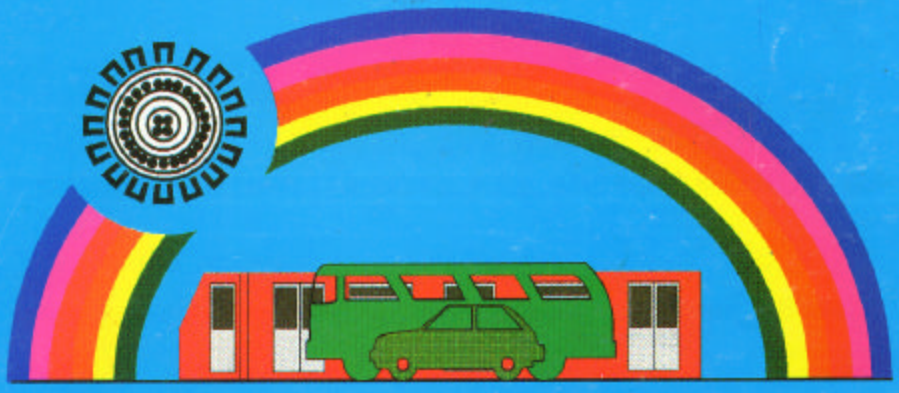
CONFERENCIA INTERNACIONAL

# HACIA UN TRANSPORTE LIMPIO: VEHICULOS LIMPIOS DE BAJO CONSUMO



INTERNATIONAL CONFERENCE

# TOWARDS CLEAN TRANSPORT: FUEL EFFICIENT AND CLEAN MOTOR VEHICLES

## RESUMEN / ABSTRACTS

MEXICO

CIUDAD DE MEXICO
MEXICO CITY

28-30/III/1994

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# FUEL EFFICIENT AND CLEAN MOTOR VEHICLES

The conference is organised by
the Organisation for Economic Co-operation and Development
(OECD) and the International Energy Agency (IEA),
with the participation of EC, ECMT,
UN ECE, UNEP, UNDP, UNIDO, World Bank, and OLADE.

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## Conferencia Internacional

# HACIA UN TRANSPORTE LIMPIO:
# VEHICULOS LIMPIOS DE BAJO CONSUMO

A la velocidad de crecimiento actual, el presente parque vehicular mundial que consta de más de 500 millones de vehículos de motor alcanzará mil millones en los próximos quince años, con un crecimiento dramático en la demanda de productos del petróleo. El incremento en el consumo de combustibles es un asapecto particularmente importante por razones de protección ambiental, balanza de pagos y seguridad energética. El transporte alcanza cerca del 60 por ciento del consumo total de petrolíferos, y los vehículos de motor se han convertido en la mayor fuente de emisiones en muchos países (por ej. contaminación del aire urbano, lluvia ácida, y gases de invernadero).

El transporte, tanto de pasajeros como de carga, es el sector de más rápido crecimiento en las economías de los países de la OCDE y en el mundo entero, con un crecimiento más rápido que el producto interno bruto. Muchos factores influyen en esta situación, tales como: el desarrollo socio-económico; poblaciones urbanas crecientes; disociación de los lugares de residencia y de trabajo; aumento en el transporte de carga por carretera; congestión del tráfico; potencia creciente delos vehículos y precios bajos de los combustibles.

Esta conferencia se basa en las experiencias de muchos países y en el trabajo que se ha efectuado en los últimos años a nivel internacional con la industria para desarrollar vehículos de motor de todo tipo, que sean limpios y eficientes. Dicho trabajo ha confirmado que, con las tecnologías de punta existentes y las que se encuentran en las etapas finales de desarrollo, los vehículos de motor, sean automóviles, camiones de carga o autobuses, pueden ser más eficientes en el consumo de combustible, más limpios, más seguros; y más reciclables, al tiempo que pueden ser más atractivos y confortables para el usuario. Lo cual requiere además una mejoría en la calidad de la gasolina y del diesel.

At current growth rates, the present world fleet of more that 500 million road vehicles could reach one billion in fifteen years, with a corresponding dramatig growth in demand for petroleum products. The rising fuel consumption is a major issue fo reasons of environmental protection, balance of payments, and energy security. Transport now accounts for more than 50 per cent of total oil consumption, and motor vehicles have become one of the largest sources of emissions in most countries, contributing to urban air pollution, acid precipitation, and increased atmospheric concentrations of green-house gases.

Many factors are involved in the growth of passenger and freight transport. They include socio-economic development, growing urban populations and sprawling cities, dissociation of work and home locations, increased transport of freight by road, traffic congestion, and low fuel prices.

This conference builds on experiences in many countries and on the work on fuel-efficient and clean motor vehicles of all kinds carried out in recent years internationally with the respective industries. Such work has confirmed that, with existing and emerging technologies, motor vehicles (private cars, trucks, and buses) can become increasingly more fuel-efficient, cleaner, safer, and more recyclable. Improvements in the quality of gasoline and diesel fuel can also make a significant contribution.

## A CASE OF REGIONAL TECHNICAL COOPERATION AIMING AT IMPROVEMENT OF MOTOR VEHICLE EMISSION CONTROL

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The paper describes a UNDP/UNIDO regional project currently under implementation, aiming to assist countries of the Asia-Pacific Region in addressing vehicle emission problems by a common or joint regional approach within the context of the project “Regional Network on Control and Regulatory Measures concerning Motor Vehicle Emissions”. This project has two main objetives:

- to initiate, develop and promote the cooperation among participating countries in the area of motor vehicle emission control, to establish working contacts between organisations dealing with motor vehicle emission control in these countries and to set up the nucleus of the operational regional network, which would develop recommendations for common standards and policy in the mentioned area;

- to lay down terms for the introduction of common standards and control procedures for motro vehicle emission control, at least for certain groups of countries within the region.

Based on the requirements of the countries of the region, the following issues to be dealt with by the project were identified:

- emission standards for new motor vehicles,
- procedures for inspection of in-use motor vehicles,
- fuel quality standars,
- practical policies to improve the maintenance of vehicles.

For this purpose, a series of guidelines for vehicle emission-related issues requiring a common approach within the region are prepared

to assist the individual governments to addres motor vehicle emission problems. These guidelines take into account region-specific conditions which affect potential solutions of common problems, such as vehicle desing, vehicle poplation structure and density, road traffic, vehicle maintenance, economic conditions, current air quality, fuel quality, etc.

These guidelines, prepared by experts on the basis of missions to countries of the region, are assessed and agreed upon at Experto Group Meetings (EGM). During the same EGMs country papers are presented by representatives of the participating countries outlining the situation of their respective countries. Two EGMs have been organized so far. The two guidelines issued respectively deal with the engine and vehicle requirements for the control of regulared pollutants, including the procedures for type-approval of new vehicles, and the infrastructure and testing regimes required for the testing of in-use vehicles. Associated with these procedures are requirements for the reference fuels to be used in the test regimes, subject of the third EGM, scheduled to be held in P.R. China in March 1994. The guidelines prepared for it, are supposed to provide a route towards harmonized fuel qualities that complement the improved engine and vehicle technologies available for the control of regulated emissions.

## A DEMAND FORECASTING SYSTEM FOR CLEAN-FUEL VEHICLES

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Manufactures and governmental agencies interested in promoting clean-fuel vehicles need to know how demand is affected by attributes that distinguish these vehicles from conventional gasoline or diesel vehicles. Such attributes include limited range between refueling, overnight recharging (electric) and refueling (ntural gas) options, limited availability of fuels, performance differences, and capital and operating cost differences. It also important to establish the excent to which consumers are willing to pay for reduced tail pipe emissions.

A proyect is underway to develop a demand forecasting model for clean-fuel vehicles in California. The project, sponsored by the two major utilities in California, the Shouthern California Edison Company and the Pacific Gas and Electric Company, involves largescale surveys of both households and commercial fleet operators. Respondents in both surveys, conducted in 1993 and 1994, were asked to choose their preferred vehicles from sets consisting of gasoline, compressed natural gas, methanol, and electric hypothetical future vehicles; each vehicle was defined in terms of atributes manipulated according to an experimental design. Respondents were also asked to indicate how their household or fleet could use the alternative-fuel and electric vehicles if they were either replacements for existing vehicles, or additional vehicles. Information was also gathered on current vehicle holdings, vehicle transactions and usage patterns.

These data are being used to calibrate a new micro-simulation based vehicle demand forecasting system. This system will focus on household and fleet transaction behavior, and it includes a complete

model of the used vehicle market with endogenous prices. Based on pre-specified attibutes of future vehicles (including specified clean-fueled vehicle incentives), the system will produce annual forecasts of new and used vehicle demand by type of vehicle and region. The system will also forecast annual vehicle miles traveled for all vehicles and recharging demand by time of day for electric vehicles. These results are potencially usefull to utility companies in their demand-side management planning, to public agencies in their evaluation incentive schemes, and to manufacturers faced with designing and marketing clean-fuel vehicles.

AIR POLLUTION CONTROL IN THE MEXICO CITY METROPOLITAN AREA (MCMA)
EMISSIONS INVENTORY FOR MOBILE SOURCES:
“TOOL FOR SCENARIO-CALCULATIONS AND NECESSARY INPUT FOR DISPERSION MODELLING”

Dipl.-Ing. Josef Brosthaus; Dr.-Ing. Heinrich Waldeyer
TUV Rheinland Gruppe

The tremendous air pollution is one of the most serious environmental problems in the Mexico City Metropolitan Area (MCMA), in a special part of the Air Pollution Control Project of MCMA, the German TÜV Rheinland, Cologne, developed a step by step Detailed (Grided) Emissions Inventory, using the well proven TÜV Emissions Simulation Model (TESM). The Emissions Inventory employs a Geographical Information System (GIS) and at this stage covers the wole area of Mexico City. The emissions are evaluated in view of time and space, thus the results are a satisfactory data base for any measure of simulation and a necessary input for dispersion modelling.

The methodology used to calculate traffic emissions with the TESM is mainly based on the multiplication of mileage with emission factors for the emission relevant de vehicles, using each factor as a function of the driving behaviour (average vehicle speed). This method will be described in further detail at the conference. Results from additional traffic censuses such as local traffic volume and vehicle speed will be shown. A discussion of the emission factors, as well as the calculated emission results for the reference year 1993 and their impact on the environment, followed by possible emission and energy reduction targets are some details of the prepared paper.

## ALTERNATIVE FUELS:
## OPTIONS AND TECHNOLOGY

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The technologies of engine and fuels are co-dependent. The optimum fuel strategy depends on the current and future levels of engine technology, as well as the cost of the alternate fuel and its necessary infrastructure. Typical vehicle fleets consist of both old and new vehicles, and effective control of emission in such fleets is difficult.

The characterustics of the various candidate alternative fuels will be discussed, with emphasis on their advantages and disadvantages. Special attention will be directed to the reformulated petroleum-based fuels. For a generalized vehicle fleet, a possible future scenario of alternative fuel use will be discussed.

## A MARKET-BASED APPROACH FOR INTRODUCING CLEAN AIR VEHICLES

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The development of national policies for energy and the environment require a stronger link to transportation policy. In the United States (U.S.), petroleum consumption by non-transportation industries has been decreasing over the last 15 years. On the other hand, the transportation portion of oil consumption has increased from nearly 20 porcent in 1973 to over 63 percent in 1990. Within the transportation sector, motor vehicles account for 97 percent of the sector's petroleum consumption. Current projections estimate that vehicle miles of travel will continue to increase leading to even greater oil consumption in the future. National policies to reduce dependence on petroleum, particularly foreign sources, must include strategies relating to the transportation sector.

The major issue guiding transportation policy is mobility. It is estimated by the U.S. Environmental Protection Agency estimates that transportation accounts for 66 percent of the carbon monoxide emissions, 40 percent of nitrogen oxide emissions, and 35 percent of volatile organic compound emissions. Moreover, mobile sources are estimated to contribute about 30 percent of the carbon dioxide emissions that lead to global warming. Similar to energy, a national environmental policy must include strategies relating to the transportation sector.

Transportation also plays an important role in environmental deterioration. The U.S. Environmental Protection Agency estimates that transportation accounts for 66 percent of the carbon monoxide emissions, 40 percent of nitrogen oxide emissions, and 35 percent of volatile organic compound emissions. Moreover, mobile sources are estimated to contribute about 30 percent of the carbon dioxido emission that lead to global warming. Similar to energy, a national environmental policy must include strategies relating to the transportation sector.

The major issue guiding transportation policy is mobility. It is estimated by the U.S. government that congestion in U.S. urban areas amounts to over $ 30 billion annually. The tradicional approach to address congestion problems is to expand the capacity of the

system. However, in light of transportation's relationship to energy and environmental objetives, this is no longer a feastible strategy for the future. In response, the U.S. has placed greater emphasis on the use of alternative transportation fuels and demand related strategies. These approaches have been in the form of governmental mandates and, unfortunately, these mandates have not been linked to economic costs. Given the complexity of the situation, these governmental mandates can lead to inefficient economic decisions. Market-based procedures, particularly for alternative fuels, are needed.

Given the existence of stated public policy objetives, it is possible to develop a relative social cost index for promoting the use of alternative transportation fuels or other forms of transportation. The index can be used to adjust motor vehicle taxation policy which directly effects vehicle operating costs. Fuels become taxed based on their relative contribution to adopted public policies. Adjusting state motor vehicle registration fees, sales tax, and fuel taxes by the social cost index produces operating costs for various alternative fueled vehicles that are less expensive than gasoline-powered vehicles. The result is a market-driven strategy that addresses energy, environmental, and transportation objetives.

