagons	19.20%	16.23%	10.13%	16.19%	5.39%	16.92%	6.00%
Heavy Pickups	8.77%	14.63%	0.47%	6.09%	47.79%	18.38%	8.00%
Jeeps	-1.49%	8.57%	1.05%	12.25%	-2.02%	4.41%	6.00%
Total Diesel Vehicles	9.32%	8.62%	5.70%	10.30%	8.68%	10.75%	

Exhibit 2

Motor Vehicles on Road in Pakistan (1947 - 1990)

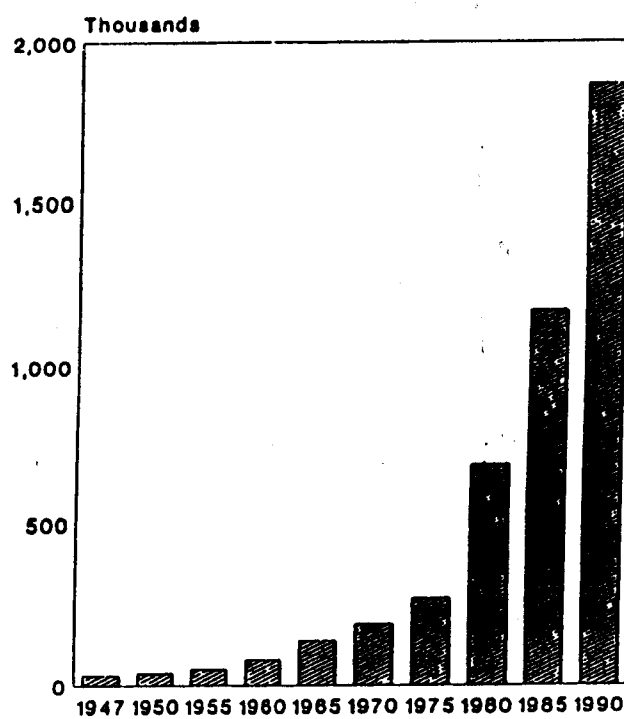
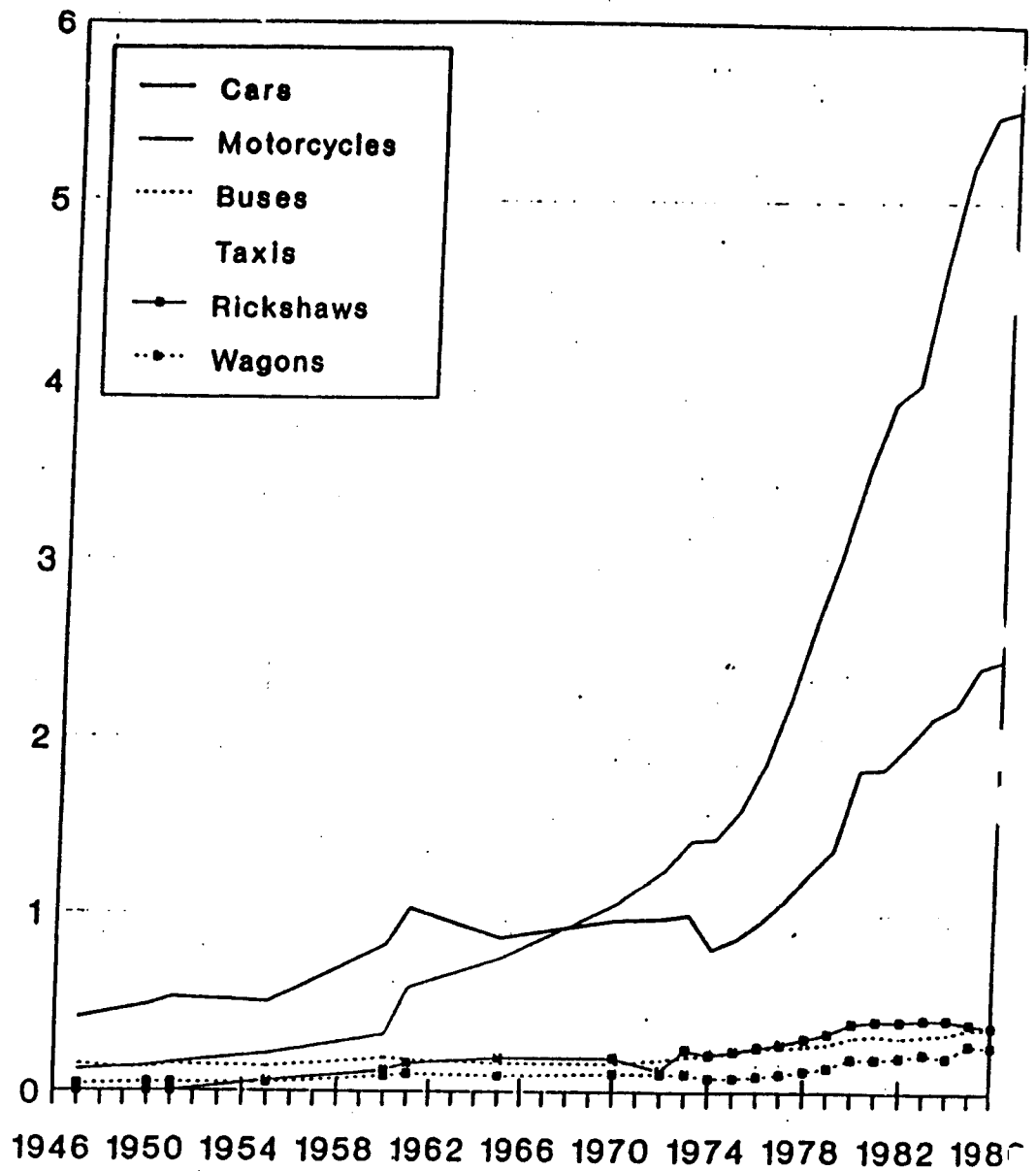


