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IEA
Advanced Motor Fuels

Annual Report 2008

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a) www.iea-amf.vtt.fi **b)** www.iea.org/impag

February 2009

To IEA

IEA Advanced Motor Fuels

Annual Report 2008

The IEA Committee for Research and Development (CERT) has recommended that an Annual Report shall be submitted by each of the IEA Agreements on Research, Development and Demonstration Co-operation.

This document contains the Annual Report 2008 of the Executive Committee of the IEA Advanced Motor Fuels Agreement.

The contributions from the Operating Agents to this report are gratefully acknowledged.

On behalf of the Executive Committee

Steve Goguen
Chairman

Claës Pilo
Secretary

Preface

Oil prices and supply saw unprecedented volatility in 2008. Oil soared from a monthly average of $84 per barrel in January to approximately $126 in June and July, with a peak of $147; only to fall to approximately $33 by December as the world economy experienced a downturn. Such volatility emphasizes the large coupling between oil prices and the world economy. Disregarding the economic downturn toward the end of 2008, the worldwide appetite for oil is expected to increase in the future as developing nations strive to improve their economic conditions. As demand for oil and other energy sources continues to increase more rapidly than new supplies are found, it is increasingly important for all nations to establish sensible long-term energy policies for the coming decades.

Along with the expected increase in worldwide energy usage, increasing emphasis is being placed on controlling Greenhouse Gases emissions (GHG's), addressing global warming. Increasing worldwide demand for energy and oil is prompting many nations to take aggressive action to promote alternative fuels and energy efficiency. In the U.S., a groundbreaking initiative was promoted to dramatically decrease the U.S. demand for gasoline and lower the overall energy footprint of the U.S. The law, known as the Energy Independence and Security Act (EISA), was passed by Congress and signed by the President in December 2007, requires the use of 36 billion gallons of renewable fuel by 2022, including 21 billion gallons from advanced bio-fuels such as cellulosic ethanol. The act also requires a lifecycle analysis of the global warming impact of any new technology as described below.

LIFECYCLE GREENHOUSE GAS EMISSIONS. The term 'lifecycle greenhouse gas emissions' means the aggregate quantity of greenhouse gas emissions (including direct emissions and significant indirect emissions such as significant emissions from land use changes), as determined by the Administrator, related to the full fuel lifecycle, including all stages of fuel and feedstock production and distribution, from feedstock generation or extraction through the distribution and delivery and use of the finished fuel to the ultimate consumer, where the mass values for all greenhouse gases are adjusted to account for their relative global warming potential.

For Europe, the policy in effect continues to be EU Directive 2003/30/EC, which promotes the use of bio-fuels and other renewable fuels. Additionally, GHG's have also received significant attention in the European Union and several amendments were proposed to EU Directive 2003/30/EC in September 2008 related to GHG's. The most notable proposals were:

- 10 % target for renewable fuel in road transport fuel by 2020
- 40 % must be met by non-food second-generation bio-fuels,
- 2015 onwards, the greenhouse gas emission saving must be at least 60 %
- Interim 5 % renewable fuels target by 2015 and at least 1% from second-generation bio-fuels

Given this backdrop of world events, the IEA-AMF finds itself well positioned to carry out meaningful and timely research, which may help frame the platforms for future generations of

alternative and advanced fuels. The year 2008 was the fourth year of the current strategic plan. AMF has defined three Strategic Objectives:

To gather, evaluate and disseminate information on advanced motor fuels and to act as a clearing-house on related information. To provide an easy-access platform for interested parties to join AMF as members.

To create, maintain and make use of networks among partners involved in research, development, demonstration and deployment related to advanced motor fuels.

To facilitate large-scale market deployment of advanced motor fuels by removing technical, economical and political barriers.

To meet these objectives, the AMF undertakes an active portfolio of Annexes, which are distributed to the member countries, then presented at the ExCo meetings. Two meetings of the Executive Committee were held in 2008. The first was ExCo 35 in Vienna, Austria in May. This ExCo was held in conjunction with a day-long conference "Transport Fuels: Crucial Factor and Driver towards Sustainable Mobility," sponsored by the Austrian Federal Ministry for Transport, Innovation, and Technology. In addition, this ExCo meeting included field trips to two facilities. A tour of the engine and vehicle test labs, and biofuels production facilities at the Vienna University of Technology was provided. A second field trip was to the Bruck-Leitha biogas plant, near the Austrian-Hungarian-Slovakian border. A prototype containerized biofuel production facility, produced in collaboration with TU Vienna and Axion was being tested. As a part of the business meeting, the status of the six current annexes was presented and several new annexes were proposed or discussed.

The second meeting was ExCo 36, which was held in Osaka, Japan, in December. A field trip to Kyoto included visits to the Research Institute of Innovative Technology for the Earth (RITE), in which one of their projects is to produce ethanol from cellulose, and then a visit to a bio-diesel refinery. The main items on the agenda were the Strategic Plan and the End-of-Term Report. Presentations on the six current annexes were made, and six proposed annexes were presented and discussed. The business meeting discussions also addressed revisions to the text of the AMF Implementing Agreement, and increased cooperation with other IEA Implementing Agreements, especially Biomass, Hydrogen, and Hybrid and Electric Vehicles. During the year, three countries (Austria, China, and Thailand) joined the AMF. Two other countries (Australia and New Zealand) were represented at ExCo 36.

The chairman wishes to thank all of the participants for their efforts throughout 2008. Dr. Nils-Olof Nylund and Mr. Kazunori Nagai are due thanks for their able assistance as vice-chairmen. Thanks are due also to Dr. Claës Pilo for his diligent work as secretary for the committee.

Steve Goguen
Chairman of the Executive Committee
Implementing Agreement on Advanced Motor Fuels

1. International Situation – National Reports

1.1 Country Report Austria

(Prepared by A3PS)

Transport fuels are a crucial factor in achieving increasingly ambitious climate policy goals and a sustainable mobility system. Alternative propulsion systems need new or modified fuels, tuned to their specific requirements, and offer opportunities for reducing pollutants, greenhouse gases and noise.

The Austrian Ministry for Transport, Innovation and Technology (BMVIT) therefore actively supports research, development and deployment of alternative fuels under its A3 (Austrian Advanced Automotive Technology) Programme since 2002, and now in the new A3plus Programme.

In 2007 in Austria a total of 8.62 million tons of liquid transport fuels were sold. 6.3 million tons (about 76 %) of them are diesel fuels. Against this background the Austrian government has a special interest in alternative fuels with lower emissions of Green House Gases (GHG) and other pollutants.

Compressed Natural gas - CNG

The Austrian government promotes natural gas as an alternative fuel. Currently there are more than 122 public natural gas filling stations in Austria. Therefore driving a natural gas vehicle (NGV) in Austria does not pose a problem. In the beginning of 2008 already more than 2 600 Natural Gas Vehicles were licensed in Austria. Measures for the further development of natural gas filling stations are planned in government policy. Beside the use of conventional fossil CNG Austria promotes the development and deployment of BIO-CNG.

Liquefied Petroleum Gas - LPG

The largest Austrian city bus fleet in Vienna is running over 500 LPG buses. LPG as a transport fuel offers benefits in terms of costs and emissions for the fleet operator, and offers environmental benefits for residents. In contrast to that, only a further 165 buses and a single self-propelled unit using LPG as transport fuel are licensed in the rest of Austria, according to figures produced by Statistics Austria (2006). In strong contrast to other countries such as Italy or Australia, there are no LPG passenger cars licensed in Austria.

This explains the small number of LPG filling stations in Austria and close to the Austrian border (12 in 2007). Currently LPG is only interesting for fleet operators. Taking everything into account, one can say that the low fuel costs and significant lower emissions are the main advantages of LPG fuel. The limited number of fuelling stations in Austria is a hurdle to be overcome for successful market introduction of LPG passenger cars.

Biofuels

In Austria there is a mandatory use of Biofuels in the transport sector since November 2004 (BGBl. 417/2004).

The legally binding directive calls for a substitution of 5.75% of fossil fuels used for transport purposes by 2010. Gasoline is therefore blended with bio ethanol and diesel blended with biodiesel. Austria is aiming to achieve this target already in October 2008.

Both Biodiesel and Bioethanol are available in higher blends (E85 and pure Biodiesel) as well, whereas the infrastructure for these fuels is limited at the moment. Currently ethanol and biodiesel face a period of high feedstock prices. These high prices result from a highly speculative feedstock market, combined with a bad wheat and corn harvest in 2007, the fast-growing market for energy crops, and rising demand for food and feed. High prices, combined with changing regulatory and fiscal framework conditions, can have a massive impact on the fuel market. To secure a successful introduction of alternative fuels, sound legal and fiscal framework conditions are of outmost importance. In 2008 feedstock prices again reached a level that makes Biofuels production interesting for fuel industry.

At the moment only first generation biodiesel and Bioethanol are available in remarkable amounts, whereas vegetable oil only plays a role in niche markets. Fleet operators of heavy-duty vehicles and trucks have a rising interest in vegetable oil. More and more of them adapt their fleets for the use of high vegetable oil blends due to the interesting cost structure and technology available to fulfill latest emission standards with this fuel.

Trends in Research and Development

Against the background of rising feedstock prices and an ongoing discussion on the social, environmental and financial impact of Biofuels, R&D is strongly focusing on the second generation Biofuels.