The social cost index is a relative measure guided by regional or national priorities that can be used as a market-based approach for influencing consumer transportation decisions.

## ANALISIS DE ALTERNATIVAS PARA DISMINUIR LA CONTAMINACION EN LA ZONA METROPOLITANA DE LA CD. DE MEXICO

Ing. Gerardo Bazán y Dr. Miguel Leiva
G.I.D.T., PEMEX-Refinación

La circulación de aproximadamente cuatro millones de vehículos en la Ciudad de México y la Zona Conurbada, así como las emisiones producidas por más de treinta y cinco mil fuentes fijas, representan serios problemas debido a la contaminación que producen. En este trabajo se presentan los resultados de las investigaciones que al respecto han realizado los autores. Se incluyen, tanto la elaboración de un inventario de emisiones, en donde se han considerado sectores económicos que no se tenían cuantificados, como información del parque vehicular (modelos, antigüedad de vehículos, etc.). En este punto se observa que existe un importante porcentaje de automóviles con tecnología vieja. De los análisis económicos correspondientes, para comparar diferentes alternativas aceptables. Tecnologías nuevas, modos existentes y organización, planes de circulación, coordinación del transporte, etc., sobresalen las siguientes acciones:

- Equipar, a los vehículos que tengan tecnología vieja, con sistemas de inyección múltiple y adaptar un catalizador regulado al sistema.
- Medidas normativas para estimular el uso de vehículos no contaminantes y ahorradores de energía.
- Capacitación de los operarios de vehículos de uso intensivo.

Es importante mencionar que para la integración del presente trabajo se consideraron los esfuerzos que al respecto ha llevado a cabo el Instituto Mexicano del Petróleo en sus proyectos de desarrollo tecnológico.

## AN ALTERNATIVE OF AN ADIABATIC CERAMIC ENGINE CONCEPT

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This paper concerns a problem of choosing a concept of a heat power installation for machine engineering. The subject of the paper is a thermodynamic substantiation of a concept of heat power installation engineering based on a conventional (cooled) piston engine in which heat rejected to working chamber walls and exhaust gases are utilized. This heat power installation and those based on “adiabatic” engine utilizing the heat carried away to exhaust gases have the same thermal efficient potential as proved by the apparatus of thermodynamics of reversy processes. In contrast to an “adiabatic” engine any development, new materials and technologies are notr necessary fir the realization of the presented concept in wich available engine designs are.

## A NEW INTEGRATED VISION FOR URBAN DEVELOPMENT, TRANSPORTATION, AND TRAFFIC

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The quality of life and the productivity in the urban sector are outstanding characteristics of a city interconnected to the accessibility and mobility of people to jobs, services, leisure and socail life, and as well as the capacity of moving goods and products.

The rise of environmental concerns has brought a new understanding to those dealing with transportation issues. Actually, it is becoming more visible that transport and traffic problems must be taken as a complex interwoven of sectors and global and local multidisciplinary issues (e.g. energy, pollution, climate change, environment, development, public policies, urban planning, etc.)

This presentation aims at highlighting that a new integrated vision of urban development and transport is starting to emerge. A document recently issued by the Intergovernmental Panel on Climate Change has summarized that this new vision must follow four basic main components:

- promotion of land-use reform to curtail trip generation,
- top-priority to public transport systems,
- curtailing to car-use and car-ownership (especially through taxation mechanisms),
- fostering of non-motorized transportation component (bicycle and pedestrians).

Examples from various parts -mainly from developed countries- will be presented to illustrate that a paradigm shift in transportation is a concrete circumstance already under way although it is not yet clearly visible because the new consensus is still being built.

AUTOMOTIVE TECHNOLOGY AND DRIVER BEHAVIOUR
SAFETY DEMANDS FOR SUSTAINABLE MOBILITY

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Fuel efficient cars are predominantly small and light cars. Bettering fuel systems and introducing various mechanisms in engine constructions may result in more than 25% savings fuel economy. Further progress demand lowering aerodynamic drag, the use of light weight materials for car bodies and down-sizing and down powering of cars. Adding such efforts, which all represent known technologies, a 50% saving in energy consumption per vehicle kilometre may be accomplished in few years.

Light weight cars, are by insurance companies and car manufacturers usually claimed to lower the total safety standars and to produce more traffic-death. The car industries respond to consumer demands for more safety by adding air bags, anti blocking brakes and more structural stiffiness to the passenger compartments. All those endeavour wil inevitable add to car weigts. The efforts solely are concentrated upon standards for occupant safety-leaving non occupant safety out of the scene.

The competition between car makers for high performance-figures introduces more and more engine powers, also in family cars. Top speeds above 180-200 km/h seem to be the standards, reducing fuel economy as well as out weighing some of the efforts increasing safety standards by the possibilities of more aggressive and high speed driving.

Based upon data from the Danish Accident Database, it is seen that small cars per vehicle kilometre produces less injured-including injured counterparts- as heavier ones. In a  heavier car passengers and drivers are better protected in an accident-situation, but this gain in protection mostly will be paid by an increased risk for counterparts. In a scenario for a traffic system based upon cars alone, heavy cars will produce the lowest injury rates. The result seems to be stable even if risk compensation is include. But if vulnerable road users are included, then the result may change in favour of a small car scenario. In the first case a way for a more sustainable transportation system may be enlightened, without compromising traffic-safety, and

with an increased mobility for all social classes. In the second case the demand for resources for transportation will continue to increase- disregarding possibilities of a more sustainable transportation system- and producing mobility and safety only for higher income classes.

A TALE OF TWO CITIES
TRAFFIC AND AIR QUALITY BANGKOK
AND MEXICO CITY

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Asia and Latin America are the most dynamic economic regions of the world. While their population growth rates area either decreasing or steady, the economie growth rates are higther than in other regions. This growth is expected to continue well into the next decade.

Mega cities are growing at unprecedent high rates, doubling their populations every 12:20 years. Increasing incomes, perception of barrier opportunities, and the primacy of these mega cities, have increased their populations and motorisation. Motor cars have been growing at 10-12% annually while motorcycles have been growing 15-20% annually. This combination has been deadly, resulting in increasing congestion and decreasing air quality. Congestion management techniques have not changed significantly in most mega cities during past two decades Bangkok and Mexico City now have the world's worst traffic air quality conditions.

This paper focuses upon congestion management techniques, traffic congestion levels and air quality. By using data from Bangkok and Mexico City, it illustrates the need for drasting changes in transportation policy tools and techniques for congestion management and for increasing environmental quality.

New approaches to investment and regulatory policy analysis and implementation are suggested. This requires the inclusion of all costs and benefits (economic and ecological) in the policy matrix so that investment and regulatory policies act in tandem.

Key*** Asia, Laint America, Mexico City Congestion Management Air Quality Urban Transport Policy, Mega Cities, Transport Planning, Urban Environment, Sustainable Development.

# CITY CAR 2007” STIRLING-ELECTRIC DRIVE TRAIN FOR ULTRA LOW EMISSION VEHICLES

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This paper analyses the Stirling Electric Wybrid concept under development at Teknik, Ekonimi, Miijo, (TEM) a R&D foundation at the University of Lund, Sweden. The project is based on a new patented Stirling engine cincept wich generates electricity in a completely sealed unit, eliminating the need for a working gas make up system, wich up till now has been typical for kinematic Stirling systems.

With its tested high energy-conversion efficiency, extremely low exhaust -and noise-, as well as vibration emission levels, the concept is identified as one of the most promising contenders as a unique drive system for ultra low emission city vehicles.

The proposed concept is a drive system combining electric and combustion engine power. The Stirling engine-generated power is used for propelling the vehicle the vehicle when power requirements are low, charging the batteries with excess power automatically, the batteries are low until the batteries are fully charged. When the vehicle operates in environmental sensitive areas, the vehicle has the option to prevent the Stirling engine to operate.

The design use technology wich can reasonably be expected to be available in the automotive industry in the nearest future.

The paper describes the technology and development status of the project and outlines its market potential in view of the local and regional environmental problems in the larger cities around the world.
COMBINING MOBILITY AND SUSTAINABILITY

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The RUF-system is a dual-mode rail/road traffic system developed in Denmark.

All the problems of individual gasoline cars cannot be solved with ordinary electric cars.

The ordinary electric cars merely moves the pollution to the power plants. Also the traffic congestion remains the same.

The problems cannot be solved by the introduction of public train -or bus- transportation systems. They do not offer door to door transportation with the comfort and privacy of the private cars.

The RUF-system is disigned to offer the mobility of private cars with no exhaust pollution in the cities. The RUF-system also offers traffic on rails to reduce the energy consumption and traffic congestion.

The RUF-system is a dual mode system based upon samall electric/hybrid cars (RUF's). The design of the RUF-cars allows formation of RUF-trains to run on RUF-rail sistems.
The formation of RUF-trains, significantly reduces the energy consumption, when travelling at high speed. As the RUF-rail providing the power to the RUF-trains, the operanding radius of a RUF-car is not limited by the capacity of the batteries.

The RUF-rails are lighter than ordinary "light-rails" and construction is less expensive.

The RUF-system will be standardized to ensure world-wide compatibility of cars and rails.

# CONTRIBUTION OF VOLKSWAGEN TO FUEL EFFICIENT AND CLEAN MOTOR VEHICLES

J Sandhagen, H.J. Oberg, A. Romero
Volkswagen Company

The Volkswagen Company is active in the field of vehicle emission control from the beginning on, in the 70's in the U.S.A. and California, in the 80's in Europe and in the 90's in Mexico.

Besides the introduction of the emission control techniques in Mexico, the availability of lead free gasoline all over the country was an important and necessary condition.

In the after sales market, VW offered an uncontrolled catalytic system for implementation in cars already in use.

Due to the high market share in Mexico, the Volkswagen Company contributes a great of emission and most ecologic use in the field of motor vehicles.

Volkswagen is a company with activities all over the world and research programs in al fields of engine and transport technology. From the Mexican plant the A-class vehicles are delivered for Canada and the United States of American including California, the most stringent emission controlled market in the world.

The Volkswagen Company has the knowledge and equipment to respond to the legislation today and in future.

Also in the production process, in managing the factory, Volkswagen is doing more than legislation is demanding for to contribute to an environment as clean as possible.

## CURRENT VIEW OF THE CARCINOGENIC HAZARD OF DIESEL EXHAUST

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The carcinogenic potential of organic extracts of diesel soot has been known since the 1950s. Concern for human carcinogenesis was elevated in the late 1970s by new bacterial mutagenicity data and the anticipated increased diesel use in the U.S. light-duty fleet. By the

mid-1980s, inhalation bioassays proved diesel soot to be a pulmonary carcinogen in heavily exposed rats, but noot inmice or Syrian hamsters. Epidemiology suggests a small increase in lung cancer risk for heavy occupational exposures, but uncertain exposure estimates and controls for cofounding factors limit the confidence of predicting lung cancer risk from human data. The relevance of the rat response for predicting human cancer risk was questioned because exposures to other particles having no organic mutagens produced similar results. Proposals to use the lung deposition of soot-associated organic compounds to extrapolate the rat lung tumor data to unit lung cancer risks for humans made it important to understand the role of organic material in the rat response. Recent studies demonstrating that diesel soot and organic-poor carbon black produce the same lung tumor response in rats suggest that the organic fraction is probably not important in the rat response. The U.S. EPA recently estimated human lung cancer risk from diesel exhaust from the rat data using the deposition of the carbon soot core per unit of lung surface as the dose equivalence term. If the rat's response to diesel soot is a general response to particles unique to the rat, and if the mechanisms by wich these tumors develop in rat lungs are not likely to occur in humans, the extrapolation of rat lung tumor data to human lung cancer risk may be inappropriate regardless of the method. At this time, the relevance of the rat lung tumor response to diesel soot and many other particles to human lung cancer risk remains uncertain.

## DESAFIOS PARA EL TRANSPORTE AUTOMOTOR EN AMERICA LATINA Y EL CARIBE

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El transporte automotor es el principal consumidor de hidrocarburos y la mayor fuente de contaminación atmosférica del sector energético en América Latina y el Caribe (AL&C). Las previsiones de OLADE hasta el año 2000 indican que este comportamiento se mantendrá en el mediano plazo. Además de los impactos energéticos y ambientales indicados, el transporte automotor demanda altas inversiones para la infraestructura vehicular y vial. Todos estos impactos pueden ser aliviados en forma temporal mientras se implantan soluciones de fondo a largo plazo. A continuación se plantean algunas soluciones transitorias.