Exhibit 3

Motor Vehicles Per '000 Population



Source: Trans. Energy Assessment of Ind.

Exhibit 4

Est. Demand for Gasoline & Diesel for Road Transport ('000 tonnes)

Estimated Demand for Gasoline and Diesel for Road Trans (All figures in '000 tonnes)

Exhibit 4

Vehicle Type	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97
Motorcycles/Scooters	158	176	195	204	221	233	247	262	278	295	312
Motor Cars	297	346	398	419	455	498	527	559	593	628	666
Jeeps	10	9	10	10	12	11	12	13	14	15	16
Motor Cabs/Taxis	131	128	129	141	157	146	155	164	174	185	196
Motor Cabs/Rickshaws	59	51	52	52	53	53	57	60	63	67	71
Delivery Vans	31	31	33	35	37	39	42	46	49	53	57
Light Pickups	120	130	149	150	159	235	254	274	296	319	345
Total Gasoline	805	871	966	1,011	1,094	1,216	1,294	1,378	1,467	1,562	1,663
Buses	578	600	597	651	741	692	747	807	872	941	1,017
Trucks	1,189	1,340	1,440	1,524	1,625	1,711	1,848	1,996	2,156	2,328	2,514
Station Wagons	190	227	263	290	337	355	377	399	423	449	475
Heavy Pickups	95	103	118	119	126	187	201	218	235	254	274
Jeeps	27	27	29	30	33	33	35	37	39	41	44
Total Diesel	2,080	2,298	2,448	2,614	2,863	2,978	3,208	3,457	3,724	4,013	4,324
Estimated Total Fuel Consumption, Tonnes											
Gasoline	805	871	966	1,011	1,094	1,216	1,294	1,378	1,467	1,562	1,663
Diesel	2,080	2,298	2,448	2,614	2,863	2,978	3,208	3,457	3,724	4,013	4,324
Actual Fuel Consumption, Tonnes											
Gasoline	851	915	964								
Diesel	2,127	2,426	2,488								
Calculated / Actual Consumption											
Gasoline	0.95	0.95	1.00								
Diesel	0.98	0.95	0.98								
Actual Consumption, Tce											
Gasoline	855	920	969								
Diesel	2,149	2,451	2,514								
Gasoline, Tonnes/TOE	0.9954										
Diesel, Tonnes/TOE	0.9899										