Beside Bioethanol from cellulose and Biomass to Liquid (BtL) diesel fuels are of special interest for Austrian stakeholders in the moment. Various Austrian companies and research institutions are active in that area [1].

Beside this a growing interest in Hydrotreated Vegetable Oil (HVO) as a renewable diesel fuel is visible from the Austrian oil and gas corporation OMV. A lot of expertise on the generation on BioCNG from the fermentation process to gas treatment processes is available in Austria and the first BioCNG filling station has opened in Austria in 2008. For the long term the production and storage of renewable hydrogen seems an interesting option for various companies as well. R&D focuses on the production from renewable sources and storage technologies.

Conclusion

Austria has a mandatory use of Biofuels since several years. Currently the Austrian government pays attention on the development and deployment of alternative fuels in Austria. The expansion of the fueling infrastructure for CNG/BioCNG fuel is visible at the moment. Also the deployment of E85 fuel used in Flex Fuel Cars (FFC) is currently on the way. Incentives are available for vehicles propelled with alternative propulsions systems and fuels as well but strongly differing from region to region in Austria.

For fleet operators vegetable oil (and high blends of it) due to its attractive cost structure has become an interesting alternative to diesel fuel in Austria.

LPG only is interesting for fleet operators especially buses at the moment.

R&D in Austria is focusing on second generation Biofuels to overcome the current discussion on environmental, social and financial impacts of Biofuels. Renewable Hydrogen seems an interesting option as an energy carrier for the long term.

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1) Austrian Technological Expertise in Transport - volume 2 - focusing on transport fuels - May 2008; Austrian Federal Ministry for Transport, Innovation and Technology

1.2 Country Report Canada

(Prepared by CanmetENERGY)

The Government of Canada's comprehensive strategy for renewable fuels includes provisions to increase the retail availability of renewable fuels through regulations that will require 5% renewable content based on the gasoline pool by 2010 and 2% renewable content in diesel and heating oil by 2012, upon successful demonstration of renewable diesel fuel use under the range of Canadian conditions. These new regulations will require enough renewable fuel to reduce greenhouse gas (GHG) emissions by about 4 megatonnes per year, the GHG equivalent of taking almost one million vehicles from the road.

Canada's largest study to date into cold weather performance of renewable diesel, the Alberta Renewable Diesel Demonstration (ARDD) was launched. This demonstration project investigates the viability of renewable diesel (2% content in winter and 5% in summer) through typical on-road use by trucking companies under extreme conditions (-40°C to +30°C). In conjunction with the ARDD, the Renewable Diesel Characteristics Study (RDCS) was performed. The RDCS focused on characterization of chemical and cold temperature properties of fatty acid methyl ester and hydrotreated renewable diesel fuels and blends. Additional information can be found at: http://www.renewablediesel.ca/

Canada and the U.S. reached an informal agreement to coordinate research in the area of advanced fuels and engine technologies. A Roadmap Workshop on "Nonpetroleum-based Fuels and Advanced Combustion Research" was held in Canada, in November 2007, with representatives from both countries. Researchers and program managers representing industry, academia, and government from both countries are working closely to establish research priorities related to the use of transportation fuels, including those derived from oil sands sources, in advanced technology engines. The workshop built on the success of the first such workshop held in 2005.

The following major advanced motor fuel related research activities took place in Canada during the time period:

Aftertreatment Systems: Advanced catalytic materials for diesel engine exhaust aftertreatment. Development of catalysts tailored to H_2+CO and NH_3 reductants for best active metal/support combinations for low temperature NOx reduction. An ammonia SCR catalyst showed highly promising results with high NOx conversion to N_2 instead of N_2O over a wide temperature range.

Sensors: Development of a novel particle matter sensor for diesel engines. Engine dynamometer testing of the device was carried out at two major automotive Original Equipment Manufacturers (OEMs). Also, development of an innovative combustion stability (COV) sensor with the ability to monitor engine behaviour and detect misfires for several engine types. A multicylinder version of the sensor went through successful evaluation by a major automotive OEM.

Emissions: On- and non-road light and heavy-duty engines and vehicles; evaluation of real world duty cycles and emissions. Detailed chemistry analysis on emissions from modern diesel engines and emission control systems using advanced diesel fuels, such as oil sand derived ultra-low sulphur diesel and biodiesel. Data used to revise regulations and test procedures to optimize regulatory testing.

Characterization: Laser-induced incandescence (LII) detection and characterization as well as numerical simulation of nanoscale particles in environments ranging from engine combustion chambers to ambient air. A high sensitivity version of the LII instrument was developed and successfully demonstrated.

Advanced ICE Technologies: Research focused on Homogeneous Charge Compression Ignition (HCCI) engine, and reforming of associated fuels. HCCI emission characteristics and analysis capabilities developed. Emission reductions through fuel enrichment investigated.

Health/environment: Investigation into the impacts of air pollution control technologies on the toxicity of automotive emissions by conducting *in-vitro* and *in-vivo* bioassays, as well as animal inhalation exposures to support risk assessment. System developed with ability to evaluate the relative benefits of advanced technologies with respect to types of emissions produced, as well as the relative potency of the emissions. Also, the human health risks of biodiesel and health risk/benefit analysis of various biodiesel fuels and their tail-pipe emissions were studied. A data gap analysis assessment report on the risk/benefit of biodiesel blends was completed. Additionally, research into the formation of DNA adducts of biodiesel fuels was perused. The ability to identify high potency emissions, as part of the overall health risk assessment was developed. Finally, results from mammalian toxicity and ecotoxicity of biodiesel fuels research indicate a possible increase in toxicity with the aging of biodiesel.

1.3 Country Report China

(Prepared by CATARC)

To be faced with severe pressure of energy supply and environmental protection caused by automobile, Chinese government took active measures to encourage the study and popularization of alternative energy vehicles. Chinese government launched the Clean Vehicles Action in 1999, from then on LPG, CNG, ethanol, methanol, CTL, biodiesel have been developed in different levels. The following paragraphs are the detailed introduction of them.

CNG

CNG is the first alternative fuel used in China. CNG vehicle population in China rose rapidly, from not more than 10,000 in 1999 to 260,000 in 2007, and there are gas stations in 16 cities of China. And in the following 5-10 years, the population will continue to increase dramatically.

LPG

LPG has been the most comprehensive used fuel in the world until now, and so has it in China. LPG vehicle population raised from 39,000 in 1999 to 106,000 in 2006. In 2007 it decreased a little to 79,000 and there are gas stations in 12 cities of China.

Ethanol

In 2001 Chinese government formed an ethanol development plan, and began to popularize E10. Until now, E10 has been used in 11 provinces of China, and in 2007 1,600,000 tons ethanol were consumed in China. For the time being, the ethanol was made of corn, and this production will not rise according to the government plan. Meanwhile there are some research projects about the technology of cellulosic ethanol. If there is a breakthrough of this technology, ethanol production will improve.

Biodiesel

For the time being there are around 10 biodiesel companies in China, but they are only on a small scale, only 100,000 tons a year on total. And the Government has formulated B100 standard while B5 and B10 is being made in.

Methanol

Methanol is used in some provinces for demonstration period, but there exist different views about whether it is suitable for vehicular use. M85 Standard will be completed at the end of year and M15 Standard is being made in.

DME

The study of technology of DME large-scale production and issues of DME used on engine is in start level.

CTL

There are some small-scale production equipments in China. And a factory of Shenhua Group whose yearly capacity can reach 3,000,000 tons is near completion.

500 alternative fuel vehicles were in demonstration operation during the Olympic Games, which reaped great social benefits. And the Chinese Government is organizing several large-scale AFVs demonstration projects in multiple cities, and is also studying and formulating national technology policy and relevant finance and taxation policy to encourage the use of AFVs.

1.4 Country Report France

(Prepared by ADEME)

Historically all national supports have been deployed for facing principally with air pollution reduction and security of supply. Today if these targets remain, the climate mitigation is clearly become the strong driver of the measures decided by Public Authorities through **the recent process of the "Grenelle de l'environnement"** including consultation and discussion phases (2007-2008) and legislative phase with the elaboration of a specific project of Law, with a strong issue on renewable energy development and particularly on biofuel production with a strong reference:

- to energetic and environmental performance criteria (including soil and water resource impacts) and the deployment of a certification process at European level;
- to priority to the development of second (lignocellulosic) and third (algae) biofuel generation.

Globally about 1 Billion of euros should be mobilized up to 2012 for R&D actions including "Energy and engines for the future". In this respect ADEME has been credited with a special fund (400 Millions of euros for 4 year period) in order to support projects of demonstration in the field of New Technology for Energy (NTE): Renewable energy, Buildings, Biofuels, Intelligent Networks, CCS, Sustainable transport vehicle...will be eligible to this fund in 2009.

During the last years the support to Alternative Fuels has been enlarged to other products like LPG, CNG, Bio fuels (ethanol and VOME) through several ways.