* Reforzamiento de los sistemas de inspección vehicular existentes para recuperar la eficiencia energética técnica del parque y reducir sus emisiones contaminantes

* Incentivos indirectos al mantenimiento vehicular adecuado mediante la eliminación de distorsiones en el mercado y la instauración de normas de inspección vehicular antes indicada

* Incorporación de innovaciones tecnológicas en vehículos obsoletos para mejorar su eficiencia y disminuir sus emisiones

* Mejora de la calidad de los combustibles automotores a través de ajustes operativos en refinerías, controles de calidad más estrictos en los sistemas de distribución e implantación de normas para instalaciones de almacenamiento y expendio

* Racionalización del tráfico para reducir la congestión vehicular urbana

* Mejor mantenimiento de la infraestructura vial financiado con recursos obtenidos de los mismos usuarios

El desarrollo del transporte a largo plazo debe incorporar estrategias básicas como reducción de las necesidades de movilización, introducción de medios de transporte de baja intensidad energética, mejora de la eficiencia del parque y uso de energías más limpias. De

aquí se desprenden algunas de las soluciones de fondo, a ser implantadas en el largo plazo:

* Incorporación de la variable energética en la planificación urbana y rural

* Puesta en marcha de sistemas de transporte masivo como trolebuses, monorriel, metro y modernización de líneas férreas

* Ampliación del transporte intermodal de carga por ferrocarril, transporte fluvial, ductos y carreteras

* Estímulo al transporte individual de baja intensidad energética (motocicletas, bicicletas, peatones)

* Optimización de la red vial existente mediante sistemas de manejo de tráfico y construcción de nueva infraestructura

* Marcos regulatorios e inducción de condiciones de mercado para promover la evolución del parque automotor hacia patrones de alta eficiencia energética y baja contaminación

* Utilización de combustibles más limpios como gas natural, metanol y etanol con el aprovechamiento de los grandes recursos gasíferos y agrícolas de AL&C.

DISEÑO Y CONSTRUCCION DE UN MINIBUS
ELECTRICO DE BATERIAS

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El objetivo del proyecto es diseñar y construir un prototipo de minibús eléctrico de baterías para transporte urbano con capacidad para 30 personas.

El vehículo tendrá una autonomía de 100 km aproximadamente. Incorporará sistemas de frenado regenerativo eléctrico e hidroneumático, ambos no disipativos.

En el diseño de la carrocería se hará un énfasis en reducción de peso, seguridad para los pasajeros, y resistencia a la corrosión. Para ello se considerarán materiales compuestos de tecnología avanzada, como por ejemplo, fibras “Kevlar” embebidas en resinas epóxicas, policarbonato, etc.

Un vehículo de este tipo podrá sustituir a un número significativo de minibuses con propulsión de motor de combustión interna, con efectos muy favorables sobre la calidad del aire.

ECONOMIZADOR VE-30-50

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Se ha desarrollado un dispositivo economizador de gasolina para los vehículos automotores de cuatro tiempos, de fácil instalación y sin modificar el funcionamiento de la máquina.

Los resultados que se han obtenido durante las pruebas efectuadas en la investigación y desarrollo a lo largo de tres años muestran las siguientes ventajas al permitir la mejor oxidación.

1. Se logra una combustión más eficiente;
2. Se evita la carbonización de las cámaras de combustión;
3. Aumenta la potencia del motor;
4. Mejora en rendimiento el combustible;
5. Reduce la emisión de gases contaminantes;
6. Prolonga la vida útil del motor.

Se han obtenido reducciones en el consumo de gasolina de hasta 30% en la ciudad y de hasta un 50% en carretera.

La aplicación de este dispositivo sirve a todos los vehículos descritos a excepción de motores turbocargados.

ELECTRIC VEHICLES:
THE FOUNDATION OF SUSTAINABLE
TRANSPORTATION

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Worldwide, motor vehicles are major sources of air pollution and freenhouse gas emissions. In large cities in both developed and developing countries, air quality continues to deteriorate, in large measure necause of the rapid growth in oil-powered vehicles. Worldwide, motor-vehicle carbon-dioxide emissions account for nearly 15 percent of global emissions from fossil fuels.

Over the past two decades, new cars and trucks have become more fuel efficient and less polluting. Yet, because of rapid growth in the global fleet, emissions of greenhouse gases and pollution from vehicles continue to grow. If recent growth trends continue, carbon dioxide emissions from the global motor-vehicle fleet will increase by 20 to 50 percent by the year 2010. The substitution of so-called alternative fuels-compressed natural gas, ethanol, and methanol will not significantly alter these CO2 trends if they themselves are derived from fossil fuels. Production of these fuels from biomass poses serious long-term environmental risks and many not be widely feasible or sustainable.

Electric vehicles powered by some combination of batteries, hydrogen fuel-cells, and flywheels offer the most promising long-term alternative to reduce carbon-dioxide emissions and pollution from gasoline-and diesel-powered vehicles. The electricity and hydrogen for these vehicles will eventually be derived from non-fossil energy sources, virtually eliminating all greenhouse-gas and air-pollution emissions.

A new form of electrified public transportation system called Personal Rapid Transit (PRT) is being developed in the United States. Based on small computer-operated 3-passenger electric cars riding on their own narrow guideways, PRT systems will be far less costly to build and operate than conventional heavy-and light-rail systems. The introduction of electric cars and trucks along with PRT systems for public transport will be an important first step in the evolution of a sustainable, global transportation system.

# ELECTRIC VEHICLES:
# THE QUIET REVOLUTION IN TRANSPORTATION

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Electric Vehicles (Evs) offer positive responses to each of the three areas of major challenge wich nations face in improving urban

transportation: (1) Environmental protection - Evs are the only vehicles wich have zero tailpipe emissions; even when power plant emissions are included, they can be far cleaner than any other vehicle options; and reduction of urban noise is a major benefit of Evs. (2) Energy efficiency and diversification -Evs are more energy efficient than conventional vehicles; the “fuel” for Evs can be derived from a broad variety of energy sources, including renewable sources, and thus can reduce dependency on petroleum and other fossils fuels. (3) Sustainable economic development -EV manufacturing represents new global business oportunities for high-tech vehicle production, environmentally-sensitive, closed-cycle battery development, and advanced electronics; further, by reducing air pollution and fossil-fuel dependency, the economic growth associated with Evs is a sustainable.

Much technological advancement has been made in recent years to improve the performance of Evs and reduce their cost, and the technological advancements must continue in order to gain wide acceptance and use. But other types of advances must be made as well. Major changes must be readied in the transportation support system, or infrastructure, in order to “fuel” and service this new transportation mode. In the U.S., extensive efforts are underway to prepare the infrastructure, including actions by the National EV Infrastructure Council (a collaborative effort of the automotive and electric industries).

This paper surveys the environmental, energy, and economic development aspects of Evs, provides a brief synopsis of their technological status, and describes the efforts underway to address infrastructure barriers to this new transportation industry.

# “EMISSION BENEFITS AND ALTERNATIVE FUEL TECHNOLOGY IN COLORADO U.S.A.”

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The use of alternative fuels holds the permise of promoting energy energy diversity and reducing motor vehicle emissions. With the

passage of the federal Clean Air Act Ammendments of 1990, the national Energy Policy Act of 1992, and state initiatives, these fuels will have far reaching influence on the fuels motor fleets operate on in the next century.

Many of the emission benefits of alternative fuels are dependent on the quality of the alternative fuel implementation, as well as the fuels themselves. To prevent degradation of motor vehicle emissions, the Colorado Departament of Helth has implemented alternative fuel retrofit system certification procedures. These, as well as EPA and California certification standards will allow current vehicles to have acceptable emissions, as well as realize low emissions in future vehicles.

# EMISIONES CONTAMINANTES EN MOTORES DE GASOLINA

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De las medidas de las emisiones por el tubo de escape de un motor a gasolina se encuetra que las emisiones de hidrocarburos HC y monóxido CO cambian poco con la potencia desarrollada, pero los óxidos de nitrógeno Nox son proporcionales a la misma. El minimizar la amplitud de las oscilaciones de la aguja del medidor de vacío en la admisión del motor, ayuda en la afinación del motor, ya que corresponde a la mezcla más homogénea a los pistones. Un

carburador afinado, proporciona un balance razonable entre las emisiones de CO y HC y las de Nox. Una ventaja adicional de un carburador bien ajustado, radica en el incremento en el rendimiento. Un coche que circula más kilómetros con la misma cantidad de combustible contamina menos, tanto por la reducción en el combustible consumido como, por que al quemarse mejor se emiten menos contaminantes.

Los valores promedio de las emisiones de motores de diferente fabricante, difieren significativamente. Sugerimos que éstos valores se incluyan en la etiqueta de rendimiento de vehículos nuevos. El manejar para obtener el máximo rendimiento de la gasolina, evitando aceleraciones bruscas y altas velocidades, así como evitar estorbar el flujo de los otros vehículos, reduce notablemente la emisión de contaminantes.

## ENERGY AND PASSENGER TRANSPORTATION IN THE MEXICO CITY METROPOLITAN AREA

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Satisfying public transportation needs has been a critical component of socio-economic development in developing countries especially in urban areas. Air pollution has become a major criterion concern in the Mexico City Metropolitan Area (MCMA) where private vehicles account for 96% of all passenger vehicles and account for an estimated 70% of the hydrocarbons, CO, and Nox in the region. This

surising high number belies the fact that only 23% of the city's population own private cars. This work analyzes the trends in passenger travel in the MCMA between 1983 and 1990 utilizing passenger-trip per day as the main indicator. We also calculate the energy intensity of the different modes of transportation in the MCMA, measured as energy use per passenger-kilometer. Although more efficient and less energy-intensive we have found that between 1993 and 1990 the share of public mass transportation (Metro, urban buses, trams, trolleys and light train) decreased in almost 30%. We conclude that rapid population rise in the City and an insufficient development of public mass transportation has provked an increase in low-capacity vehicles with high energy intensities. This situation has contributed to the increase in traffic congestion and the worsening of the air quality of the MCMA.

## ENGINE DOWNSIZING - THE KEY TO FUEL EFFICIENCY AND ROAD SAFETY

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In several OECD Member states environment and traffic policy aims to achieve farreaching reductions of road traffic emissins and fuel consumption in the near future.

A three-track approach needs to be followed: in addition to technical measures "at source", this includes reduction of total vehicle mileage, improvement of driving habits and reduction of vehicle speeds. As to read safety policy, ambitious goals will also need to be set. Current policy measures are expected to fall short of fulfilling the goals set.

One measure that needs more attention both in reserach and in policymarking is the downsizing of the power output, engine size and performance of all categories of vehicles. This approach requires no high tech tour force, and it is up the regulating bodies such as the EC and the ECE to proceed as soon as possible along this course.

Compared to their predecessors today's cars have been upgraded in may ways; engine capacity, weight, power, speed, acceleration capacity, road holding, interior dimensions, suspension, driveability, amintenance, safety/crash protection, and fuel consumption at constant speeds. Car markets have been constantly upgrading over the last decades;

- small cars have grown bigger;
- all size categories have grown bigger;
- all cars have become faster;
- the supply of high-powered family cars has increased;
- the supply of moderately powered vehicles has declined;
- cars buyers increasingly buy bigger and faster cars;
- car sales and the number of crs have increased considerably.

There are strong correlations between:

- vehicle weight and fuel consumption/CO2 emissions;
- power/performance and fuel consumption/CO2 emissions;
- vehicle speed and emissions of Nox and CO2;
- Driving habits and fuel consumption/emissions;
- power/performance and road safety.

Safe cars are cars that do not encourage unsafe driving behaviour.
A sustainable transport system needs to incorporate, on the one hand, far-reaching CO2 emission redutions and fuel efficiency improvements of over 50 per cent, and on the other, road safety improvements (more than 80 per cent fewer victims). Such far'reaching policy goals cannot be fulfilled without downgrading vehicle power, speed and performance levels through engine downsizing (reducing power to weight ratios) for all categories of motor vehicles. Car and truck manufacturers will never take the initiative towards engine downsizing, since competition and market

demands -given current fuel price level- keep manufacturers captured withing the race for performance. Thus national and international regulating bodies -including the EC and ECE- should take initiatives towards:

a) vehicle standards that limit power to wight ratios and topspeeds of all categories of motor vehicles (progressively over time);
b) fuel consumption/CO2 emission standards for all categories of private cars (progressively over time);
c) fiscal incentives for purchasing/owning fuel efficient cars.

## ENVIRONMENTALLY COMPATIBLE DRIVING SYSTEMS IN THE FEDERAL REPUBLIC OF GERMANY

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In the light of the increase in the number of motor vehicles, the minimization of emissions caused by road traffic will be one of the most important tasks in the years to come. This applies in particular to urban and residential, areas, because the citizens there are becoming more and more sensitive to noise and the pollution caused by traffic. Here, action must be guided by the principle that the adverse effects of traffic on environment and healt must be tackled while maintaining a maximum of mobility.

The question therefore is: What contribution can new driving systems making of framework will have to be provided to achieve this objetive? In answering this question, I will deliberately deal with two different types of driving systems, namely gas and electric drive.

# ESTRATEGIA PARA EL CONTROL DE LAS EMISIONES CONTAMINANTES VEHICULARES EN LA CIUDAD DE MEXICO

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En el Area Metropolitana de la Ciudad de México se realizan más de 20 millones de viajes-persona-día a través de múltiples modalidades de transporte. Por sus calles circulan vehículos automotores, tranvías, trenes y metro. Entre los objetivos del Programa Integral Contra la Contaminación Atmosférica, instrumentado a través de una Comisión intersectorial de cáracter metropolitano, destaca el referente a lograr un transporte limpio a través de las siguientes acciones:

- Mejorar la calidad de los combustibles automotrices, introduciendo combustibles alternativos y adaptando la formulación de los mismos a las condiciones de altitud de la ciudad y las características fotoquímicas de la atmósfera del vallde de México. Así, se ha adicionado MTBE a las gasolinas, a la vez que se ha reducido su presión de vapor y el contenido de plomo, azufre, olefinas y aromáticos.
- Desincentivar el uso del auto privado y controlar las emisiones contaminantes de los autos en circulación. Programas como el “Hoy No Circula”, la verificación obligatoria de emisiones de escape y los operativos de retiro de vehículos ostensiblemente contaminantes, además del aumento en la oferta de transporte colectivo, ilustran los cambios ocurridos en los últimos años.
- Renovar la flota vehicular y/o adaptarla a las comisiones de servicio y las políticas de control de la contaminación. Aunque la recuperación económica del país propicio la renovación “natural” de la flota en circulación, principalmente de autos particulares, las autoridades emitieron regulaciones más estrictas en vehículos utilitarios para que éstos fueran renovados obligatoriamente y en su caso que fueran convertidos al uso de gas o gasolina sin plomo, aprovechando el desarrollo de la tecnología automotriz alternativa. Así ha sucedido con los taxis, microbuses, autobuses y camiones de carga.
- Introducir los adelantos tecnológicos de la industria automotriz en los vehículos automotores nuevos. México a expedido un conjunto de normas, cada vez más estrictas, para introducir entre otros dispositivos, los convertidores catalíticos o los motores dedicados a la carburación de gas LP o natural comprimido. Desde 1994 los autos nuevos vendidos en el país deben cumplir con normas de emisión de gases contaminates semejantes a las aplicadas en Norte América.