Source: Energy Yearbook, 1991 for Historical Data

Exhibit 5

Estimates of Fuel Use by Vehicle Type

Vehicle Type	Fuel Type	km/year	km/litre	Tonnes/ Yr/veh.
Motorcycles/Scooters	Gasoline	12,000	35.00	0.25
Motor Cars	Gasoline	15,000	10.00	1.10
Jeeps	Gasoline	15,000	6.00	1.83
Motor Cabs/Taxis	Gasoline	75,000	9.00	6.08
Motor Cabs/Rickshaws	Gasoline	50,000	22.00	1.66
Delivery Vans	Gasoline	20,000	10.00	1.46
Light Pickups	Gasoline	45,000	10.00	3.29
Buses	Diesel	60,000	2.80	18.64
Trucks	Diesel	65,000	2.50	22.62
Station Wagons	Diesel	75,000	8.00	8.16
Heavy Pickups	Diesel	45,000	10.00	3.92
Jeeps	Diesel	15,000	10.00	1.31

Source: Transportation Energy Assessment of Islamabad, 1991; International Institute for Energy Conservation

Exhibit 6

Percentage Distribution of Vehicle Age

Type of Vehicle	1980 and Older	1981-1985	1986-1990	Total
Motorcycles/Scooters	40.60%	34.62%	24.79%	100.00%
Automobiles	23.66%	28.18%	48.16%	100.00%
Taxis	75.67%	10.65%	13.69%	100.00%
Buses	10.18%	30.15%	59.67%	100.00%
Trucks	55.06%	29.64%	15.30%	100.00%
Passenger Wagons	48.45%	28.69%	22.86%	100.00%

Note: Figures for motorcycles/scooters, automobiles, and taxis are based on survey conducted in Islamabad. Figures for buses, trucks and passenger wagons are based on country statistics.

Exhibit 7

Vehicle Emission Standards

Sr. No.	Parameters	Proposed Standards (Max. Permissible Limits)	Measuring Method
1.	Smoke	40% or 2 on the Ringelmann Scale (During engine acceleration mode)	To be compared using Ringelmann Chart at a distance of 6 meters or more
2.	Carbon Monoxide	Emission Standards	
(i)	New vehicles	4.50%	Under idling condition:
(ii)	Used vehicles	6%	Non-dispersive infra-red detection through Gas Analyzer
3.	Noise	85 dB (A)	Sound Meter at 7.5 meter from the source

Exhibit 8

Estimate for Emission in Road Transport Sector

Estimate of Emission, 1992-93

Vehicle Type	CO2 '000 Tons	SO2 Tons	LEAD Tons	NOx '000 Tons	HC '000 Tons	CO '000 Tons	SPM '000 Tons
Motorcycles/Scooters	719	933	121	2	50	336	39
Motor Cars	1,533	1,990	259	7	26	232	14
Jeeps	35	46	6	0	0	3	0
Motor Cabs/Taxis	451	585	76	2	7	61	4
Motor Cabs/Rickshaws	164	213	28	2	7	48	6
Delivery Vans	120	156	20	1	2	18	1
Light Pickups	723	939	122	4	12	109	7
Total Gasoline	3,745	4,863	632	18	105	808	71
Buses	2,157	13,839	0	33	5	22	7
Trucks	5,333	34,224	0	73	12	49	15
Station Wagons	1,107	7,106	0	49	8	32	10
Heavy Pickups	581	3,730	0	3	2	3	3
Jeeps	102	654	0	0	0	0	1
Total Diesel	9,280	59,553	0	158	27	106	36

Estimate of Emission, 1996-97

Vehicle Type	CO2 '000 Tons	SO2 Tons	LEAD Tons	NOx '000 Tons	HC '000 Tons	CO '000 Tons	SPM '000 Tons
Motorcycles/Scooters	962	1,249	162	3	67	449	52
Motor Cars	2,051	2,663	346	10	35	310	19
Jeeps	47	61	8	0	0	4	0
Motor Cabs/Taxis	603	783	102	3	9	82	5
Motor Cabs/Rickshaws	220	285	37	2	10	64	8
Delivery Vans	177	229	30	1	3	27	2
Light Pickups	1,062	1,380	179	5	18	161	10
Total Gasoline	5,122	6,652	864	24	142	1,098	96
Buses	3,169	20,335	0	49	8	32	10
Trucks	7,836	50,286	0	108	17	72	22
Station Wagons	1,482	9,509	0	65	10	43	14
Heavy Pickups	854	5,481	0	4	2	4	5
Jeeps	136	875	0	1	0	1	1
Total Diesel	13,477	86,485	0	226	38	152	52