- **fiscal** : Reduction or exemption of excise taxes on alternative fuels, completed by an income tax credit of 2000 euros for a new vehicle 2007 registration using even partially CNG, LPG or electricity (hybrid also) if tailpipe CO2 emissions are lower than 160g/km.This credit option is no longer applicable since the 1st January 2008. A new bonus/malus system has been created by the 2007 Law of finance for application from 1st January 2008 based on GHG emissions classes.
- **Information initiative** generally through multiple ADEME publications or development like the creation by 2005 of a label required to be exhibited on each new vehicle selling on the market (from A under 100 g/km up to F upper 200 g/km).
- **methodology** for a better assessment of Environmental performances of biofuel financed and driven by ADEME/IFP/Public Authorities
- **Research project financial support** : this is the third very active pillow of the French Policy towards Alternative Fuels with three principal instruments :
    - **ADEME** through historical programme like AGRICE created in the 80's to finance Biofuel projects or its new system for research, demonstration and innovation supports (about 50 millions of euros per year).
    - **"les pôles de compétitivité",** regional structure.
    - **ANR or National Research Agency: a public institution for the management of administrative issues created on January 01, 2007, and is a funding agency for research projects. The principal thematic for Alternative fuel is the "Sustainable Energy & Environment"** which includes: Program PAN-H - National Action Plan on Hydrogen and Fuel Cells, program BIOENERGIES 2008, Program VTT or Road Transport Vehicle.

1.5 Country Report Japan

(Prepared by NEDO and LEVO)

This is the overview of the trend of alternative fuels for vehicles, which are being developed and promoted in Japan.

Liquefied Petroleum Gas (LPG)

About 300,000 LPG vehicles such as light car (small size vehicle which is manufactured under the Japanese special standard), passenger car, small bus, and pickup truck, etc. are running on roads in Japan at present. LPG engines with an electronically controlled system, which enables a fine engine control, are being developed for reducing exhaust emissions. A multi-point-liquid injection system is also applied.

Natural Gas

As of the end of March 2008, 34,203 Compressed Natural Gas (CNG) vehicles were widely distributed. Of the total, 14,320 were passenger vehicles, light duty commercial vehicles, and light cars including forklift, 18,481 were freight trucks and garbage vehicles, and 1,402 were buses. Moreover, the CNG fuelling stations are located in 327 sites.

The National Traffic Safety and Environment Laboratory (NTSEL) is promoting R&D of a Liquefied Natural Gas (LNG) heavy-duty truck. Manufacturing the vehicle was completed in fiscal year 2006, and the road test with running mileage extended to about 20,000km was conducted in fiscal year 2007.

Hydrogen engine

Mazda Motor Corporation has developed the hydrogen engine vehicle called "RX-8 Hydrogen RE", which takes advantage of qualities of a Wankel engine that the combustion does not occur in the fuel supply area, and enables less abnormal combustion and low thermal load of hydrogen injector. It covered about 4,500 km in the event “Fuel Cell & Hydrogen Car Caravan Touring across Japan” from September to October 2008, and its practicality was shown.

Biofuels

There are concerns that the import dependence of biomass feedstock to specific countries rises and that competition with the foods increases, though Japanese government is setting the future introduction target of biofuels.

In Okinawa, a production area of sugarcane, the five-year E3 demonstration experiment of which biomass feedstock is blackstrap molasses has been being conducted since 2005.

The petroleum industry started test-market of Bio-ETBE (Ethyl Tertiary Butyl Ether) blend gasoline in April 2007, in the demonstration project of the Ministry of Economy, Trade and Industry (METI), at the fifty fuelling stations in the metropolitan area.

However, there is concern over the security of grain supply, which is applied to bio-ethanol feedstock, in the situation of fairly low domestic food self-sufficiency.

Regarding biodiesel, the Ministry of Agriculture, Forestry and Fisheries (MAFF) started "Demonstration Model Project on Biofuels for Regional Use (Biodiesel Fuel Business)" by five-year plan in 2007. However in Japan, available feedstock for FAME (Fatty Acid Methyl Ester) is thought to be only waste cooking oil and rice for industrial use.

Di-methyl Ether (DME)

The first large-scale fuel grade DME plant in Japan, of which production scale is one hundred thousand tons per year and of which feedstock is methanol, has completed in Niigata prefecture in August, 2008. Industry, household, and vehicles are assumed as the end users.

The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) is conducting the demonstration test of five DME vehicles on the road in "The Project Promoting the Development of Next-Generation Environmentally Friendly Vehicles". The project has been continuing under the initiative of NTSEL and the running mileage of each test vehicle is accumulated successfully.

1.6 Country Report Spain

(Prepared by IDAE)

Alternative Vehicles and Fuel Stations

In the frame of the Action Plans 2005-2007 and 2008-2012 of the Spanish Energy Efficiency and Saving Strategy, IDAE is currently supporting in collaboration with Regional Governments, the acquisition of alternative vehicles (hybrid, electric, LPG, natural gas, hydrogen and fuel cell) and the implementation of charging points/fuel stations for each technology.

The financial support covers up to 15% of the market price of these vehicles and the 30% of the implementation costs of the charging points/fuel stations.

In this frame, there are established supporting lines for the acquisition of motorbikes, cars, and vans and also for trucks, buses and other fleet transport vehicles.

Current situation (October, 2008):

Alternative fuel	Current amount of Vehicles	Number of fuel stations
LPG	Amount of vehicles: 2.500 (market of 40-50 new cars per month).	TOTAL FUEL STATIONS: 35

(financial support to the acquisition and transformation) of industrial vehicles and cars/vans with a maximum CO2 emission of 170g/km)	There is some experience on urban buses fuelled by LPG (Valladolid).	
Natural Gas (financial support to the acquisition of industrial vehicles and cars/vans with a maximum CO2 emission of 170g/km)	1.536 vehicles of the following models: Fiat Multipla MY 1.6 16v Dynamic 68 CV Metano BiPower Opel Combo 1.6 16V 97cv Opel Zafira 1.6 16V 94cv Volkswagen CADDY 5/7 PLAZAS 2.0 Volkswagen TOURAN 2.0 (2/3 of the actual fleet are urban buses and waste lorries).	TOTAL FUEL STATIONS: 35 (practically all the fuel stations on NG are located in fleet sites).
Hybrid	Honda Civic Hybrid: 1.100 units (from 2003 to 2008) Toyota Prius: 5.700 units at the end of 2008. Lexus: 3.500 units aprox. " "	___
Electric (financial support to the acquisition of : Motorbikes >10Kw M1, N1 and L7e (heavy cuadricycles) vehicles and Industrial vehicles	Bus: 20 Buses Gulliver for EMT Madrid Motorbike (Vectrix): around 200 units Cuadricicles (Reva, Mega, Microcar): numbers not available	(1 EMT Madrid in Carabanchel -6 hr charging for 10 hr range)
Hydrogen/Fuel Cell (financial support to the acquisition of cars, vans and industrial vehicles)	Not commercialized today. Pilot (fuel cell) vehicles in different places: Andalucía (Hércules Project- Santana Vehicle) Albacete: 1 cuadricicle and 1 tricicle 3 Buses Gulliver modified in Zaragoza (Expo zone)	TOTAL FUEL STATIONS: 4 2 (CUTE project). Currenly not in operation. 1 Zaragoza (operating until 2016, in the Expo zone) 1 Albacete (Ajusa; will operate since 2009) 1 Andalucía (Hércules Project)

Biofuels

Biofuels currently in Spain are supported with a zero tax rate on hydrocarbon fuels.

In the frame of the Spanish Renewable Energy Plan 2005-2010, IDAE is supporting the following measures:

- The development of technologies for the collection, conditioning, transport and storage of raw materials.
- The development of biofuel production techniques based on lignocellulose products and/or seeds, and also using animal fats.
- Bioethanol: selection of plant varieties that optimise the starch-protein ratio, and the search for and selection of species producing sugar or lignocellulose that is suitable for the production of bioethanol as a biofuel.
- Biodiesel: search for and selection of oil-producing species better suited to the conditions under which Spanish agriculture operates and allowing high quality production at low cost.

The Spanish government has just approved a new regulation on compulsory mixes of biofuels (biodiesel and bioethanol) with diesel and petrol fuels. This regulation (Order ITC 2877/2008 of 9th October) establishes individual minimum compulsory aim of 3,9% for bioethanol and biodiesel and 5,83% for the whole amount of the two biofuels in 2010.

Fuel	Vehicles	Fuel stations
Bioethanol	2006: capacity of production in Spain: 420.000t (European´s largest producer) and 1,57% of the whole gasoline market share in Spain VEHICLES: Current models in commercialization: Ford: Focus FFV and Focus C-max FFV Saab: 9-3 BioPower y 9-5 BioPower Volvo: V50 F, S40 F and C30 F Renault: Megane Peugeot: 307 Bioflex Citroën: C4 Bioflex There is an Bioethanol experience on urban buses in Madrid City.	TOTAL FUEL STATIONS: 9 PUBLIC STATIONS: 5 (2 Álava, Guipúzcoa, 1 Madrid, 1 Valencia) PRIVATE STATIONS: 4 (3 Madrid, 1 Murcia)
Biodiesel	124.577t of biodiésel were produced in Spain in 2006 (8th European producer) Acciona and Repsol YPF agreed to make new biodiesel capacity plants for 1Mt ni 2009	TOTAL FUEL STATIONS: 364

1.7 Country Report United States

(Prepared by DOE)

Compressed Natural Gas - CNG

CNG (methane) is one of the more common alternative fuels used in the United States. Additionally, the United States Government actively promotes the use of natural gas in appropriate niche applications such as urban mass transit. Roughly 20% of the transit bus fleet is currently CNG powered, and the percentage is expected to increase since cost differential has been dramatically reduced in the past few years. However, the light-duty sector has not responded with as much enthusiasm to the use of CNG in passenger vehicles. The number of models available for sale from Original Equipment Manufacturers (OEMs) has dropped from 16 in 2003 to just 1 in 2008. Currently, the only CNG vehicle for sale in the United States through an OEM is the Honda Civic GX. Even with the lack of available OEM vehicles, there were approximately 775 fueling stations available in the United States in 2008 and approximately 116,000 CNG vehicles in service as recently as 2006. Additionally, a number of individuals have purchased or leased smaller non-commercial pumps that allow them to fill their CNG tanks at home using the low pressure natural gas infrastructure designed for residential uses such as home heating.