# IMPACTO ECONOMICO NACIONAL DE LA SELECCION DE VEHICULOS PARA TRANSPORTE PESADO

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El problema de eficiencia que ha tenido el autotransporte de carga en México está ligado en gran parte con la relación que tiene el consumo de combustible y el volumen de carga tranportada por unidad tractiva. Parece haber indicaciones de que a pesar del avance tecnológico vehicular relacionado con la eficiencia energética, en general el costo por tonelada no ha disminuido de manera importante. En efecto, en el presente estudio se muestra que, el consumo de combustible por unidad tractiva, ha disminuido,

pero incluirán la carga por unidad. Más aún del análisis realizado, se muestra la influencia que sobre el problema tiene la selección técnica vehicular para la renovación de la flota y el efecto de los viajes vacíos. También se enfatiza la importancia que a nivel nacional ejercen los diagnósticos energético -y las acciones que se derivan de ellos como la conducción técnica, el cambio del paso del diferencial- y otras acciones sobre el problema citado.

# IMPORTANCIA DE LOS COMBUSTIBLES EN EL MEJORAMIENTO DE LA CALIDAD DEL AIRE LOS COMBUSTIBLES Y SU EFECTO EN LAS EMISIONES

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Debido a que los años recientes y en un futuro cercano el binomio vehículo/combustible será de gran importancia desde las perspectivas de ahorro energético y protección ambiental, el uso de combustibles reformulados y alternos con características y calidad que repercutan en emisiones menos agresivas con el ambiente, aunado a los avances tecnológicos en los motores, constituirán un factor importante en el mejoramiento de la calidad del aire en las grandes ciudades.

El presente trabajo corresponde a los diversos estudios realizados por el Instituto Mexicano del Petróleo relacionados con la aplicación de tecnología para el empleo de combustibles gaseosos y gasolinas reformuladas bajo las condiciones de la ciudad de México, su efecto en las emisiones de escape, consumo de combustible y potencialidad para formar ozono.

# INTERNAL COMBUSTION ENGINE BUSINESS, ENVIROMENT AND RESOURCES GAMBLE

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A long term perspective (until 2060) of road traffic for ten regions of the world has been built on a “business as usual basis” It relies on the United Nations regional population anticipations, one the World Energy Council (WEC) GDP growth medium and long term perspectives, as well as on historically y observed trends on goods and passenger traffic in 10 regions for the 30 last years.

The principal findings of this scenario are following:

Passenger traffic. Despite:

- very conservative anticipations of the growth of per capita car equipment in the developing countries and a rapid saturation of per capita equipment in the OECD countries, the world number

of cars could be multiplied threefold between 1985 and 2020 an sixfold in 2060 to attain 2.5 billons cars;

- assumption of a real effort to control mobility, the total number of kilometers driven in the world could climb from 5.2 billion of kms per year to 16.3 in 2020 and 36.2 in 2060
- assumption of a rapid dissemination throughout the world of technical progress on fuel efficiency to reach real miles consumption less than 50 to 40 miles per gallon before 2060, the total fuel consumption could climb from 3.8 to 9.1 billion barrels/yr in 2020 and 14 billions in 2060.

Goods traffic. Despite:

- optimistic assumptions concerning the drop of elasticities of road transport traffic versus GDP in most countries, the total world road traffic of goods could multiply fivefold by 2020 and more than tenfold in 2060.
- a drop of specific consumption from more than .25 gallon to .15 Galon/ton*km due to a large dissemination of technical progress, fuel consumption could reach 9.8 billion barrels per year in 2020 and 21 billion barrels per year in 2060.

Even with a large dissemination of technical progress applied to fuel efficiency, this “Business as ussual” scenario inovlves major problems of depletion of oil reserves and local and global pollutions.

- The total fuel consumption of road traffic could reach as more as 19 billion barrels in 2020 and more than 30 billion barrels in 2060, 1.5 times the present production of oil (35% today);

- The contribution of road traffic to carbon emissions could reach 2,1 billion tons of equivalent carbon/yr in 2020 and 3.4 billions in 2060 (0.8 Mt today)

These figures highlight the necessity to prepare from now the medium and long terms ruptures wich are essential if sustainable development is to be attained.

Beside the technical measures concerning fuel efficiency and promotion of renewable fuels, this scenario emphasizes the importance of regulations and financial support to promote a better control of the mobility of passengers and goods as well as better balance of transport modes share.

# INTRODUCCION DE TECNOLOGIAS AVANZADAS EN LOS TRANSPORTES PUBLICOS EN PAISES EN DESARROLLO

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En los países en desarrollo, particularmente en América Latina, los transportes públicos se caracterizan por generar polución y por el uso ineficiente de los recursos energéticos. Por otra parte, las alternativas para cambiar esa situación enfrentan barreras de orden institucional, económica y financiera que buscan mantener las tendencias actuales, incorporando modificaciones secundarias sin promover la provisión de un servicio energético satisfactorio.

La evolución tecnológica de los países en desarrollo sigue una secuencia en la cual nuevas tecnologías sólo son incorporadas cuando las actuales han alcanzado un largo tiempo de maduración. Sin emabrgo, la sustitución de ómnibus a diesel en aglomeraciones urbanas que presentan elevados niveles de emisión tendría que ser

planificada y organizada con prioridad. Todavía, nuevas tecnologías de transporte no se viabilizarán hasta que no se internalicen las externalidades generadas por los sistemas actuales.

El ejemplo del Programa de Omnibus Movidos a Gas Natural en la ciudad de Sao Paulo (Brasil), descrito en el texto, evidencia las principales barreras enfrentadas en ese proceso. Barreras económicas (condiciones de la demanda), financieras (crédito), tecnológicas (no internalización de las ventajas técnicas) e institucionales (la política de los precios entre energéticos) restringen las posibilidades de evolución de ese Programa. Por otra parte, las condiciones críticas de una gran aglomeración deberían permitir la introducción de tecnologías avanzadas simultáneamente a su implementación en países desarrollados. Los criterios para viabilizar ese proceso tienen que superar las barreras descritas en el texto y organizar alternativas con base en esa superación.

# LA INTERNALIZACION DE LOS COSTOS SOCIALES Y AMBIENTALES DEL TRANSPORTE Y EL DESARROLLO DE MERCADOS VEHICULOS DE MOTORES LIMPIOS Y EFICIENTES EN COMBUSTIBLES

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Los costos ambientales y sociales derivados del uso de vehículos de transporte público y privado no son asumidos por quienes los generan, produciéndose no sólo pérdidas económicas importantes sino también daños ambientales considerables. En este contexto, el desarrollo de mercados para vehículos limpios y más eficientes en la combustión implica contar no sólo con las tecnologías para producir este tipo de vehículos a precios razonables, incluyendo los combustibles requeridos por los mismos, sino también la demanda por vehículos limpios. El inducir esta demanda requerirá de una política de internalización de costos sociales y ambientales que desincentive el uso de vehículos poco eficientes en la combustión. Incentive el uso de vehículos más limpios y, adicionalmente limite el número de viajes privados brindando mejores alternativas de

transporte público. Esto además promovería la investigación y el desarrollo de nuevas tecnologías.

## LONDON: PROBLEMS AND OPPORTUNITIES IN A MEGA - CITY

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London is one of the largest cities in the European Community. The area of Greater London has 6.7 million inhabitants, or 12% of the population of Great Britain, living in an area of 16,000 square kilometres. It is as large as Paris and about twice the size of Berlin.

The road system in Central London has been effectively saturated for many years, with the peak periods steadily spreading through more of day. Traffic congestion has also been getting worse in the hitherto less affected areas of Outer London. Average traffic speeds have fallen by between 3 and 4 kilometres per hour between 1968 and 1992. In the central area, average speeds are 16-17 kilometres per hour over the whole working day. Below 40 kilometres per hour fuel consumption and pollution emissions rise steeply as traffic speed declines.

There has been a shift in London’s structure from a dominant centre, served by a radial public transport networks, to a more polycentric form, with more dispersed patterns of employment and movement.

Because the greatest rail capacity and the most frequently served bus routes are still radial, this shift of activity away from the centre has been associated with a change of travel mode from public transport to car, 68% of all journeys in London are now made by car, 5% more than ten years ago.

Forty years ago, smoke and sulphur dioxide pollution from domestic coal burning, industry and power sations led to the premature death of 4,000 people. Now urban air quality is again causing public concern, largely as a result of emissions from motor vehicles. Concentrations of polllutants are regularly exceeding internationally agreed health guidelines in London.

The problems of congestion and air pollution can be tackled in a number of ways; by adopting corrective transport, planning and fiscal policies, and by technical developments. There is no single solution to London’s problems. Action is required to encourage the use of alternative fuels; to improve charging mechanisms so that the polluter becomes aware that he o she is paying for the damage caused; to improve public transport; and to re-concentrate activities where they can be better served by public transport.

# MAQUINA TANGENCIAL TIPO EOLITICA

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En la prospectiva de explotar en una nueva generación tecnologías para vehículos no contaminantes, formadores de automóviles limpios se ha investigado para la modernización de maquinarias no emisoras de tóxicos el medio ambiente, y de tipo universal para generar energía motríz y eléctrica a un bajo costo y a un alto rendimiento, durabi-lidad sin contaminar y sin causar daños graves a la ecología, sin consumir gasolina ni derivados del petróleo; esta máquina se acopla fácilmente a cualquier tipo de vehículo cual fuere su marca, contando con una gran facilidad de manejo (no contiene palanca de velocidades ni engranes de tracción).

Funciona en cualquier tipo de zona geográfica si previo calentamiento, como quiera que sea el objetivo principal es el diseño de una turbina de aire, no confundir con molinos de viento o maquinaria circular o rotatoria, la cual se puede utilizar en una gama

ilimitada, creando un diseño de vehículo limpio como una propuesta razonable para combatir y resolver los problemas de contaminación sin generar probables problemas con la industria, será necesario mencionar que este tipo de maquinaria es autosustentable puesto que genera su propia energía, energía limpia. Tiene patente folio expediente: 935324, folio: 38068 con fecha 1 de septiembre de 1993.

Esta es una mejora en la tecnología vehicular de transporte limpio, el cual logra los mejores resultados ambientales y socio-económicos, esta investigación tiene un desarrollo de 13 años, y se ha creado una tecnología limpio (No Tóxica).

Mejorando los autos de la ciudad y sin confrontar el tamaño de estos, causando el ahorro y el consumo indiscriminado de combustibles, en el cual no se encuentra ninguna competencia por su novedad creando una tecnología de punta mundial.

# OPTIONS FOR CLEAN “NEAR FUTURE” FUEL AND ENGINES FOR TRANSPORTATION

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Covers a short surveys of trends in transportation fuels quality improvements to reduce emissions, as well as gasoline and diesel engine technology trends and its impact on luboil quality requierements. All with the purpose to establish practical and short term solutions for a city pollution problems.

Each transportation fuel (gasoline and diesel) quality aspects, are discussed to see its current impact on Sox, Nox, CO and HC, particulate emissions and the quality improvements such as lead phase down, additives, sulfur reductions, distillation adjustments, oxygen (oxygenaies) incorporation, aromatic reduction, olefine reduction. Luboil quality requierements by current and future engine technology to meet performance and emission is discussed as a complementary way to allow necessary engine technology contribution in solving a city pollution problems.

Engine technology and after combustion traps and converters are discussed to round up engine technology contribution with consideration as to viability of replacement the passenger and load transport vehicles or retrofitting new technology engines.

Finally, options are given to address practical ways to tackle a city pollution problems.

# PARTICULAS DIESEL, NIVELES DE EMISION Y CORRELACION CON LAS CONDICIONES DE OPERACION DEL MOTOR Y CON LAS PROPIEDADES DEL COMBUSTIBLE.

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El presente trabajo pretende describir el estado del aire en el tema de la emisión de partículas por los motores de encendido por compresión y a la vez, algunas opciones que se pueden adoptar para su reducción.

En este sentido, se muestra que las características de diseño así como las condiciones de operación del motor y también las características del combustible, juegan un importante papel en la generación y emision de partículas.

En cuanto a los parámetros de operación, se comenta la influencia del avance, el régimen de giro y el grado de carga, ya que los ensayos experimentales tuvieron como propósito establecer algunas relaciones entre los ya mencionados niveles de emisión de partículas y los parámetros de funcionamiento del motor.

Por otra parte, se utilizaron dos combustibles con características notablemente distintas: contenido de aromáticos, azufre, densidad, temperatura de destilación y número de cetano.