Exhibit 11(Cont.)
Data on Fuel Efficiency from Instrumented Tune-ups

Manufac. of the Car	Manufac.'s Model	Year of Manufac.	Engine Capacity, cc	Time Since Last Tune-up, months	Carbon Monoxide before Tuning, %	Carbon Monoxide after Tuning, %	Hydro- carbons before Tuning, ppm	Hydro- carbons after Tuning, ppm	Oxygen before Tuning, %	Oxygen after Tuning, %	Fuel Consump. before Tuning, km/litre	Fuel Consump. after Tuning, km/litre	Impr., %
Suzuki	Van	1980	800		1.7	1.9	2000	2000	10.4	10.2	13.2	13.7	3.9
Toyota	Corolla	1989	1200	2	3.2	1.7	676	504	2.1	0.5	10.3	11.4	10.7
Suzuki	FX 800	1988	800	6	4.5	1.7	553	423	6.4	3.3	11.4	12.5	9.7
Suzuki	Van	1988	800		1.6	1.2	1782	265	8.1	3.6	9.8	10.8	9.6
Toyota	Corolla	1982	1200		9.2	3.8	776	518	0.8	4.4	10.9	12.4	13.2
Toyota	Corolla	1979	1200		5.6	2.4	768	565	2.4	2.5	8.5	9.3	9.0
Toyota	Corolla	1979	1200		7.3	4.0	2000	2000	8.2	9.2	10.2	10.3	1.6
Nissan	Sunny	1988	1000		4.5	2.2	393	478	2.7	4.0	9.6	10.1	5.5
Daihatsu	Charade	1987	1000	12	1.6	1.6	544	256	1.0	0.3	9.6	10.1	4.9
Peugeot	205	1988	1000		1.0	2.0	473	490	2.1	1.4	7.2	7.2	-0.1
Toyota	Corolla	1986	1200	1	6.7	3.6	658	482	4.6	6.0	7.6	9.2	21.3
Suzuki	Swift	1988	1000		3.7	1.7	340	350	0.9	1.8	13.6	13.6	0.1
Suzuki	FX 800	1985	800		2.3	1.5	327	351	2.0	1.6	13.3	13.6	2.2
Daihatsu	Charade	1985	1000		2.2	0.2	441	623	6.4	4.7	11.8	12.0	1.6
Daihatsu	100 A	1979	1000		5.6	1.6	630	443	6.7	3.4	5.2	5.8	12.2
Datsun	120 Y	1979	1200	6	7.8	1.7	859	388	6.9	3.7	9.2	10.5	14.8
Suzuki	SA 310	1984	1000		8.0	2.8	545	211	2.9	4.4	7.4	1.3	26.2
Toyota	Corolla	1979	1200		7.7	1.1	1246	539	6.0	0.4	10.9	11.6	6.3
Toyota	Corolla	1979	1200	3	6.8	2.2	857	614	0.4	2.6	8.3	9.5	13.5
Suzuki	FX 800	1986	800		9.4	1.6	826	438	1.3	1.2	15.5	15.6	0.6
Suzuki	FX 800	1986	800		4.3	1.5	473	363	9.2	2.4	14.6	15.4	5.7
Suzuki	FX 800	1984	800		0.7	1.6	650	303	5.4	1.2	11.7	12.7	8.8
Mazda	1000	1971	1000		6.7	1.1	1611	1708	2.3	3.8	10.9	11.9	9.3
Toyota	Starlet	1979	1000		3.0	1.5	1365	735	6.5	0.6	9.5	10.5	10.0
Suzuki	FX 800	1987	800		6.7	3.4	350	422	0.2	2.2	13.3	13.5	1.7
Toyota	Corolla	1979	1200		5.3	1.2	797	518	4.2	3.3	9.6	11.4	18.6
Suzuki	Van	1986	800		0.1	1.4	633	416	4.1	1.2	13.6	14.5	5.9
Mazda	323	1986	1300		5.5	2.5	995	487	5.2	1.3	9.5	10.5	10.7
Average					4.3	2.1	744	509	3.7	2.7	11.2	12.1	8.5

Explanation Note (Exhibit 11):

ENERCON had conducted a limited number of “jar” or “liter” tests before and after the tune-ups conducted in one of the demonstration centres in Karachi in 1988-89. The results of these tests are included in the above exhibit.