Liquefied Natural Gas – LNG

While LNG does increase the volumetric energy density of methane compared to CNG, it is not commonly used or available in the United States for transportation use. There were only 37 fueling stations in the United States in 2008 and less than 3 thousand vehicles in use. Furthermore, most of the LNG fueling stations aren't publically accessible and 27 were concentrated in the State of California. The US considers LNG to be exclusively a fuel for fleets due to safety and complexity related

to dispensing and using cryogenic liquid fuel. The United States Government does not have any active R&D programs studying LNG as a replacement for petroleum fuels.

Liquefied Petroleum Gas – LPG

LPG (propane) has the largest refueling infrastructure of the alternative fuels in the United States with 2,113 fueling stations in 2008, and is one of the more common alternative fuels in use. While there is only one light-duty vehicle offered by the OEMs, a number of companies provide certified conversions for dedicated or bi-fuel use and there were an estimated 165,000 vehicles in use as of 2006. LPG is most commonly used in off-road and non-transportation applications such as hi-lo lift trucks and agricultural equipment. Due to the maturity of the market, the government does not have active R&D programs with LPG.

Hydrogen

The United States government has a large research program studying hydrogen for transportation. The work is primarily being done in the Department of Energy's Hydrogen Fuel Cell and Infrastructure Technologies Program. Hydrogen as a direct replacement for gasoline in internal combustion engines has received less attention and far less funding than fuel cell usage, but there are active research programs in both areas. Hydrogen refueling stations are rare, with only 58 in the United States. Seventeen states have at least one hydrogen refueling facility (although most are not publically accessible), with California having the most with 28 stations. At present, hydrogen is still considered a fuel of the future to a greater extent than other alternative fuels.

Biofuels

The United States government has many active research programs studying various biofuels and is aggressively pursuing ethanol as a replacement for gasoline.

Ethanol

Ethanol is the most common alternative fuel in the United States by a large margin. Ethanol use in the United States continues to increase as have the number of available Flex-Fuel Vehicles (FFVs) which may operate on gasoline / ethanol blends up to 85% ethanol (E85). There are approximately 7.3 million FFVs in the current United States light-duty fleet, although the number using E85 is significantly smaller. Chrysler, Ford, and General Motors each offered several FFV models in 2008. In total, there were 31 different E85 FFV models for sale in 2008 compared to 22 models in 2003 and just 2 models in 1998. Additionally, there were almost 1900 E85 fueling stations in 2008 compared to less than 200 stations in 2003. Due to the increasing availability and use of E85, the government commenced with nationwide E85 quality surveys in 2008. Also, because fuel consumption increases with ethanol compared to gasoline, the government has an active research and development

program aimed at increasing engine efficiency when operating on ethanol. Funded research projects mainly exploit ethanol's octane, which is higher than that of gasoline, to improve engine thermal efficiency.

While E85 use is rapidly increasing, the vast majority (>99%) of ethanol sold in the United States is in the form of gasoline blends containing up to 10% ethanol (E10). E10 is legal for sale and use in all regions of the United States as a direct replacement for gasoline. The use of gasoline blended with 10% ethanol has

increased from less than 3 billion gallons in 2003 to approximately 9 billion gallons in 2008. Due to laws enacted in 2007 requiring the use of 36 billion gallons of renewable fuels by 2022, additional research is being conducted on ethanol by the government and private industry. One major research program is to determine the impacts of increasing the legal blend limit for non-FFVs from 10% to something higher, such as 15% or 20%. The ongoing program is focusing on issues including, but not limited to emissions, durability, unintended health effects, and infrastructure.

Biodiesel

Biodiesel use in the United States has increased from approximately 20 million gallons per year in 2003 to 260 million gallons of pure biodiesel in 2006. Blends of up to 20% biodiesel (B20) are currently legal for sale in all regions of the United States and 687 dedicated B20 fueling stations were available throughout the United States in 2008. Blends containing up to 5% biodiesel can be marketed as regular diesel fuel instead of biodiesel and may use the existing infrastructure.

Other Fuels

A workshop was held in Washington, DC in December 2008 to develop a roadmap for a research path studying algal oils for renewable fuels. Several hundred worldwide experts were invited to participate in topics ranging from cultivation to end-use deployment. One purpose of the workshop was to help guide government funding into high value areas. The government also has several research programs studying Biomass to Liquids (BtL). Methanol is currently not under study by the government as a direct replacement for gasoline, but there are still research programs studying it for use in fuel cells. Worth mentioning but not widespread is hydro-treated waste fats for fuel use. While such fuels are eligible for tax credits and are being studied by several private companies, they are not currently being studied by the government. Di-methyl Ether (DME) is another notable fuel not being currently studied by the government as a replacement for gasoline.

Trends in Research and Development

With the passage of the Energy Independence and Security Act (EISA) in December 2007, the United States has dramatically increased its renewable fuel targets. While EISA does not specifically call for ethanol to be the major renewable fuel to meet a 36 billion gallon per year mandate by 2022, it is being pursued as the most likely choice. EISA also limits the renewable credits available for corn ethanol. This has raised the bar for research into advanced biofuels such as cellulosic ethanol and algal-derived fuel and the US Government has substantially increased funding in those areas in recent years. Biodiesel use is also mandated by EISA, but biodiesel production capacity in the United States is significantly lower than ethanol capacity and diesel is not expected to significantly replace gasoline as a transportation fuel for passenger vehicles. Diesel is expected to remain the fuel of choice for over the road freight transport, and research into the effects of increasing biodiesel levels in the heavy industry fleet is ongoing. Another recent trend is research into the various steps of biofuel production ranging from feedstock cultivation through end usage is becoming increasingly integrated. Various non-process oriented impacts are also becoming increasingly critical to strategic decisions, such as land usage changes and lifetime greenhouse gas production.

Conclusion

The United States has significantly expanded its mandate for renewable fuel use, and is exploring several strategies to meet its aggressive targets. Expansion of the E85

market is being aggressively pursued in two main areas. Infrastructure expansion and research into potential efficiency improvements aimed to lessen the fuel economy penalty of ethanol are underway. Additionally, increasing the percentage of ethanol blended into gasoline above 10% is being examined by the government. Along with efforts to expand ethanol usage, significant efforts are being made to derive ethanol from cellulosic sources. Hydrogen is still being pursued as a transportation fuel, but is considered a longer-term solution to petroleum dependency and will be primarily used in fuel cells rather than internal combustion engines.

2. How to Join the AMF Programme?

A number of IEA Member countries have found it efficient and cost effective to co-operate on research, demonstration and exchange of information regarding Advanced Motor Fuels (AMF) to develop new and improved technologies and facilitate their introduction into the market.

This collaboration programme takes the form of an ***Implementing Agreement*** under the legal guidance of the International Energy Agency (IEA). All countries concerned about energy and environment in the transport sector, whether or not they are members of the IEA, are welcome to join this international effort and share this experience.

We are facing a diversification of energies and vehicle technologies in the transport sector. Working together makes it easier to define the proper pathways for the future.

The participating governments designate a government organisation or a private entity (for example from industry) as their representative to the Programme.

The Advanced Motor Fuels collaboration programme was launched with 5 participating countries in 1984. Today 14 countries are actively involved in the programme and form a most interesting and efficient network. In 2002 Belgium closed all active participation but did not withdraw. So formally there are today 15 member countries.

In 2008 Austria, Thailand and the People's Republic of China joined the Advanced Motor Fuels collaboration programme. Today Australia and New Zealand participate as Observers.

The following countries and designated bodies are active since the year of their joining AMF:

Austria	2008	Austrian Agency for Alternative Propulsion Systems (A3PS)
Canada	1984	Department of Natural Resources Canada (NRCan)
China	2008	China Automotive Technology and Research Center (CATARC)
Denmark	2001	Technical University of Denmark (DTU)
Finland	1989	VTT Technical Research Centre of Finland (VTT)
France	2000	Agence de l´Environnement et de la Maîtrise de l´Énergie (ADEME)
Italy	1988	ENI S.p.A.
Japan	1988	New Energy and Industrial Technology Development Organization (NEDO)
	1998	Organization for the Promotion of Low-Emission Vehicles (LEVO)
Spain	2002	Institute for the Diversification and Saving of Energy (IDAE)
Sweden	1984	Swedish Energy Agency (STEM)
Switzerland	2004	University of Applied Sciences Bern (AFHB)
Thailand	2008	National Science and Technology Development Agency (NSTDA)
UK	1994	Department for Transport (DfT)
USA	1984	US Department of Energy (DOE)

Those interested to participate as Observers at the meetings of the AMF Executive Committee (see Para. 3.9) with the intention of joining the programme are welcome to contact the IEA/AMF Secretary Claës Pilo, SDAB Transport & Environment, Karlavägen 93, SE-115 22 Stockholm, Tel +46 8 15 11 90, E-mail pilo.sdab@swipnet.se

3. The Implementing Agreement and the AMF Programme

(Status February 2009)

The AMF Implementing Agreement expires 31st August 2009. A request for extension will need to be presented to the End Use Working Party (EUWP) and the Committee on Energy Research and Technology (CERT). The required documents are an "End-of-Term Report 2005-2009", a "Strategic Plan 2009-2013", and a Self-evaluation Report. In order to meet the deadline the final documents should be available by the end of 2008.