Los ensayos experimentales se realizaron sobre un motor diesel de inyección directa de 10 litros, turbocargado, con intercooler y potencia máxima de 250 KW a 2000 rpm.

Respectoa al equipo de medición, se utilizó una sonda de muestreo que permitió recolectar partículas en condiciones estables del motor. Para tal efecto, se siguió el ciclo 13 modos europeos y algunos otros puntos de operación que complementaron una gama considerable de condiciones de funcionamiento.

Los resultados obtenidos indican cuantitativamente los niveles de emisión y cualitativamente los niveles de las fracciones orgánicas insoluble y soluble (IOF, SOF) de las partículas.

Finalmente, se establecen una serie de conclusiones en la dirección que se apuntaba en el inicio de este resumen.

# POLICY OPTIONS FOR IMPROVING TRANSPORTATION ENERGY EFFICIENCY IN DEVELOPING COUNTRIES

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This paper provides energy conservation options for road travellin developing countries that are low cost, that can be implemented by the private sector, and that are applicable to a broad spectrum of developing countries. The paper focuses on three issues relevant to the transportation sector in developing countries; 1) the prevalence of two wheeler, or motorcycles, as an inexpensive mode of personal travel, 2) the role of diesel-powered vehicles for freight transportation, and 3) motor vehicle scrappage. Measures to improve fuel economy and to reduce emissions attributable to two-wheelers and to diesel-powered trucks are investigated. Policies are also investigated to retrofil older vehicles with low cost technologies to improve fuel economy.

In most developing countries, the transportation sector accounts for over 50% of total petroleum usage. Within transportation, road travel in developing countries often accounts for over 80% of total transportation petroleum demand. There are a number of factors which affect road transport fuel consumotion. These include: 1) growth in motor vehicle fleets, 2) the composition of a country's

motor vehicle fleet, 3) technological characteristics of vehicles in use which influence motor vehicle fuel efficiency, and 4) growth in road travel. Changes in these factors are brought about by shifts in demographics, macro-economic trends and the structure of the automotive industry in developing countries.

Increased motorization in developing countries has inmediate impact on the demand for gasoline and diesel fuel. Furthermore, normalized fleet consuption across developing and industrialized countries demonstrates that differences in gasoline consumption between countries with similar total fleet sizes result less from variations in technology than from differences in fleet composition. For example, the rapid growth in two-wheelers has made these vehicle significant, if not dominant, consumers of gasoline relative to the rest of the motor vehicle fleet in many Asian developing countries.

The affordability of gasoline in developing countries, as measured by the ratio of GNP per capita to gasoline prices, is a barometer of gasoline consumption per capita. In general, people in developing countries with relatively low affordability levels -that result from high gasoline prices and/or low per capita incomes- consume little gasoline. On the other hand, diesel pricing does not appear to have a significant impact on the consumption of diesel fuel. Diesel usage in the transport sector is largely by locomotives and comercial vehicle fleets, and its use is directly linked to the output of goods. Thus, the correlation between diesel usage and GDP is high. As economies expand, given current infrastructure and technology, the consumption of diesel will increase to reflect greater mobility of given current infrastructure and technology, the consumption of diesel will increase to reflect greater mobility of freight from production areas to markets. Moreover, low vehicle scrappage rates in many developing countries directly reflect low income levels. Consequently, many developing countries are saddled with a large existing population of inefficient, high emitting vehicles.

As result of the unique characteristics that define energy use in the road transport sector of developing countries, creative policies need to be developed that confront some of the more pressing issues. This analysis has focused on policies to improve the energy efficiencies associated with two-wheelers, diesel, and vehicle scrappage. The

energy efficiency of two-wheelers can be improved by policies that range from incentives to accelerate the penetration of four-stroke engines to the removal of restrictions on engine size. Growing diesel demand can be controlled by policies that increase the adoption of alternative fuels and that induce shifts from truck to rail. The inefficiencies caused by low vehicle scrappage can be mitigated by policies that retrofit vehicles with newer low cost technology or through tax incentives that accelerate scrappage.

# POLITICA DE PRECIOS DE PRODUCTOS PETROLIFEROS EN PEMEX-REFINACION

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En un entorno de apertura económica, y de liberalización gradual de esquemas de otorgamiento de subsidios. Petróleos Mexicanos bajo un proceso de mejoramiento de sus estructuras de refinación, distribución y comercialización, se ha venido adaptando a este nuevo modelo económico, mediante la implementación y depuración de sus políticas de precios.

Tradicionalmente, los precios de los productos petrolíferos en el mercado interno, habían respondido exclusivamente a medidas de carácter macroeconómico, ya sea de otorgamiento de subsidios para algún sector en particular o para el fortalecimiento del nivel de ingresos, vía impuestos del Gobierno Federal.

Ante esta situación, y adoptando un mecanismo de ajuste gradual, se han implementado nuevos mecanismos de precios, que para determinar el nivel de ingresos de Pemex-Refinación indican su costo de oportunidad.

De esta manera dichos mecanismos corresponden, por un lado, a la balanza producción-consumo por producto, y por otro al comportamiento de los mercados internacionales de influencia, tomando como referencia cotizaciones spot del mercado norteamericano.

Adicionalmente, la nueva política de precios refleja las condiciones de calidad y los costos de suministro, con ágiles mecanismos de ajuste a las cambiantes condiciones de los mercados, todo ello, con

el propósito de alentar la convergencia económica de las estructuras de precios entre México y Estados Unidos.

PROVEMENT METHODS OF ECOLOGICAL
INDEXES OF AUTOMOBILE POWER PLANTS
IN “FULL LIFE” CYCLE

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Testing benches for experimental research of fuel economy and emissions of the exhaust gases of Otto, Diesel anda gas engines with power ranging from 10 to 300 kWt have been developed and mounted.

On the basis of publications analyses and engines bench tests we have systematized data (speed and load maps) relevant to the controlled emissions of the exhaust gases (CO, CH, Nox, particles) of 10 passenger car Diesel engines, 7 bus and truck Diesel engines, 7 Otto carburetor passenger car engines, 1 gas engine and 1 gasodiesel engine.

Naturally aspirated gas engine with swept volume 10.85 ( on the basis of KAMAZ Diesel engine) has been developed and mounted to the test bench.

The model of running emissions (g/km) of CO, CH, Nox, particles, CO2, SO2, Pb of passenger cars, trucks and buses for 8 running cycles in accordance with GOST 20306-90 has been developed.

Emissions of CO, CH, Nox for 1 km run are estimated on the basis of engine emissions measured in ppm or mg/1, as well as of CO2, SO2 and Pb -on the basis of experimantal and calculated data of fuel consumption, air-excess coefficient and composition of fuels used.

A mathematical model of vehicle movement was developed in traffic flow along two lane streets and crossroads with detailed imitation of the behavior of each driver enabling to estimate variations of speed, fuel consumption and emissions of vehicles in the flow. The prediction goalon the size of vehicle park in Russia for the period up to 2010th year and estimation of the volumes of fuel consumption and gross emissions of said exhaust gases components using petrol and diesel fuel, is also provided. The park size, fuel consumption and emissions calculations are done with the account taken of annual supplies of vehicles to the park and their quitting park, annual run variations, depending on the life period of examined 12 groups of vehicles, fuel consumption parameters variations and running emissions depending on the age of the engine.

# REDUCING EMISSIONS AT THE SOURCE: TDM AND OTHER VEHICLE TRIP REDUCTION STRATEGIES

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An expanding body of evidence supports the view that our growing dependence on the automobile represents possibly the single greatest social and environmental challenge to major cities throughout world today. Clean, or “alternative fuel” technology offers an important short term solution to curtailing the harmful air pollutants that adversely affect the lives and health of millions of urban residents. For this reason, alternative fuels are a vital component in any strategy that seeks to reduce vehicle emissions.

But it is important that we do not rely too much on technological solutions alone. Ultimately, it is necessary to reduce our reliance on the automobile altogether.

Automobile dependency is responsable for numerous other social and environmental problems such as traffic congestion, the loss of valuable agricultural land, and social damage caused when inner cities are abandoned in favour of valuable sprawling suburbs. For these reasons and more, a comprehensive strategy aimed at reducing vehicle use -as well as reducing tail pipe emissions- is required. Otherwise, alternative and clean fuel technologies merely serve to reinforce our dependency on the automobile.

In order to regain some of what our cities have sacrificed to unrestrained automobile growth over the last serveral decades, it will be necessary to apply some tough policy measures. This paper seeks to proveide an overview of Transportation Demand Management (TDM) and other related policies that can be used to reverse current trends that lead to greater automobile dependency while beginning the process of restoring social and environment health to the world’s cities.

REDUCCION DE PARTICULAS CONTAMINANTES

# SILENCIADOR ECOLOGICO

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Dispositivo que sustituye al silenciador en los motores de combustión interna a gasolina, en cuyo interior se aloja un filtro de cartucho intercambiable el cual retine un porcentaje de partículas sólidas provenientes de la combustión y que son expedidas al ambiente por el tubo de escape de los vehículos.

Entre las partículas más comunes se encuentran las cenizas, azufre, cobre, hierro, manganeso y plomo el cual se alcanza a retener hasta el 60%, el cartucho filtrante es fácilmente cambiable cuando se ha saturado, lo cual acontece cuando ha sido usado durante 10,000 km o más.

Las pruebas de funcionamiento del silenciador ecológico han sido pasadas ante la Universidad Nacional Autónoma de México (UNAM), el Instituto Mexicano del Petróleo (IMP), y por al Automotive Testing and Development Services Inc. de California U.S.A., y ha sido aprobado por el Comité de Proyectos y Estudios para la Recuperación Ambiental (COPERA).

El silenciador además de lo antes descrito reduce el ruido del motor, reduce la contrapresión del silenciador convencional, es de fácil instalación, no modifica la estructura del vehículo ni su funcionamiento y tiene un costo similar al de un silenciador convencional. Producto de desarrollo mexicano con patente mexicana e internacional.
REDUCTION IN COMMUTER EXPOSURE TO AIR
POLLUTANTS: A DIRECT BENEFIT

OF THE INTRODUCTION OF CLEANER VEHICLES

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Determing the risk of environmental pollution to public health requires a knowledge of: the sources of pollution; the transport of pullutants; the exposure of humans; the dose received by people, and the adverse effects resulting from these doses. This paper addresses the exposure component of this risk model, stressing the contribution of commuting to the total air pollution exposure of people in urban areas.

This paper also presents a review of the most important studies on exposure of commuters to carbon monoside undertaken in different countries. These studies indicate that measurements taken at fixed-site monitoring stations tend to underestimate in vehicle concentrations of CO, and that high exposures to CO are usually associated to long commuting times. There is evidence to suggest that similar concentration patterns may also be present for other air pollutants such as lead, nitrogen dioxide, and volatile organica compounds such as benzene.

Due to the proximity of drives and passengers to the sources of pollutants (the motor vehicles) and to the exponential nature of the decrease of pollutant concentration from the road it is expected that introduction of cleaner vehicles has grater benefits (health and subsequently economic) than those estimated or anticipated by merely measuring changes in ambient concentration of pollutants.

REDUCTION OF FUEL CONSUMPTION
AND POLLUTANT EMISSIONS IN VEHICLES-

# A SWITCH TO OPTIMIZED VEHICLES AS A FUNCTION OF THEIR USE

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At the beginning of the 80's, research essentially addressed low consumption vehicles, but a reverse evolution has been observed since 1985. Car manufactrers present and sell vehicles, with an ever increasing power, and thus despite the improvements observed in engine combustion, vehicle energy consumption has been increasing, even for so-called small-size vehicles.

Such a phenomenon has led a regular development of a same model year after year: weight and power have been added to vehicle, maximum speed has been increased far beyond allowed speeds through restyling operations (in 1993, 80% of the vehicles sold in Europe could exceed a 150 km/h speed versus only 10% in 1975).

Simultaneously, in order to maintain or-slightly-increase vehicle performances in terms pf safety, a number of manufacturers have advocated the maintaining or even the increase of vehicle size and mass to guarantee safety (automobile safety and CAFE).

But it has been translated into:

- Hight vehicle unit consumptions
- more significant pollutant emissions,
- higher driving speeds, and unlawful speeds on highways and roads
- increased safety risks due to increased and uncontrolled speeds.

A great number of examples of such a recent development are given, as well as the accurate incidence of any mass and/or power increase on fuel consumption.

Technical alternatives do exist to reduce drastically current consumptions without much disturbing users in terms of comfort, while not reaching the low consuption asymptotic values that have been know and presented for a number of years on a lot prototypes.
These alternatives are aimed at:

- installing a lower engine in a prescribed vehicle, thus reducing urban and periurban consumption for similar use conditions,
- presenting lighter weight models by about 100 kilograms for a same internal size,
- improving the efficiency of auxiliary equipment wich requiers a lot of energy (e.g, air conditioning system),
- analyzing in a more critical way -i.e constructive way- the famous weight-safety compromise, wich has often put forward to justify vehicle weight increase.

So the following results could be obtained with the most current sizes of vehicles:
medium-size vehicles: 750 to 850 kilos 160 km/h4,65,5 1/100 km
small-size vehicles: 450 to 610 kilos km/h2,8-3, 5 1/100 km

The fuel consumption values are for mixed cycle urban, road and highway.