The procedure for the tests is fairly common and well established. The tests were conducted in the following manner:

1. Fuel supply line from the fuel tank to the fuel pump was disconnected by closing a valve temporarily installed in the line for this purpose. The pump was instead connected to a container or jar in which a known quantity of fuel could be poured.
2. The carburetor of the car was run dry while idling in a stationary condition.
3. The fuel container was filled with a known quantity of fuel.
4. The car was started again. The odometer reading was recorded to the tenth of a kilometer.
5. The car was driven on a predetermined route by the owner/driver of the car. This route was selected near the workshop where the demonstration centre was set up.
6. The car stopped when it ran out fuel. The odometer reading was again recorded.
7. The fuel consumption of the car was calculated by dividing the distance run by the fuel consumed.
8. The above procedure was repeated after the tune-up, with the same driver.

Accuracy of the Test Procedure

The error in odometer reading was of the order of ± 0.05 km, as the reading was rounded off to the nearest 0.1 km. The effect of the driving style can be ignored as the same driver was used in both before and after tests. The quantity of fuel was measured fairly accurately using a container with a narrow neck. The main source of error was the change in traffic condition on the route between the before and after tests, which could lead to an error of about $\pm 10\%$. The overall error margin therefore could be in the range of $\pm 15\%$.

Other Comments on the Data

1. The hydrocarbon sensor had a maximum range of 2000 ppm, beyond which the level was reported as 2000 ppm.
2. The oxygen sensor in a few cases was not functional. The readings were reported as zero in such cases.
3. An overall reduction in fuel efficiency was observed in some cases. This could be either due to the fact that the engines were already in good tuning and could not be improved, or due to measurement errors in cases where improvement was very small.
4. The period elapsed since last tuning in months, was not recorded in a large number of cases. No data was recorded where the owner stated that it had been more than a year since the last tune-up, as reliability of any reported number beyond one year was not considered to be good.

Exhibit 12 Potential for Reduction in Fuel Consumption by 1996-7 Through Tune-ups

	Reduction Potential	Market Value	
		Rs/Tonne	\$/Tonne
Gasoline Vehicles:	6.00%	16.151	140
Diesel Vehicles:	6.00%	5.805	160

Vehicle Type		1991-92			1996-97		
		Fuel Saved Tonnes	F.E. Savings \$ Mill.	Customer Savings Rs. Million	Fuel Saved Tonnes	F.E. Savings \$ Mill.	Customer Savings Rs. Million
Motorcycles/Scooters	Gasoline	14,001	1.96	226	18,737	2.62	303
Motor Cars	Gasoline	29,855	4.18	482	39,952	5.59	645
Jeeps	Gasoline	686	0.10	11	917	0.13	15
Motor Cabs/Taxis	Gasoline	8,779	1.23	142	11,748	1.64	190
Motor Cabs/Rickshaws	Gasoline	3,199	0.45	52	4,280	0.60	69
Delivery Vans	Gasoline	2,343	0.33	38	3,442	0.48	56
Light Pickups	Gasoline	14,086	1.97	227	20,697	2.90	334
Total Gasoline		72,947	10	1,178	99,774	13.97	1,611
Buses	Diesel	41,518	6.64	241.00	61,004	9.76	354.10
Trucks	Diesel	102,671	16.43	595.96	130,857	24.14	875.66
Station Wagons	Diesel	21,317	3.41	123.74	28,527	4.56	165.59
Heavy Pickups	Diesel	11,191	1.79	64.96	16,444	2.63	95.45
Jeeps	Diesel	1,961	0.31	11.38	2,624	0.42	15.23
Total Diesel		178,658	29	1,037	259,456	41.51	1506.04