3.1 Strategic Plan, End-of-Term Report & Self-evaluation Report

A first strategic plan was prepared in 1995, a second "Strategic Plan for 1999-2004" in 1998, a third in 2004, and a fourth "Strategic Plan 2009-2013" together with an "End-of-Term Report 2005-2009" have been prepared during 2008 by Ralph McGill, US, in cooperation with an advisory group.

Since 2004, when the "Strategic Plan 2005-2009" was written, the world has changed, and even more change is foreseen in the next term. The new "Strategic Plan 2009-2013" has been framed in the context of world events, the changing scene with regard to energy supplies, transport fuels, local environmental conditions, and global challenges. The plan provides a synopsis of the framework in which the AMF must operate for the next five years and a look forward in terms of the evolution of sustainable new fuels that might be expected in the marketplace with the next several years.

CERT has introduced "Criteria for Implementing Agreement Extensions". In AMF's request for extension AMF has to use these criteria for a self-evaluation. During the last ExCo 36 meeting in Osaka AMF carried out such a complete self-evaluation.

3.2 Change of the name AMF

In 1984 the "Implementing Agreement for a Programme of Research, Development and Demonstration on ***Alcohol and Alcohol Blends as Motor Fuels (AMF)*** was signed in Paris. During the first period 1984-90 the Agreement focused on alcohols (such as methanol, ethanol, and higher alcohols) as well as on related oxygenated hydrocarbons (such as MTBE, and ETBE).

In 1990 it was broadened to address also other alternative motor fuels and was renamed "Implementing Agreement for a Programme of Research, Development and Demonstration on ***Alternative Motor Fuels (AMF)***.

Following the proposals in the "Strategic Plan for 1999-2004" the name was changed in October 1998 to "Implementing Agreement for a Programme on Research and Demonstration of ***Advanced Motor Fuels (AMF).*** This was done to make provisions to include reformulated hydrocarbon fuels in the scope of AMF.

3.3 Vision of AMF

According to the new "Strategic Plan 2009-2013" AMF has the following vision:

To contribute to sustainable solutions through our system view of the entire fuel chain from resource development to end-use. Our cooperative research in the field of transport fuels helps to facilitate the widespread use of sustainable fuels of high quality.

3.4 Mission of AMF

According to the new "Strategic Plan 2009-2013" AMF has the following mission:

AMF is one of the key players in the promotion of international collaboration in R&D, deployment and dissemination of clean, energy-efficient and sustainable fuels and related vehicle technology. It will continue to provide a fuel neutral platform for co-operative R&D, deployment and dissemination, make use of the multifaceted expertise of its partners and networks, and provide a respected clearing-house for information facilitating the wide spread deployment of technologies for sustainable transport. We foresee increased need for cooperation and collaboration with other transport-related Implementing Agreements, such as Bioenergy, HEV, and Combustion. Together with new AMF member countries we are able to address a more diverse set of challenges in technology and local conditions. We also work actively for energy conservation in transport.

3.5 Objectives

According to the new "Strategic Plan 2009-2013" AMF has the following objectives:

Objective 1 (Information, Dissemination and Membership): To gather, evaluate and disseminate information on advanced motor fuels and to act as a clearing-house on related information. Provide an easy-access platform for interested parties to become member of AMF.

O**bjective 2 (Cooperative R&D):** To create, maintain and make use of networks among partners involved in research, development, and demonstration related to advanced motor fuels.

Objective 3 (Markets and Deployment): To facilitate large-scale market deployment of advanced motor fuels by contributing to the removal of technical and economic barriers and by providing solid data to decision makers.

3.6 Definition of advanced motor fuels

Advanced motor fuels encompass alternative fuels as well as advanced, petroleum-based fuels, and the scope of the AMF Implementing Agreement includes all such fuels. Additionally, AMF has the license to work on the entire spectrum of fuels from feedstock, through fuel processing, distribution, and, finally, end use in vehicles. Directly and indirectly AMF is also promoting fuel efficiency of vehicles.
Fuels included under the definition of Advanced Motor Fuels are fuels that fulfill one or more of the following criteria:

- Low toxic emissions
- Improved life cycle efficiency
- Reduced greenhouse gas emissions
- Renewable energy sources
- Fuels for new propulsion systems
- Sustainability in transportation
- Security of supply

Advanced motor fuels studied in the framework of the AMF Programme are:

- Alcohols (ethanol, methanol), ethers (DME, ETBE, MTBE, etc), esters (RME, etc), gaseous fuels (natural gas, biogas, hydrogen, LPG, etc)
- Reformulated gasoline and diesel fuels, including oxygenated versions
- Synthetic fuels, such as Fischer-Tropsch fuels
- Fuels for new types of engines and fuel cells

3.7 Participating countries

14 countries participate actively in the IEA collaboration on advanced motor fuels. In 2002 Belgium closed all active participation but did not withdraw. So formally there are today 15 member countries.

Austria, Canada, China, Denmark, Finland, France, Italy, Japan, Spain, Sweden, Switzerland, Thailand, United Kingdom, and United States.

Each participating country has designated one Contracting Party to sign the Implementing Agreement (IA), except Japan that has designated two Contracting Parties (NEDO and LEVO). One Delegate and one Alternate represent each Contracting Party in the Executive Committee.

3.8 Cooperation with other Implementing Agreements

AMF has a history of working together with other Implementing Agreements, having already completed one annex that was jointly supported by AMF and HEV. One annex just under way has the objective of combining support from AMF, Bioenergy, HEV, and possibly others. Another annex is contemplated that would seek support from AMF, Combustion, and others.

AMF welcomes participation by other Implementing Agreements in AMF's ExCo meetings, and AMF delegates are encouraged to communicate with and, perhaps, join meetings of other IA's ExCo meetings. Recently representatives of the HEV and Bioenergy Agreements attended an AMF ExCo meeting.

Because of AMF's interest and capabilities in all phases of the fuel spectrum, we are well positioned to work with other Implementing Agreements as is illustrated in Figure 6 below.

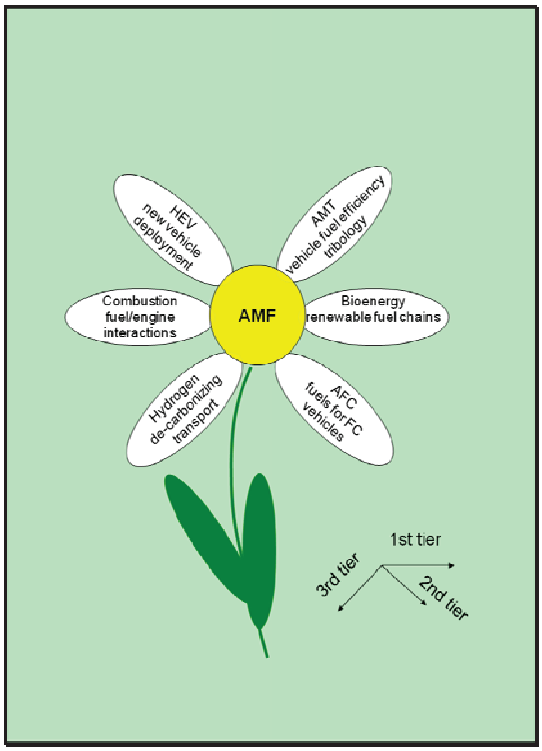

Figure 6 - AMF Has Central Role that Relates to Other IA's

AMF also reaches out to other countries for them to consider membership in AMF. These activities will continue into the future, and emphasis will be placed on the "Plus Five" countries of Brazil, China, India, Mexico, and South Africa (China has already joined AMF).

3.9 Executive Committee and Secretariat

The Executive Committee consists of the National Delegates and Alternates of Member Countries to the Agreement. The ExCo is the decision-making body of the Agreement. The ExCo can take decisions to invite Observers and Experts to the ExCo meetings. Representation of the IEA Secretariat at the ExCo meetings is desirable.

The ExCo meets every 6-12 months. It is an active and authoritative group representing independent organisations. Thus, it is possible to supply governments participating in this IA with the results of studies that are objective and not coloured by industrial or political interests.

The ExCo appoints a Chairman and an appropriate number of Vice Chairmen to give the AMF "Board of Directors" a geographically balanced constitution.

The ExCo appoints a Secretary to handle day-to-day administration. An annual Membership Fee is collected to cover the costs for the Secretariat and other activities decided upon by the ExCo. Such activities could be e.g. starting up new research activities using collective funds as seed money.

Normally a technical seminar is arranged in conjunction with the ExCo meeting. This gives, e.g., the hosting country an opportunity to present national R&D activities.