REGARDING ROAD FREIGHT VEHICLES
IN THE ENVIRONMENT

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In Japan about 50% of all energy is consumed by the industrial sector, with the transportation and residential/commercial sectors consuming roughly equal amounts each of the 50%. Over the last twenty years, we have seen sector changes in the growth rate of energy consumption. Over that period, there has been a 1.15 growth rate in the industrial sector, whereas the residential/commercial sector has seen a growth rate of 2.18, and the transport sector of 2.08. When we try to make targets for energy conservation, we can see that while the transportation sector has become such a huge problem it, nevertheless, is more amenable to government control than that of the residential/commercial sectors for where setting, clear conservation targets is near impossible. Today we are anxious about emission gases, such as CO2 and Nox, wich are serious actors of air pollution. In Tokyo, Osaka and other big cities there have been increasing numbers of vehicles in recent years, while at the same time, the rebuilding of old roads, construction of new roads and traffic control systems have been delayed. The results being ever worse traffic congestion and increasing levels of air pollution. Air pollution from energy consumption by vehicles has prompted us to study the way in wich we use energy for transportation. The environmental problem of air pollution is now the main theme. All these problems are laying down the conditions and restrictions of future vehicles and traffic management research.

For this report we focused on the busy heart of Tokyo, the city area, aplace where road transportation must face the aforementioned problems of energy use as they have both strong economic and environmental effects. We must therefore look towards improving freight vehicles transport efficiency and analyze the impact of this for the betterment of the city environment. So far, our present policy has been rather one-sided as it has required us to principally cut down exhaust emissions.

# REORDENACION DE LA JORNADA LABORAL URBANA COMO UNA MEDIDA DE MANEJO DE LA DEMANDA EN EL TRANSPORTE

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El interés de considerar el sector transporte urbano en el contexto de la problemática del uso racional de energía, se basa en que: a) es uno de los mayores consumidores; b) es a la fecha totalmente dependiente de los hidrocarburos; c) es posiblemente el sector más susceptible de ahorro energético a través de medidas de organización y de cambios estructurales, basados en disposiciones reglamentarias y jurídicas.

En la ponencia se presenta una sugerencia de cambio de organización social que conduciría una reducción en la demanda diaria de transporte, así como los avances parciales logrados en estudios específicos realizados por investigadores de la Universidad, apoyados por el Programa Universitario de Energía (PUE).

La propuesta consiste en estudiar la posibilidad de modificar las jornadas de trabajo individuales, de manera que se cubran las horas semanales contratadas, ya sean de 48 ó 40 horas, con un día menos, esto es, en cinco o en cuatro días, pero con jornadas un poco más largas. Los lugares de trabajo, fábricas, oficinas y comercios, seguirán funcionando los mismos días laborables que en la actualidad, reorganizando la asignación de labores. De esta manera, el día libre adicional no es el mismo para todos los individuos.

Los resultados parciales de estas investigaciones corroboran algunas delas expectativas y confirman aspectos centrales de la propuesta, en especial la magnitud del número de viajes al trabajo, el impacto de éstos en la economía del trabajador y las posibles consecuencias en el consumo energético vía su reducción y la disminución de la contaminación ambiental debida a emisiones de

plomo y otros contaminantes. Estos estudios han permitido visualizar y precisar muchas otras actividades a realizar.

RESEARCH AND DEVELOPMENT PROGRAM
OF LITHIUM BATTERY IN JAPAN

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The demand for electric power in Japan is rising enormously and is expected to continued increasing in the future. Under these circunstances, the difference between daytime and nightime demand is becoming a major problem. In order to solve this problem, it is an efficient way to utilize the electric energy at night on consumer side with “Dispersed-type Energy Storage Systems”, such as load leveling apparatuses for houses and office buildings, electric vehicles and so on. Electric vehicles will contribute to the reduction of air pollution in urban areas, too.

Considering this state, we have started “The Development of Dispersed-type Battery Energy Storage Technology” from FY 1992 as a projet of the New Sun-Shine Program of AIST. This proyect has been conducted by New Energy and Industrial Technology Development Organization (NEDO).

R&D schedule covers a ten-year period extending from 1992 through FY 2001, and the planned R&D expenditure totals about 14 billion R&D items of this proyect are as follows;

(1) R&D of 20-30 Wh high performance ambient temperature lithium secondary battery with long life and high energy density for load leveling system on consumer side, electric vehicle and

others

(2) Research on the total system of battery application technology.

ROAD POWERED ELECTRIC VEHICLE
DEVELOPMENT

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The roadw ay powered electric vehicle system, wich has been under development in California for the past 10 years, is a system variant of the EV in wich the basic technology encompasses a high-frecuency non-contacting electromagnetic energy transfer system between the roadway and the vehicle. The active roadway element is buried in the surface of the highway, permitting distribution of electrical power along the lane centerline, wich is then absorved by an antenna like pickup on the vehicle under carriage. Onboard energy storage is used to permit autonomus operation off of powered lanes. By upgrading the public sector highway technology in this fashion a practical, general purpose EV becomes feasible. Fully deployed it will, in efect, permit unlimited range for the electric vehicle, and a net reduction in costs and a improvement in performance over the ICE vehicle. In the program thus for a mid-size bus aand a van, and a 150 m test facility have been built to demonstrate the technology.

The present emphasis of the California effort, centered on test facilities and demonstration in the San Diego region, is the development of an electric bus using “opportunity” charging at stops. Economic comparisons between the diesel transit bus, the trolley coach, and the roadway powered electric vehicle (RPEV) have been made using data from the trolley bus system of the San Francisco Muni and studies prepared for the Los Angeles region. These look very favorable for the RPEV. The central issue is economics, not spo much clean air. On the basis of this it is provisionally concluded that the life cycle costs of the trolley bus expresed in terms of dollars per vehicle-kilometer are about 110 percent of the diesel, the RPEV is 85 percent, and an RPEV with electricity costing 3c/kw-Hr is about 67 percent of the diesel bus. These provide a very powerful incentive for developing the electric bus, since the RPEV also offers a clean-air transport system with low ambient noise. Thus the current effort is focussed on a near-term electric bus that can be deployed on a demonstration basis in the nex 2 years.

On the automobile side economic analyses of the system for the San Diego region suggest that a fully deployed system, i.e., 1 percent of the highway network and 3 km avg. access distance, would add about 0.6c/veh.-Km to automobile costs (applied to all vehicles) for amortization of the roadway capital improvements, whereas net savings with a fully mature electric vehicle (vith some degree of automation) would be around 6.0 c/veh.Km. Since there area about 120x109 per year for the region. Air quality benefits would increase this further. Thus the ultimate goal of the program is to develop and perfect an automobile that can use the powered roadway and deploy a substantial network by 2000.

## ROLE OF AROMATICS FROM MOTOR VEHICLE EMISSIONS IN THE FORMATION OF ATMOSPHERIC PHOTO-OXIDANTS

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Formation urban photo oxidants is caused by the emission of carbon monoxide, volatile organic compounds VOC's) and Nox emissions from motor vehicles make a significant contribution to the atmospheric pollution inventory. During the daytime the oxidation o VOC's is initiated by reactions with OH radicals and 03 while during night time the oxidation continues by reactions with 03 and NO3 radicals. In addition to 03 and peroxyacetylnitrate (PAN) the photochemical reactions involving hydrocarbons and Nox produce a wide variety of other secondary pollutants. Not all hydrocarbons emited into the atmosphere contribute equally to ozone and PAN formation. For CO and a limited number of VOC's the chemical mechanisms by which different photo oxidant species are being formed are reasonably well know. However, there are groups of VOC's, in particular aromatics and biogenic alkenes (isoprene and terpenes), for wich many important kinetic data are lacking. Several estimations indicate that the aromatics in urban areas may contribute more than 30% to the formation of photooxidants. The mechanism of formation and exact nature of the photooxidants formed in the oxidation of the aromatics is presently very poorly understood.

Aromatic compounds, in particular benzene, toluene and the xylene insomers, are major components of car exhausts. Other reactive hydrocarbons such as butadiene and isoprene have also been observed in tailpipe emissions. Numerical models are currently being used in the US and Europe to develop abatement strategies. Shortcomings of these models include transport problems and chemical mechanisms which accurately describe the photo-oxidant chemistry. The detailed mechanisms by which the aromatics contribute to photo-oxidant formation represents one of the most poorly characterized aspects of the chemical modules models. The current knowledge on aromatic oxidation mechanisms will respect to the chemistry presently included in the EMEP model will be reviewed. This model has recently been re-evaluated and is being used in Europe to develop abatement strategies. A critical analysis of the West- European situation with respect to the contribution of aromatics to the photo-oxidant problem will be given.

SISTEMA PALEMAN

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El petróleo y el carbón se denominan combustibles fósiles. Se formaron hace millones de años, cuando quedaron enterradas grandes cantidades de sustancias animales y vegetales.

Actualmente estamos quemando comsbustibles fósiles a un ritmo considerablemente más rápido que el de su formación. Es muy importante tomar en cuenta y saber que una vez que se utiliza un combustible fósil puede darse por perdido para siempre. Cada litro de petróleo que quemamos nos aproxima al fin de la existencia de este combustible.

También sabemos que no se puede obtener más energía de un combustible que aquella que buenamente posee; sin embargo se puede obtener un mejor aprovechamiento del mismo, mejorando el rendimiento del motor.

El aumento de rendimiento de un motor se obtiene aumentando la relación de compresión y es aquí donde aparece la detonación: el combustible que para una relación seis (6) no es detonante, lo es para una relación siete (7), por ejemplo.

Con mi nueva tecnología la cual llamaré “Sistema Paleman” el motor trabaja o funciona a mayor relación de compresión y la mezcla de aire-combustible carburada a través de un carburador explota por sí misma; esta verdadera explosión espontánea se propaga a una velocidad mil veces mayor que la explosión original y propagada por el concurso de la chispa eléctrica en la bujía en un motor de explosión “OTTO”.

El Sistema “Paleman” es una nueva y simplificada tecnología capaz de producir más energía dentro de la cámara de combustión en un motor de combustión interna, mayor aprovechamiento de esa energía y no necesita del sistema eléctrico (distribuidor, platinos, bobina, bujías, etc.), ni de la bomba de Inyección para hacer la explosión de la mezcla de aire-combustible dentro de la cámara de combustión; además elimina los gases tóxicos y nocivos para la salud que salen por el tubo de escape, residuos de combustibles no quemados dentro de la cámara de combustión disminuyendo así, la contaminación del medio ambiente.

Este Sistema “Paleman” se puede aplicar también a los motores rotativos Wankel haciéndoles una pequeña modificación y obteniendo mejores resultados.

La forma de construcción del sistema “Paleman” es adecuada, en especial la alimentación del motor, logrando mayores relaciones de compresión sin permitir que explote la mezcla aire-combustible antes del momento deseado, casi en su Punto Muerto Superior. Con este sistema se consigue un desplazamiento mayor sin que aumente el consumo de combustible.

En el motor “Paleman” la combustión explosiva y expansiva de la mezcla aire-combustible se autoinflama a una velocidad rapidísima directamente dentro de la cámara de combustión aumentando la presión explosiva y expansiva a una velocidad extremadamente alta y siendo el tiempo de explosión o de fuerza el más corto de todos, con el sistema “Paleman” se logra un mejor y mayor aprovechamiento de esa fuerza explosiva y expansiva encerrada dentro de la cámara de combustión hasta que se abre la válvula de escape.

Esta fuerza explosiva y expansiva que se aplica de modo rapidísimo al pistón que a su vez se mueve muy de prisa, tiene un mayor aprovechamiento con el sistema “Paleman”, por la forma, originalidad y simplicidad de funcionamiento de este sistema.

El motor de combustión interna “Paleman” tiene mayor durabilidad y menos problemas ya que no requiere de un sistema separado de encendido porque lo trae integrado y forma parte vital del mismo motor.

El llenado de los cilindros es superior a los actuales motores, mayor cantidad de gases admitido lo cual eleva la compresión efectiva aún con el acelerador poco pisado.

A medida que un gas se comprime, sube su temperatura y la mezcla aire-combustible se autoinflama y se propaga a una velocidad extremadamente alta, haciendo que la presión explosiva y expansiva dentro del cilindro aumente rápidamente.

Esta alza de presión explosiva y expansiva es proporcional a la cantidad de mezcla aire-combustible que entra turbulentamente dentro del cilindro.

En el motor “Paleman”, por trabajar a una mayor relación de compresión, el rendimiento es mayor, más económico, es decir obtiene más energía de su combustible que con cualquier otro tipo de motor y no necesita que la gasolina empleada sea de buena clase.

Parece ser que los hidrocarburos que forman la gasolina se oxidan con el aire en que se vaporizan y en esos peróxidos la propagación de la llama se hace a una velocidad extremadamente alta.

Técnicamente el motor “Paleman” está en capacidad de funcionar y consumir cualquier clase de combustible líquido o gaseoso, mediante pequeños arreglos.

STRATEGIES FOR THE MANAGEMENT OF END-OF-LIFE CARS-INTRODUCING AN INCENTIVE FOR CLEAN CAR DEVELOPMENT

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Complex products, i.e. products consisting of several different components and materials and having relatively long lives prior to disposal, are gaining an increasing interest as regarded to their environmental end-of-life strategies. Typical complex products may be electrotechnical products (home electronics, white products, measuring instruments, electronic machines, etc.), machinery and vehicles (lawn-mowers, cars, power aggregates, aeroplanes, etc.), and also building material.