Potential for Reduction in Emissions by 1996-97 Through Tune-Ups

Reduction Targets	CO2	SO2	LEAD	NOx	HC	CO	SPM
Gasoline Vehicles	6.00%	6.00%	6.00%	6.00%	21.00%	45.00%	20.00%
Diesel Vehicles	6.00%	6.00%	0.00%	6.00%	17.00%	8.00%	20.00%

Reduction Potential	CO2 '000 Tons	SO2 Tons	LEAD Tons	NOx '000 Tons	HC '000 Tons	CO '000 Tons	SPM '000 Tons
Gasoline Vehicles	307	399	52	1	30	494	19
Diesel Vehicles	809	5,189	0	14	7	12	10
Total	1116	5,588	52	15	36	506	30

Exhibit 15 Projected Fuel Savings & Reduction in Emission as a Result of the Projects

	1992-93	1993-94	1994-95	1995-96	1996-97
Estimated Fuel Savings, Tonnes					
Gasoline Engines		862	5,495	12,929	12,929
Diesel Engines		7,130	28,520	71,300	71,300
Total Fuel Savings		7,992	34,015	84,229	84,229
Estimated Savings for Customers, Rs Million					
Gasoline Engines		14	89	209	209
Diesel Engines		41	166	414	414
Total Estimated Savings		55	254	623	623
Estimated Savings in Foreign Exchange, \$ '000					
Gasoline Engines		121	769	1,810	1,810
Diesel Engines		1,141	4,563	11,408	11,408
Total Savings in FE		1,261	5,332	13,218	13,218

Estimated Reduction in Emission By 1996-97 ('000 Tonnes)

	CO2 Tons	SO2 Tons	LEAD Tons	NOx Tons	HC Tons	CO Tons	SPM Tons
Gasoline Engines	39,820	52	7	187	3,872	63,998	2,488
Diesel Engines	222,219	1,426	0	3,725	1,787	3,345	2,855
Total	262,040	1,478	7	3,912	5,659	67,343	5,342

	1992-93	1993-94	1994-95	1995-96	1996-97
CO2 Gasoline Engines	0	2,655	16,924	39,820	39,820
CO2, Diesel Engines	0	22,222	88,888	222,219	222,219
Total CO2	0	24,877	105,811	262,040	262,040
SO2 Gasoline Engines	0	3	22	52	52
SO2, Diesel Engines	0	143	570	1,426	1,426
Total SO2	0	146	592	1,478	1,478
Lead Gasoline Engines	0	0	3	7	7
Lead Diesel Engines	0	0	0	0	0
Total Lead	0	0	3	7	7
NOx Gasoline Engines	0	12	79	187	187
NOx Diesel Engines	0	373	1,490	3,725	3,725
Total NOx	0	385	1,570	3,912	3,912
HC Gasoline Engines	0	258	1,646	3,872	3,872
HC Diesel Engines	0	179	715	1,787	1,787
Total HC	0	437	2,360	5,659	5,659
CO Gasoline Engines	0	4,267	27,199	63,998	63,998
CO Diesel Engines	0	335	1,338	3,345	3,345
Total CO	0	4,601	28,537	67,343	67,343
SPM Gasoline Engines	0	166	1,057	2,488	2,488
SPM Diesel Engines	0	285	1,142	2,855	2,855
Total SPM	0	451	2,199	5,342	5,342

Annex II Equipment for Gasoline Engines

- Level 1** Electronic Engine Analyzer with "all systems" engine diagnostics. This will cover all components in all major engine systems, i.e. fuel distribution, compression, charging, timing, ignition and on-board computers. Analyzer print-outs will show malfunctioning components with specific instructions for repair, replacement or adjustment. Four gas analyzers and printer are essential components of this type of equipment. Manual testing mode measures all engine parameters and displays it digitally.
- Level 2:** Digital Engine Analyzer with capability of individual engine system tests. Print outs of results with diagnostic message is possible, and a measurement screen with live scope patterns and digital data display is available. Four gas analyzer and printer are essential components of this type of equipment.
- Level 3:** Only digital display of elementary engine parameters is possible. A separate CO analyzer and HC analyzer is required. Tacho/Dwell meter and timing lights are to be included.