3.10 Projects/Annexes

Altogether, 29 collaborative projects (Annexes) have been completed since the programme started in 1984 (see Electronic Attachment No 1: Tables A-E). Six others are presently running (see Table 1 and 2). All reports prepared within the AMF Annexes are listed in Electronic Attachment No 2.

The following areas have been covered since the start of the programme:

	Annexes
• General information	I, II, IX, XXIV, XXVIII
• New fuels	VI, X, XIV, XVIII, XIX, XX, XXV, XXXIII, XXXIV, XXXV, XXXVII
• Emissions – particles	V, XII, XIII, XXII, XXV, XXXIII, XXXVI, XXXVII
• Test procedures	XVII, XXIX, XXXIII, XXXVI
• Health effects	XXX
• Environment	VII, XXXVII
• Standardization	XXVII, XXVIII
• Lubricants	XVI, XXXIII
• Non-road engines	XXV
• Life cycle analysis	XXXI, XXXIV, XXXVII
• Production	IV, XXXI
• Demonstration	II, III, VIII
• Implementation	XI, XV, XXI
• Operational experience	XXVI

3.11 Recent initiatives

During its last meetings ExCo 35 in May 2008 in Vienna, Austria, and ExCo 36 in December 2008 in Osaka, Japan, the Executive Committee took a number of initiatives.

ExCo 35 in Vienna, Austria

- **Austria was welcomed as new participating country** in the Advanced Motor Fuels programme.
- The ExCo decided to **start a new Annex** XXXVII "Fuel and Technology Alternatives for Buses" with VTT, Finland, as Operating Agent. The intention is to carry out the annex in cooperation between the three Implementing Agreements AMF, Bioenergy and HEV.
- The ExCo decided to **prepare 4 proposals for new annexes** on:
  - "Tomorrow's Diesel Fuels"
  - "Research of toxicity of combined aerosols (gaseous and particulate) from Diesel engines with bio- and alternative fuels"

  - "Algae as feedstock for biodiesel production"
  - "Renewable Fuels and Future Combustion Technology in Transport"
    and to follow up discussions with the IAs on Combustion and Biofuels
- The ExCo decided to **prepare a whitepaper** on ammonia.
- The ExCo decided to **prolong three annexes** until the end of 2008 without additional costs for the Participants (Annex XXXIII, Annex XXXIV, and Annex XXXV).
- A comprehensive **"AMF Outlook" report** "Status and outlook for biofuels, other alternative fuels and new vehicles" prepared within Annex XXVIII was presented by TEC, Finland.
- The Operating Agents presented **reports on**: Annexes XXXIV, XXXV, and XXXVI.
- Interesting analyses were presented on:
  - The **international development** in the EU Member States, China, Japan, and within IEA
  - The work within the **Bioenergy IA and HEV IA**
- The ExCo decided to adopt revisions to the **legal text of the AMF IA**.
- The ExCo approved AMF participation in the **International Motor Show** in Geneva in spring 2009.

ExCo 36 in Osaka, Japan

- **China and Thailand were welcomed as new participating countries** in the Advanced Motor Fuels programme.
- **Australia and New Zealand** participated as Observers.
- The **"Strategic Plan 2009-2013"** was adopted.
- The **"End-of-Term Report 2005-2009"** was adopted.
- The ExCo carried out a complete self-evaluation during the meeting and decided to **deliver its self-evaluation to EUWP and CERT.**
- The ExCo decided to **start a new Sub-task No 2 "Algae as a Feedstock for Biofuels** – An Assessment of the State of the Technology and Opportunities" under the umbrella Annex XXXIV– on condition that the Bioenergy IA has no objections.
- The ExCo decided to **continue Annex XXXVII as an AMF project** even if the Biofuels IA and the HEV IA will not participate.
- **Annex XXXV was prolonged** until the next ExCo meeting in May 2009 in Helsinki.
- **Annex XXXIII was prolonged** until the end of 2009 after e-mail vote.
- **Sub-task No 1 of Annex XXXIV was closed**.
- French, Japanese and Swiss proposals for new annexes are expected to be presented at the next ExCo meeting.
- The revised **AMF IA text was adopted**.
- **Interesting presentations** were given about Japan, New Zealand and the European Starbus project.
- The Operating Agents presented **reports on**: Annexes XXVIII, XXXIV, XXXV, XXXVI, and XXXVII.
- The ExCo approved that VTT Technical Research Centre of Finland becomes **Operating Agent** for Annex XXVIII after TEC TransEnergy Consulting Ltd, Finland, as of 2009-01-01.
- The ExCo approved the work carried out during 2008 within Annex XXVIII. **Four newsletters** were published in 2008 within Annex XXVIII "Information Service & AMF Website (AMFI)". All material is assembled in a special Newsletter database on the website. The AMFI website has been completely re-designed and re-structured.

- The ExCo approved the final report "**Outlook for Standardization** of Alternative Vehicle Fuels" prepared by Atrax, Sweden, within Annex XXVIII as Sub-task No 1.
- Nils-Olof Nylund as new Vice Chairman for Transport in the End-Use Working Party (EUWP) reported that he has the ambition to facilitate **cooperation between IAs** with transport related activities.
- The ExCo decided to send a **letter to the Government of Belgium** about participation.
- Nils-Olof Nylund, Finland, was elected as **Chairman** for two years.
- Jean-Francois Gagné, Canada, was elected as **Vice Chairman** for two years.
- Claës Pilo, Sweden, was re-elected as **Secretary** for two years.
- The **Membership Fee for 2009** was set to € 9 500.
- The ExCo decided how to use the **Common Fund** in 2009.
- **Next ExCo meeting** will be in Helsinki, Finland, 26-28 May 2009.

3.12 AMF Focus

AMF is committed to evaluating its performance on a regular basis. The main vehicle for the evaluation and for communicating progress toward fulfilling the AMF mission and objectives will be the Annual Report of the AMF. This will review the activity of the Agreement against the objectives set out in this Strategic Plan.

In its self-evaluation, AMF will be guided in part by the Action Plan adopted by the Committee on Energy Research and Technology (CERT) in 2006 and focused on the following:

- **Stronger focus on the role of policy** in developing cleaner, more efficient energy technologies, and in deploying them
- **More frequent, more effective communication** to policy makers
- **More fruitful liaison within the IEA family**
- **More vigorous outreach to non-IEA countries**

AMF has performed well in these goals in the past and will continue to emphasize these in every activity.

3.13 IEA/AMF on Internet

- As a part of the Information System, Annex XXVIII, the AMF website is updated regularly. For the Delegations, a password protected section including e.g. ExCo documentation is provided.

Updated information on IEA/AMF is found on:

www.iea-amf.vtt.fi and **www.iea.org/impag**

4. RUNNING PROJECTS/ANNEXES

(Status February 2009)

Table 1
Running Projects/Annexes

The following six projects/annexes are presently running.

Annex	Title	Run time	Operating Agent	Participating Countries
Annex XXVIII	Information Service & AMF Website (AMFI)	2004 - - - -	TEC (FI)	15
Annex XXXIII	Particle Emissions of 2-S Scooters	2004 – 2009	AFHB (CH)	6 + EU
Annex XXXIV Sub-task No 2	Algae as Feedstock for Biofuels	2009 – 2010	Sentech, Inc. (US)	Not yet determined
Annex XXXV Sub-task No 1	Ethanol as a Fuel for Road Transportation	2007 – 2009	DTU (DK)	15
Annex XXXVI	Measurement Technologies for Ethanol (METEV)	2008 – 2009	SRA (SE)	4
Annex XXXVII	Fuel and Technology Alternatives for Buses	2008 – 2010	VTT (FI)	6 + IA?

Table 2
Participating Countries and their Contributions

(Œ denotes the Operating Agent. Amounts are given in 1 000 €.)

	AT	CA	CH	CN	DK	ES	FI	FR	IT	JP	SE	TH	UK	US	Total
XXVIII	**X**	**X**	**X**	**X**	**X**	**X**	**Œ X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**25***
XXVIII Sub-task No 1	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**Œ X**	**X**	**X**	**X**	**20**
XXXIII		**0**	**Œ 20**		**0**		**0**	**0**	**0**						**20**
XXXIV Sub-task No 1		**15**					**15**		**15**	**15**				**Œ 15**	**75**
XXXV Sub-task No 1	**X**	**X**	**X**	**X**	**Œ 70**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**70**
XXXVI		**20**					**40**				**Œ 50**			**40**	**150**
XXXVII		**?**					**Œ 350**	**150**		**50**	**50**			**?**	**600 +?**
TOTAL															**960 +?**

* Annual budget 2008 and 2009

5. Progress Reports by the Operating Agents

(Status February 2009)

5.1 Annex XXVIII Information Service & AMF Website (AMFI)

Operating Agent	TEC TransEnergy Consulting Ltd, Finland
Decision to start	January 2004 (ExCo 29)
Project Duration	Continuous
Participants	All Contracting Parties (15 countries)
Total Budget	€ 20 000 in 2005, € 36 000 in 2006 (AMF Outlook extension), € 40 000 in 2007 (Standardisation extension by Atrax), € 25 000 in 2008 (extension of renewal of website) € 25 000 in 2009 Paid via the Common Fund
Project Leadership	Ms. Päivi Aakko-Saksa TEC TransEnergy Consulting Ltd Teknikantie 14 FIN – 02150 Espoo Phone: +358 40 505 57 50 Fax: +358 9 2517 2361 E-mail: paivi.aakko@teconsulting.fi

Background

AMF has been running an Information Service called IEA AMF/AFIS (Automotive Fuels Information Service) under two previous Annexes, Annex IX and Annex XXIV. Annex IX produced, among other things, five volumes of the "Automotive fuels survey" for AMF. In 2000-2004 Annex XXIV produced three yearly Newsletters on the subject of automotive fuels and related issues. Innas BV of Holland handled both Annexes. Since 1999, VTT Processes (Finland) has been maintaining a website for AMF.