The characteristics of complex products differ in many ways from products that traditionally are recycled. One of the main characteristics of complex products is that the inherent complexity of them may discourage recycling. Complex products are build of various materials wich may be combined in ways that make them technically difficult and/or expensive to separate during recycling. The use of new materials with not yet know environmental qualities and the long life of
the products prior to disposal makes predictions of the costs for the handling and treatment of complex products difficult. These characteristics indicates that special consideration must be taken when forming systems for the handling and treatment of worn-out complex products and that it is important to implement incentives, wich facilitates these activities, in systems for end-of-life products.

Sweden has an in many ways unique experience from end-of-life management systems for complex products, with its governmentally administrated car scrapping system implemented as early as in 1975. The Swedish car scrapping system has, though, been criticised for not constituting any real incentive for car manufacturers to develop easily dismantled and recycled cars. A more and more extensive use of plastic materials in cars have resulted in incrasing amounts of waste at the car recycling facilities, especially since the recycling of organic materials, so far, has not been seen as profitable activities among car scrappers.

It is obvious that the manufacturers have the unique opportunity of changing the design and construction of their products making them more easily dismantled and recycled. The implementation of an exgended producer responsibility in carefully designed car scrapping

systems may, therefore, constitute a strong incentive for manufacturers to develop cars with increasing performance, as regards dismantling possibilities and recyclability, thereby avoiding costs and difficulties during these activities. Such car scrapping systems will be even more important in the coming future considering today's development towards and increased use of weight reducing plastic materials in cars in order to improve their fuel efficiency.

In many of the European countries and also in the EU a development of car scrapping systems are in progress. The paper will, in the light of the Swedish experiences from car scrapping, examine some of these strategies and analyse to what extent they provide incentives for cleaner products development.

## SUPERCARS: ADVANCED ULTRALIGHT HYBRIDS

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Adding hydrid-electric drive to normally heavy production platforms improves their fuel efficiency by 11.3-1.5x. Making them ultralight (curb mass MX, even É,kg) and low-drag (CDA 50.33 m2, roM 1 kg-wheel) but not nybrid improves efficiency by 2-2.5x. But artfully combining ultralight design with hybrid drive can increase efficiency

by 5-20x. This ultralight-hybrid technological fusion, highly integrated with meticulous attention to detail, can yiel general-purpose, extremely fuel-flexible family cars with combined urban/highway fuel intensities of 0.4-1.6 1/100 km (150-600 mi/gal), and with unchanged or improved safety, performance, amenity, and probably price. Indeed, the parameters needed to achieve 1.0/100 km have already been demonstrated.

This surprising and robust result is mainly due to two importants synergies. First, reverse mass compounding is stronger with ultralights than with heavy platforms, stronger with hybrids than with other drivelines, and strongest with both. Second, once irrecoverable losses are greatly reduced (by 21/2.6* for aerodynamic drag and 5-8* for rolling resistance), the only remaining tractive load is aceleration, which is first decreased 3-4* with platform mass and then largely recovered by the hybrid drioves regenerative braking. Radically reduced tractive and accessory loads (the latter decreased 3-10*) then yield fuel savings manyfold larger still by avoiding most of the upstream driveline losses. Moreover, the engine becomes 10* smaller (10 km) because most power for acceleration and gradeability come from temporarily stores braking energy, and becomes roughlywice as efficient (if Otto) by operating at or near minimum BFSC and without idling. Low platform mass cuts driveline mass to the order of 100 kg. 4* less than for a battery car, and helps avoid batteries power-density limits. Most interactions between parameters appear to be favorable, and proven methods ample to ensure cashworthiness.

The resulting light vehicles, and their heavy-vehicle analogues, are likely to be bought because they are superior vehicles, not because they save fuel. Emissions can be reduced by 2-3 + orders of magnitude, typically to below those of the local portion of battery-electric cars recharging power stations. Moreover, producing “supercars” chiefly from net-shape advanced composites offers promising economics and the fundamental strategic advantages of very short cycles times, market agility, low risk, high flexibility, and streamlined structure. Many further technical refinements are possible and desirable, but they are a need, not a barrier: the key barriers are neither technological nor economic but cultural. Overcoming those barriers and rapidly leapfrogging to widespread

use of ultralight hybrids appers both feasible and prudent. A parallel agenda of transportation reform will also be vital since supercars cannot solve and may worsen the problem of excessive automobility.

SWISS RESEARCH AND IMPLEMENTATION PROGRAMS
FOR THE REDUCTION OF ENERGY CONSUMPTION
AND ENVIRONMENTAL POLLUTION
IN TRANSPORTATION

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In Swizerland, approximately one third of the final energy consumption is used for passenger and goods transportation, while motorized road transport continues to show high growth rates. The focal points of current Swiss research and implementation activities are therefore to be found in energy-saving and environmentally-compatible passenger transportation, on the one hand, and in the rational transportation of goods on the other.

In order to eliminate existing obstructions when introducing energy-saving transport technologies and to achieve the fastest possible market introduction of technologically proven vehicles using various forms of drive, the Swiss Federal Office of energy Economy has introduced a number of research and implementation programs under the general title of “The economic use of energy and transportation “for the fields of”General traffic” and “Electric vehicles”. These programs have the following designations:

- Basic research on passenger and goods transportation
- Basic research on “Electric vehicles”
- Pilot and demostration installations
- Implementation program: “DIANE”
- Promotion program; “Lightweight Electric Vehicles”

Campaign program: “Fuels”

In the programs “Basic research” “Pilot and demostration installations”, “DIANE” and “Electric vehicles”, approximatley 10 projects are currently being supported in the following fields:

- Development of compact lightweight vehicles with their associated components (wheels, tires, etc.)
- Optimization of electric, hybrid, gasoline, diesel, and natural -gas powered frives for standard and lightweight vehicles.
- Development and optimization of two-wheeled vehicles

Further development of combined goods transportation using small containers

Over 30 projects are included in the “Lightweight Electric Vehicles” promotion program. The main focus of this program is structured in four sectors:

As part of a large-scale test in a major Swiss community, the targeted promotion of lighweight vehicles aims to test and demostrate potential areas of application in everyday use. At the same time, this promotion is to be undestood as an impulse for market introduction and as a forum for a wide range of scientific investigations.

## TARGETED INFORMATION ACQUISITION AND DISSEMINATION PROGRAMMES-A KEY MECHANISM FOR OVERCOMING BARRIERS TO THE PROMOTION OF ENERGY EFFICIENCY IN TRANSPORT

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Improving the efficiency of transport energy use in highly populated urban areas is a key goal for both the industrialized and the developing world. Policies aimed at introducing more energy efficient vehicle technologies and alternative fuels, stimulating greater leadership in public transport, enhancing traffic management techniques and adopting appropriate land-use planning measures are being developed in many cities. Environmental sustainabillity drives these initiatives, but other benefits such as economic efficiency and direct financial savings can also be obtained.

However there are formidable difficulties which hinder the widespread achievement of these benefits. The barriers include lack of information and technical expertise, inappropriate regulatory frameworks and low financial incentives for the efficient use of fuels.

This paper describes the barriers to improve transport energy efficiency in both industrialized and developing countries. It examines the role of targeted information acquisition and disemination programmes. These use transport technology transfer to promote energy efficiency techniques. The paper draws on examples of successful programmes from Europe and identifies how they can be used in other regions. Conclusions are drawn on the most appropriate programme mechanisms and Government-industry interactions for coordinating technology transfer and market acceptance. (The paper is based on ETSU's experiences in energy technology programme management and strategic programme planing for UK Government and the European Commission, but does not reflect the views of these bodies.)

# TECHNOLOGICAL ADVANCES TOWARDS DEPLOYING CLEANER, MORE FUEL-EFFICIENT AND RECYCLABLE MOTOR VEHICLES

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Growing environmental and energy conservation concerns have led automotive manufacturers to focus on developing cleaner and more fuel-efficient motor vehicles. Present technology has led to considerable progress towards achieving this goal; however, many challenges still lie ahead. Anticipated technological advances will aid manufacturers in producing new, highly-efficient, clean and recyclable vehicles.

# TECHNOLOGICAL AND OTHER MEASURES PROVIDE POTENTIAL FOR SUSTAINABLE TRANSPORT OF GOODS AND PEOPLE

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The rapid growth of both passenger and freight transport over the world creates different kids of problems of environmental, safety congestion, fuel consumption and socio-economic nature. There is

an increasing international concern about how all these problems should be undertaken to make the development of a sustainable society possible.

The paper starts a brief identification of the environmental problems connected with growing vehicle population and denser traffic in metropolitan and rural areas. The problems can be divided into local, regional and global problems.

Technological measures are being implemented wich will reduce the emission of air pollution from vehicles dramatically as older and more polluting vehicles are replaced. Among these measures are improved engine and catalytic converters in combination with improved fuel quality.

Futher technological developments, including impromovement of fuel efficiency, the use of alternative fuels, and possible use of electric vehicles and hybrid solutions especially for the commercial transport in urban areas are also reported.

The role of politicians and planners should bbe to set specific goals for an improved future situation. Society and city planning must include strategies aimed at giving traffic a smooth flow, which counteracts not only congestion but also emission of air pollutants. Development of effective public transit which can be generally accepted by the public is also important.

It is essential for an overral favourable development that the automotive industry receives political signals in good time. Industry is prepared to meet advanced demands for vehicles with less environmental impact. However, the need of sufficient lead time must be respected, and the requirements must be internationally harmonized. When it comes to technological solutions for vehicles, industry should take the lead in their development. Questions related to recycling and minimizing of waste from end-of-life vehicles are also important in the technological development towards a future sustainable society.

Advanced information technology will open improved prospects of traffic guidance. Infraestructure will also benefit from this

development, since city and society planning should include and infraestrucute desing which facilitates optimal coordination of the different modes of transportation of people and goods. A transport systems approach which takes into account all the benefits of the different modes of transport urgently requires. This means that the transports systems research and development must be given high pripority on an international scale.

## TECNOLOGIA EN EMISIONES DE MOTORES DIESEL PARA SATISFACER A LOS CLIENTES

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Se hace una presentación de la tecnología de emisiones de Motores Diesel en una forma clara y sencilla, pero desde el punto de vista del cliente y usuario final, se tratará de superar las expectativas que el cliente tiene o de lo que hubiese deseado referente a las emisiones y producto final.

El enfoque tecnológico para satisfacer las legislaciones, se presenta bajo el enfoque de “CALIDAD TOTAL”. El ambiente es a final de

cuentas cosiderado como otro cliente al que también hay que satisfacer. La degradación del mismo tendrá implicaciones y consecuencias que a todos involucran y afectan.

Se cubren tres áreas específicas: Legislación, satisfacción del cliente y estrategias tecnológicas.

Se analizan en forma breve las tendencias a nivel mundial sobre legislaciones de emisiones, así como los puntos básicos para satisfacer las demandas de los clientes.

Por último, se exploran las estrategias tecnológicas hasta el año 2000, su evolución y cambios básicos en los diferentes sistemas del motor, que permitan tener emisiones más bajas y mejores productos para nuestros usuarios finales.

## THE ASIACAR-THE NEW VEHICLE SYSTEM IN DEVELOPING COUNTRIES

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This proposal suggest an electric vehicle transportation system designed to combat the deterioration of the environment which will accompany the expected availability of electric vehicles to the masses in the countries of Asia and other developing countries as well as to suppress the generation of greenhouse gases by electric vehicle traffic. It also examines solutions to the problems of energy use, accidents and congestion that blight our electric vehicle-centered society.

The author, who has participated in the development of high-performance electric vehicles, combines that expertise here with knowledge of the use of solar cells to achieve energy savings and a major reduction in environmental load. The proporsal also shows how the number of accidents can be greatly reduced by implementing and automatic driving system which includes functions to prevent collisions, cause cars to stop properly at red lights, and keep cars within their traffic lanes. Significant increases in road and parking lot capacities can be achieved by introducing a new standard which reduces car widths to no more than 120 cm. Limiting the overall weight to a maximum of two tons would permit a change in road structures -ordinary roads could be multilayered and three-dimensional, unlike today's roads, the overwhelming majority of which employ flat, single-deck surfaces. This would make it substantially easier to construct roads in our cities.

This proporsal brings together all these different elements.

The cars proporsed here are two-seaters, with one seat in front and one behind. This configuration can be altered, however, according to requirements. The basic model can accomplish 250 km of city driving on a single battery charge and achieve a maximum speed of 130 km/h. Charging solely by solar cells allows an annual range of 18,000 km. The purchase price can be lower than that of a standard Japanese minicar.

Implementing this program step by step in stages can eventually yield solutions to all the problems caused by automobiles. The program is also ideally suited to the trend toward mass availability of cars in Asia and other developing countries.

# THE BRAZILIAN POLICY FOR MOTOR VEHICLE EXHAUST EMISSION REDUCTION

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In general, air pollution from mobile sources in Brazil affects mainly the large metropolitan areas. The fast and continous urbanization trend, observed in Brazil since the early 1960's, has led the major cities to traffic congestion and motor vehicle pollution.

In an effort to addres this problem, the federal government establised, in 1986, the National Emission Control Program, called PROCONVE, to control emissions, in such a ways as to promote technological development for vehicles and fuel quality improvement.

Initially, the emission control for new light duty vehicles (gasoline and alcohol) was emphasized. In 1993, the limits for new heavy duty

vehicles (diesel) were established with the technical requirements of an inspection and maintenance program to control in use vehicle.

The paper will describe the PROCONVE requirements and the most important aspects related with the automotive technological developments, fuel characteristics (diesel and gasoline) and air quality. Additionally, the brazilian automotive scenario, since 1980, will be described with the PETROBRAS program to reduce the sulphur level from diesel fuel (metropolitan diesel) and the trends for the nineties.