In 2004 AFIS was replaced by a new information system, AMFI (Advanced Motor Fuels Information, Annex XXVIII). AMFI now combines an electronic Newsletter service and maintaining the AMF website.

Objectives

Sharing and providing information are very important elements in IEA cooperation. The new information system AMFI makes use of electronic communication. AMFI comprises the production of electronic Newsletters and the maintenance of the AMF website.

AMFI/Annex XXVIII is a low budget Annex, and all participants of the AMF Agreement share its costs. AMFI/Annex XXVIII provides an easy access platform for those parties interested to join the cooperation of the Advanced Motor Fuels Agreement.

Deliverables

AMFI provides four yearly electronic Newsletters describing recent developments in transportation fuels, vehicles, energy, and environmental issues in general. So far, 16 issues have been distributed, one in October 2004, four in 2005, three in 2006, four in 2007, and four in 2008. Each issue covers a list of fixed themes: Natural gas and LPG, ethanol, bioesters, synfuels and sunfuels, other advanced fuels (hydrogen, DME etc.). In addition, each issue is focused on one particular theme with a general section. E.g., the following focus themes were discussed in special articles:

- Policies on alternative fuels, biofuels, and energy efficiency
- Process technologies on alternative fuels, Coal to liquids, Biomass to liquids, Hydro treatment of oils and fats
- Plant oils as feedstock and their sustainability (jathropa, palm oil, algae)
- Development of emission regulations
- Engines and fuels go hand in hand into the future

All material presented in the Newsletters is assembled in a special Newsletter database on the website. The Newsletters can bee freely downloaded on the AMF website.

The AMF website serves both the general public interested in transportation fuel related issues and the Members of the Advanced Motor Fuels Implementing Agreement. For the Members, a special password protected area is provided. The website, originally built up in 1999, was renewed in 2008 to utilise today's possibilities of website technology.

A highly topical "Outlook Report" on projections for transportation energy, vehicle technology and advanced/alternative fuels was distributed as a restricted version to the Executive Committee in February 2007. A condensed version of the "AMF Outlook" report was prepared in co-operation with EU Bioenergy NoE, and this report is now publicly available. As of December 2008 this document had been downloaded from the AMF website over 50,000 times since it was made available online earlier in 2009.

Sub-task No 1 "Fuel Standards"

Björn Rehnlund, Atrax, has earlier presented proposals on "Co-operation with ISO and CEN on Standardization" and "International Standard for Fuel Ethanol". In October 2006 it was decided to include this work with modified content in the AMFI Annex XXVIII in the form of a Sub-task No 1 "Outlook on Standardization" prepared by Atrax and published on the AMFI website. Thus, all the member countries will be involved. Atrax will under the AMFI Annex XXVIII carry out the work and prepare the reports. A sum of € 20 000 has been allocated from the Common Fund to include Atrax's work on "Outlook on Standardization" in Annex XXVIII during 2007 (ExCo 32, Decision #8) and 2008 (ExCo 34 Decision XX). A draft

report was sent out for comments at ExCo 34 and the final report was distributed in October 2008.

5.2 Annex XXXIII Particle Emissions of 2-S Scooters

(Reduction technology and Inputs for Legislation)

Operating Agent	Univ. of Applied Sciences Bern (AFHB) Lab. for Exhaust Emissions Control Switzerland
Assistant	Prof. Jesper Schramm, DTU, Denmark
Decision to start	October 2004 (ExCo 30)
Project Duration	July 2004 –December 2009 (5,5 years)
Participants	CA, CH, DK, FI, FR, IT, and JRC EU Laboratories (6 countries + EU)
Total Budget	No AMF budget. Task-sharing. Total cost € 20 000.
Project Leadership	Prof. Jan Czerwinski Univ. of Applied Sciences Bern (AFHB) Lab. for Exhaust Emissions Control Gwerdtstrasse 5 CH-2560 Nidau Switzerland Phone: +41 32 321 66 80 Fax: +41 32 321 66 81 E-mail: jan.czerwinski@hti.bfh.ch

Background

The serious health effects of particle emissions from traffic are known from the discussions about diesel engines technology and legislation. In this context the particle emissions of small 2-S engines with lost oil lubrication cannot be neglected any more.

A particular concern is about the 2-S scooters, small motorcycles and 2-S 3-wheelers which in several countries are used very much in congested city centers.

Objectives

According to the participation of different partners there are following objectives of the activities:

- basic research of the 2-S aerosols, their composition with different lube oils and fuels and with different engine technology
- study of sampling and measuring procedures for particle mass and particle size distribution
- research of improvements of exhaust gas after-treatment systems
- toxicity and new methods of health effects research
- new inputs for industrial partners concerning their products
- new inputs for the legal authorities
- including of new partners, who actively work in this field and creation of further collaboration and/or information exchange.

Content of Work

- Technical topics of the Swiss working network:
  - emission factors of 2-S scooters with consideration of particle mass and counts
  - catalyst ageing
  - research of sampling for particle analysis
  - research of influences of different oils and fuels on the particle emissions
  - research of emissions, of catalyst ageing and VOC-analytics at the EMPA Federal Laboratories
- Analytical works at the JRC EU Laboratories, Ispra (PAH, TEQ)
- Preparations of the joint activities with the French toxicity network
- Preparations of activities with Asian countries and authorities
- Requests for participation and/or information by other interested parties under leadership of Prof. J. Schramm, DTU

Financial Status

The framework of Annex XXXIII is at task-sharing basis, i.e. each partner has own sources of financing his work.

For the activities of the Swiss Operating Agent a budget of € 20 000 is available.

Time Schedule

- Meeting Zurich, Jan. 12, 2005
- 1st technical report from the Swiss Network (June 2005)
- Meeting Zurich, June 15, 2005
- 1st information report for Annex XXXIII (Oct. 2005)
- 2nd technical report from the Swiss Network (Dec. 2005)
- Meeting Zurich, February 15th, 2006
- 2nd information report for Annex XXXIII (Nov./Dec. 2006)
- 3rd technical report from the Swiss Network (Dec. 2006)

- Meeting Zurich, February 14th, 2007
- 3rd information report for Annex XXXIII (Nov./Dec. 2007)
- AFHB annual technical report "2-wheelers" for Swiss EPA (BAFU) (Dec. 2007)
- Meeting Zurich, Mai 23rd, 2008 (Toxicity)

Results and Reports

The results will be presented in the technical reports, which will be officially available after approval by the industrial partners.

Other working groups of the network will be encouraged to give appropriate information about their activities. The summaries of this information will be given in the information reports for Annex XXXIII.

In the 1st information report (B169) the activities and results of following institutes were shortly presented:

- AFHB, Automotive Division Biel, CH of the University of Applied Sciences Bern, CH
- EMPA Federal Laboratories, CH
- ENEA & Municipality of Rome, IT
- RICARDO Consulting Engineers, UK
- Technical University Graz, A
- EU Joint Research Center, Ispra, I
- Technical University of Denmark

In the 2nd information report (B189) the activities and results of following institutes were presented:

- AFHB, Automotive Division Biel, CH of the University of Applied Sciences Bern, CH
- EMPA Federal Laboratories, CH
- ENEA & Municipality of Rome, IT
- Technical University Graz, AT
- EMITEC, DE
- ADEME, FR
- Other activities from literature

In the 3rd information report (B209) the activities and results of following institutes were presented:

- AFHB, Automotive Division Biel, CH of the University of Applied Sciences Bern, CH
- EMPA Federal Laboratories, CH
- ENEA & Municipality of Rome, IT
- Technical University Graz, AT
- GEO_2 particle filtration
- AECC & ICCT
- Other activities from literature and internet

In the last report some additional information about 4-stroke 2- and 3-wheelers was presented.

The most important conclusions are:

- The importance of 2-S 2-wheelers emissions and their contribution to the air pollution in the cities is recognized and investigated in several countries.
- The primary source of particle emissions is lubricating oil, which consumption has to be minimized.
- Several improvements of particle emissions can be achieved by right choice of oil quality, by increasing the catalytic post oxidation, by using more efficient particle trap systems and eventually using of alternative fuels.
- Very sophisticated technical solutions, like hybrid scooter, or H_2-mobike are possible, but difficult from the point of view of costs.
- There is an interest of the EU-authority to further lower the emission levels and the toxic effects of 2-S 2-wheelers. Nevertheless the legal limits for particle mass, or counts are still not taken into consideration, for this sensible market sector.