## THE IMPACT OF U.S. REFORMULATED GASOLINE, OXYGENATED FUELS, AND ALTERNATIVE FUEL REQUIREMENTS AND INCENTIVES-A STATUS REPORT

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As a result of four major legislative initiatives in the past five years, the United States has assumed world leadership in the reformulation of gasoline and diesel fuels, as well as the promotion and development of cleaner-burning alternative fuels in the transportation sector. The motivation for these revolutionary initiatives is the fact that the transportation sector makes the single largest contribution to air pollution. It has now become the policy of the U.S. government as well as many states, to begin replacing petroleum-derived fuels with

domestically-produced, less-polluting, and renewable alternatives. This paper will examine the public policy rationale for these initiatioves, describe the programs (federal and states), assess their expected impacts (including cost and expected air quality improvements), and make predictions about the composition of motor fuels in the U.S. for the coming decade.

# TOWARDS SUSTAINABLE MOBILITY THE IMPORTANCE OF THINKING IN TERMS OF TRANSPORTATION SYSTEMS AND COHERENT PARCKAGES OF POLICY MEASURES

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Technology, like fuel efficient and clean motor vehicles (passengers and freight transportation), will play a major role as contributor to reduction of the adverse environmental effects of motorized transportation. However, projection studies show that the projected traffic growth, eve in already heavil motorized countries, will offset the gains from clear and more fuel efficient vehicles, at least in the mid term. Currently there is an increasing awareness that measures, that are restricted to a certain aspects to transportation will not yield the required results and migth even have perverse effects. A breach of trend is likely to be necessary, in which many measures of different nature addressing the whole field of transportation are included.

To be able to design integrated transport policies that take sustainable development as starting point, there are two basic prerequisites: operationalisation of the concept of sustainable mobility and an understanding of the transportation system and the interdependencies of the constituent elements.

The operationalisation of sustainable mobility migth be done by using the concept of “carrying capacity of the environment”, the identification of indicators (impacts), the selection of criteria and getting limit values. Such an operationalisation at international level is urgently needed to enhance the understanding of the severeness of the problems.

The transportation system may be described in terms of mobility demand, and supply of infraestructure and vehicles. An integrated transport policy would address those markets, that reflect the various aspects of the transportation system: land use, infraestructure, vehicle and motor technology, travel and driving behaviour, transport and traffic organisation etc. It would be backed up by regulatory instruments and incentives with an economic, an organizational and a technical nature. An interactive process can be designed to include socio-economic and environmental trade offs.

The design and implementation of packages of measures is still far from being common pratice. Questions to be addressed are: how could coherent packages be designed, what might be the criteria, how could synergy be achieved taking into account positive and perverse effects of various measures, what might be the various types of barriers and how could acceptance be raised to the level needed to overcome those? A number of examples is given.

Finally, the development of an innovative process that could support the development of vision about future transportation systems and thus the design of long term transportation policies and packages of measures is discussed.

# TRANSLATION OF GLOBAL ENVIRONMENTAL INITIATIVES TO LOCAL TRANSPORTATION SECTOR ACTION: THE CASE OF CO2 IN SWEDEN

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The automobile has long been identified with ultimate freedom of mobility and holds a positive lalbe as creator of jobs and as facilitator of access to resources and activities for a large number of people and societies. However, automobiles are growing at a rate which worldwide corresponds to a 1.2 ratio with population growth (one car introduced to the market for every two people born per annum). This would not be a highly discussed issue in this or any other conference were it not for the fact that these cars deplete natural resources and create serious harmful effects on the ecosystem. Vehicles in the OECD contribute with 55% of the CO2, 85% of airborn carcinogen benzene, 75% of CO, 48% of Cox, 40% HCS, 13% of particulares and 3% of Sox emitted into the atmosphere (Goodland, 1994).

Although this “double-morality” of the vehicle is important, the problems of automobility are not that simple. The transportation

system is complex due to the heterogeneous character of the actors which want to further their interests and the structure of the society which is centered (to a high degree) on furthering the positive aspects of the automobile. In situations where a diverse number of demands have to be satisfied, as in the transportation system the general structure of rational decision making tends to break down. Sometimes the inability to deal with the diverse demands makes it difficult to define and solve problems at a local level, leading to simple solutions (usually technical in nature as the electric vehicle) which stifle alternative ones.

The underlying goal of this paper is to show how coordination of actors at different levels (global-regional-local-national) in the transportation sector can lead to implementation of environmental policies. The paper will outline the way in which Sweden translated the Global Climate Convention to a national climate proporsal with specific emphasis on the transportation sector. Understanding this translation process will open up alternative solutions to automobility by being able to integrate actors, resources and socio-economic structures to fulfill national goals at local level with sectorized Agenda 21 (in the spirit of the UNCED conference in Rio 1992).

# TRANSPORTATION DEMAND MANAGEMENT (TDM) IN THE FIELD OF PASSENGER TRANSPORT IN THE NETHERLANDS

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The Netherlands is a small but densely populated country in north-west Europe. Car mobility has risen enormously in recent decades and it will increase further. The estimate is that problems caused by unbridled growth in car mobility will exceed the boundaries of social acceptance.

The Dutch Ministry of Transport drew up a national transport policy plan in 1990. Remarkable is that expansion of road infrastructure occupies a less central position. Congestion management, TDM and (motor-vehicle) technology development (cleaner and more economical), have become at least equal important.

TDM attempts to diminish the demand for car mobility. It has a two-fold objetive: to reduce the risk of congestion and to diminish the impact on the quality of life. It's clear that from the point of view of the environment, technological improvements such as cleaner and more economical vehicles are very important. However what could be more fundamental than ensuring that car mobility as such is reduced?

Two levels of influencing car mobility are recognizable in the Netherlands:

1: Reducing the number of car trips and reducing the length of such trips. Land-use policy and pricing are major instruments.

2: Influencing modal-split. Improving alternatives as public transport, car pooling and cycle usage but also transport plans for companies, parking policy and making certain vulnerable areas less accessible to cars are important instruments.

TDM is no easy route to pursue. Nevertheless, it is found that results can be achieved in practice. It requires a balanced and coherent approach. Great attention will have to be paid to improving the alternatives and discouraging car usage if necessary. Carefully considered communication programs to reach the target groups and to get acceptance for your policy are important.

We need some time to achieve succes on a large scale. At several specific situations (f.i. at companies) we see obvious changes in modal-split. Encouraging the use of alternatives in combination with parking policy is a powerful strategy.

Implementing land -use policy, large-scale improvements to public transport and bicycle networks, unfortunately, do take some time. Nevertheless, the aim of the Dutch Governments is that TDM will have reduced the expected growth in car mobility by 50% (from +70% down to +35%) by the year 2010 (compared to 1986).

# TRANSPORT-RELATED AIR POLLUTION STRATEGIES
# WHAT LESSONS FOR DEVELOPING COUNTRIES?

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Motorization - the growth in ownership and use of motorized vehicles- both facilitates economic development and causes environmental degradation. Goverments worldwide are attempting to devise transport policies that balance the increase in mobility and accessibility, which motorization brings about, with the costs it imposes on the environment in the form of pollution, congestion and traffic accidents. These cost become economically and socially escessive when motorization reaches certain levels.

This paper reviews the current air quality strategy that is being pursued in developed and developing country cities where the air pollution problem has reached unbearable dimensions. The strategy is essentially curative -stabilize the amount of emissions first and then reduce the level of air pollution gradually. For mobile sources it focuses on impored fuel and automotive technologies for new

vehicles, plus inspection and maintenance programs for the entire fleet on a routine basis.

Developing countries need to modify this strategy. They should adopt cost-effective solutions to problems which vary by locality. Interventions must be selective, enforceable and affordable. Given the low fleet turnover rate in these countries and the old technology used in domestic production of motorized vehicles special attention should be given to the most polluting and most heavily used components of the fleet.

A strategy relying on the ability to influence the development of new automotive and fuel technologies is not available to most countries nor is a technological fix sufficient. Most developing countries are not large enough players (as consuers or producers) in the global fuel and vehicle markets to ve able to influence the development of new technologies. This is a concern, to the extent that, the new technologies might incorporate operating and maintenance requirements that are too sophisticated and sensitive to be usefully adopted in countries with poor infrastructure and enforcement capabilities. Countries that must select from the options available in the global market must at least generate selection criteria based on local needs.

More importantly, air quality strategies which count on advances in automotive technology alone, such as in-vehicle air pollution because they do not address the rise in car owership caused by economic growth nor do they consider the increased vehicle use, as in the case of the United States, that is induced by improved automotive technology itself, such as the reduced cost of travelling associated with more fuel-efficient vehicles. Demand management measures are necessary to complement supply side interventions.

Demanda management measures, however, whether regulatory or pricing not been utilized much to date and are still being experimented with in only a few cases.

Finally, the paper notes that experience worldwide suggests that government intervention on transport-related air pollution tends to start only when pollutant concentrations reach intolerable levels for

the urban population of the megacities. This does need not continue. There is a need, therefore, to develop a longer term preventive strategy, which would involve implementing a package of policies and measures capable of managing the process of motorization to avoid its negative environmental impacts. Medium-sized cities-where air pollution is not currently and issue but where, based on likely motorization trends, it could become a major problem in the next one or two decades -are prime candidates for initiating preventive strategies now.

ULTRALIGHT MASS TRANSIT VEHICLE (UL MTV)
JANUARY 17, 1994.

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Proporsals abound for so-called “light” rail systems in major cities around the world. The term invokes the notion of light weight and low cost, but this is not the case. “Light” merely refers to light duty service, i.e., something substantially less than the 300,000 passengers per day that is the typical level for major subway routes.

It is estimated that the underground metro “Red Line” in Los Angeles will cost $ 5.3 billion for 22.7 miles of track, or $ 230 million per mile ($142 million per kilometer), to handle 385,000 passengers per day or $ 600 per passenger-mile ($ 370 per passenger-km) of capacity. By contrast, monorail of “light” rail systems are projected to cost $ 50 million per mile ($ 30 million per km) supporting 100,00 lb vehicles carrying 160 passengers (625 lbs/passenger). With significantly lower carrying capacity, the cost per passenger mile of capacity will be significantly worse than metro systems.

In an underground system, weight may not be critical, but in an overhead system, the weight of the moving car has profound implications for the overall system cost and performance. By drastically reducing vehicle wight, the design of supporting structures is altered so that dramatic cost reductions are possible. Furthermore,

above-grade operation is environmentally benign because truly light weight vehicles are much quieter than so-called “light” rail systems. We refer here to such designs as Ultralight Mass Transit Vehicle (UL MTV’s).

“Ultralight Mass Transit Vehicles”

The authors offer a patented UL MTV which weighs less than 200 lbs. per passenger. With and estimated top speed of 100 mph, the passenger’s average speed is estimated to be double that of “light” rail. Superstructure costs are estimated at $ 1 million per mile, and even if this estimate were in error by a factor of 10, it would still be 5 times cheaper than typical elevated or monorail systems. Operating costs may be as little as 1/3 that of “light” rail. With costs so low, it will be possible to build complete service grids at 1 mile intervals (so that no one would have to walk more than ½ mile) at less cost than single-line systems only servicing a major axis.

Other details and summary, UL MTV:

- Lower cost than paved road, rail transit, or monorail
- Can be erected faster than any paved road, rail transit, or monorail
- Can move more people per hour than any paved road, rail transit, or monorail
- Requires 5% of the energy of an automobile to operate
- As an overhead system, it is not constrained by surface traffic congestion
- Cruises at 100 mph while operating safer than automobiles
- The system is quite shippable, and thereby can become an important international industry for early adopters.

# USING BIOFUELS AS ADDITIVES FOR CLEARNER FUELS FORMULATION

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The development of biofuels appers as a strategic stake for many countries in the world, at the cross-roads of three main issues:

- Reduce the environmental impact of transports, by contributing to the formulation of cleaner fuels.
- Recude the energetic dependancy,
- Give new outlest to agriculture faced with saturated food markets, and then help to maintain employment in rural areas. A lot of different raw materials, available throughout the world, can be used for biofuels production (table 7).

Among the different strategies which could be pursued, we would recommend to concentrate on the use of biofuels blended at low levels in fossil fuels:

- Mixing 5 to 7% of bioethanol (or 10 to 15% of ETBE) in unleaded gasoline should significantly reduce polluting emissions, greenhouse effect, and allow to meet the most advanced emission standards, without increasing the use of aromatic compounds. In order to add 2% oxygen to gasoline required in

RFG by the Clean Air Act, the fuel could either be blended with 12% ETBE or 5.7% ethanol. This solution means that there is no increase in the amount of aromatic compounds (benzene, toluene, xylene) in the petrols; these compounds, currently used up to 40% are sought after for their volatility and toxicity. The most dangerous, benzene, is presently limited to 5%.

- Mixing 5 to 10 % of rape methyl ester in gasoil would contribute to reduce soots, smoke, and to limit the greenhouse effect; a higher level of 30% of mix should be recommended for public fleets (bus, taxis, trucks) in polluted urban cities to get a more significant environmental improvement.

At there levels, there is no needs of engines modifications (or just slight adjustment of diesel engines for 30% mix of RME use) and no risk of supply shortage. The macro-economic benefits encourage most goverments to give an iniciative framework to these productions wich insure their competitivity. All the “links” of the channel growers, oil companies, car manufacturers should then cooperate to promote such a sustainable development.