Future Plans

- Adaptation of the results to the engine/vehicle technology from other markets
- Further studies of health effects and toxicology
- Support by legal authorities

5.3 Annex XXXIV Biomass Derived Diesel Fuels

5.3.1 Sub-task No 1 Analysis of Biodiesel Options

Operating Agent	Fuels, Engines, & Emissions Consulting (FEEC), USA
Assistants	Dr. Nils-Olof Nylund and Ms. Päivi Aakko-Saksa, TEC TransEnergy Consulting Ltd, Finland
Decision to start	October 2006 (ExCo 32)
Project Duration	November 2006 – December 2008 (2 years)
Participants	CA, FI, IT, JP, and US (5 countries)
Total Budget	5 x 15 000 = € 75 000
Project Leadership	Dr. Ralph McGill Fuels, Engines, & Emissions Consulting (FEEC) 305 Sugarwood Drive Farragut, TN 37934 USA Phone: +1 865-966-3512 Mobile: +1 865-207-9137 Fax: +1 865-675-2866 E-mail: rnmcgill@chartertn.net

During ExCo 33 in Detroit it was decided to use Annex XXXIV as an umbrella for various Sub-tasks with Ralph McGill as Annex coordinator (ExCo 33, Decision #7). It was also decided that all Member Countries participate in Annex XXXIV without committing any funds (ExCo 33, Decision #8). Finally, it was decided to reclassify an existing Annex in this subject as Sub-task No. 1 "Analysis of Biodiesel Options" under the umbrella Annex XXXIV with Ralph McGill as Operating Agent (ExCo 33, Decision #9).

Background

Use of fatty acid methyl esters (FAME) as a substitute diesel fuel is on the rise around the world. Volumes of biodiesel use and production are growing very rapidly. In the US, for example, the volume of biodiesel used in transportation has grown by a factor of 6 to 7 times in only four years. While no national requirement for biodiesel content in diesel fuel is yet in place in the US, national tax incentives now promote the use of biodiesel, and individual states are beginning to enact requirements for biodiesel content in diesel fuel.

In Europe the situation is similar, with growing amounts of biodiesel being used in transportation. Additionally, the European Commission has adopted goals of a 2% minimum level of biofuels as a proportion of all fuels by 2005 and reaching 5,75% of all fuels by 2010.

Such a rosy outlook for biofuels is not without technical hurdles, though. Methyl esters face some serious technical barriers that either require special measures to accommodate the fuels or limit their practical use in some climates at some blend levels. Among these barriers are poor oxidative stability, incompatibility with some elastomers, low-temperature flow properties, and higher NOx emissions.

If we are to achieve greater impact of bio-derived fuels, we must utilize all varieties of feedstocks and produce a broader slate of fuel choices, ranging from gasoline replacements to diesel replacements. Therefore, the world's attention is turning to concepts of more diverse manufacturing processes, and the notion of a flexible biorefinery is coming into being.

These biorefineries can take several forms in concept. One concept is for a manufacturing facility that would take all kinds of biomass and produce (1) alcohols or gasoline-like fuels through a sugar – fermentation platform and (2) diesel-like fuels through a thermochemical platform. Another concept put forward by Neste Oil of Finland would integrate a biorefinery into a normal petroleum refinery plant. Thus, the biomass-derived fuel would simply be adsorbed into a petroleum platform.

The new generation of Biorefineries will produce 2nd generation biobased fuels. The Biorefineries will use a wide spectrum of biomass as feedstocks – switch grasses, agricultural waste, animal waste, cellulosic biomass, even black liquor.

The fuel products will be versatile, ranging from alcohols to FT diesel and synthetic gasolines and diesel fuels. One combines a sugar platform (fermentation) with a syngas platform (thermochemical). Some would combine integrate fuel processing with power generation and district heating. Some would be combined with a petroleum refinery so that bio-based products become integrated with petroleum-based products.

Objectives

The overall objective of this annex is to provide a better picture for IEA/AMF of where the biodiesel industry is going in the future – how technical barriers will be overcome, what bio-derived fuels will replace significant quantities of diesel fuel, what will be the feedstocks for those fuels, and what will be the processes by which the fuels will be made. To accomplish this, we will make great use of literature, especially the results of ongoing research and development. We will have discussions with those in industry who can provide guidance. We will attend the most appropriate technical meetings. And, we will make an analytical assessment of competing biodiesel production concepts with a view to characterizing the efficiencies of the processes and the value of the products.

Content of Work

The study will have three major parts:

- Review and analyze the situation with methyl esters as diesel substitutes – how far can we go?
- Make an in-depth study of the conceptual biorefineries to learn how broadly we can extend the range of biomass feedstocks as well as products.
- Make a technical analysis and comparison of various biorefinery proposals.

Financial Status

The total costs are estimated to € 75 000. With 5 countries participating the cost will be € 15 000 per country.

Results and Reports

A complete draft final report was distributed in early 2008, and the final report was distributed to the Participants in June 2008.

Ralph McGill reported the status at ExCo 35 in Vienna, Austria, and following the receipt of all payments, he recommended that the task be closed at ExCo 36 in Osaka, Japan.

5.3.2 Sub-task No 2 Algae as a Feedstock for Biofuels

During the ExCo 36 meeting in Osaka the Executive Committee unanimously decided to start a new Sub-task No2 "Algae as a Feedstock for Biofuels – An Assessment of the State of the Technology and Opportunities" under the umbrella Annex XXXIV with Ralph McGill as Operating Agent – on condition that the Bioenergy IA has no objections.

The ultimate potential of algae is huge:

- Could harvest crop every day instead of once per growing season
- Algae productivity is 30 to 50 times as great per hectare as conventional crops
- Potential for algae is too large to ignore

The interest in algae has exploded worldwide since ExCo 35:

- Industry and interest groups have formed
- Investments being made in start-up activities, worldwide
- National and international conferences being held
- Researchers face challenges in every aspect of algae fuel production

Objectives of the Sub-task:

- Inventory and assess the important R&D activities in the area of algae fuels
- Make recommendations about the most promising pathways to large-scale production of algae-based fuels

Main tasks of the Sub-task:

- Inventory important R&D projects in algae fuels. Focus on challenges.
- Using discussions with researchers and visits to R&D projects, develop an assessment of the R&D directions that have most promise.
- Develop recommendations intended to aid governments and policy-makers in their decisions on funding R&D in this area.
- Identify a particular area of work in algae fuels that would be attractive to the IEA-AMF for funding in a 2nd phase.
- Report progress in ExCo meetings, and provide a final report.

The Sub-task will be carried out with the following team

- Sentech, Inc – the Operating Agent, will provide half the work
- Martijn van Walwijk, covering Europe, and Nuwong Chollacoop, covering Asia, will each provide ¼ of the work

The work can be completed in one year from start of project.

Funding required: €150 000 of which US Department of Energy will supply €50 000 (tentative agreement) and 10 other member countries will provide €10 000 each.

Canada, Finland, Japan, and USA declared interest (4). Denmark and Sweden had to consult national authorities first.

5.4 Annex XXXV Ethanol as Motor Fuel

During ExCo 33 it was decided to start a new Annex XXXV "Ethanol as Motor Fuel" as an umbrella for various Sub-tasks with Jesper Schramm as Annex Coordinator (ExCo 33, Decision #3). It was also decided that all Member Countries participate in the new Annex XXXV without committing any funds (ExCo 33, Decision #4). Finally, it was decided to start a new Sub-task No 1 "Ethanol as a Fuel for Road Transportation" under the umbrella Annex XXXV with Jesper Schramm as Operating Agent (ExCo 33, Decision #5).

5.4.1 Sub-task No 1 Ethanol as a Fuel for Road Transportation

Operating Agent	Technical University of Denmark (DTU), Denmark
Decision to start	April 2007 (ExCo 33)
Project Duration	April 2007 – December 2008 (1,5 years)
Participants	All Contracting Parties (15 countries)
Total Budget	No AMF budget. Task sharing. Total cost € 70 000.
Project Leadership	Prof. Jesper Schramm Technical University of Denmark (DTU) Bldg 403 DK-2800 Lyngby Denmark Phone: +45 4525 4179 Fax: +45 4593 0663 Mail: js@mek.dtu.dk

Background

Ethanol is an excellent alternative fuel for road vehicle application. If the application of ethanol is going to increase, there is a demand for rather technical, but easily understood, information about the applicability of ethanol as an engine fuel. This is necessary in order to eliminate the skepticism among people, who do not know about this fuel.

Objectives

The purpose of this project is to provide an easily read technical report about the applicability of ethanol as an engine fuel. The report should describe the potential for ethanol application in the member countries participating in this annex. The results from the investigations of the member countries´ situations should be extrapolated to recommendations for worldwide implementation in a near future

Content of Work

The main project is inspired by the discussions from the IEA/AMF Executive Committee discussions in addressing the following questions:

- "Gasoline/Ethanol blends. How much ethanol can be tolerated by gasoline vehicles?"
- "True performance of FFV vehicles?"
- "Conceptual studies for optimized ethanol engines"
- "Diesel/ethanol blends?"
- "The need for ethanol blended fuels"
- "Differentiation of bio from mineral derived ethanol"
- "How ethanol blends perform in GDI vehicles"
- "The need for fuel specifications for ethanol blended fuels"

The main report will be followed up by individual implementation reports from the member countries.

Financial Status

The Annex is task shared. The internal Danish budget for the main report is estimated to € 70 000.

Results and Reports

A draft final report of 90 pages was distributed in December 2008.

5.5 Annex XXXVI Measurement Technologies for Hydrocarbons, Ethanol, and Aldehyde Emissions from Ethanol Powered Vehicles

Operating Agent	Swedish Road Administration (SRA), Sweden
Assistant	Mr. Lennart Erlandsson, AVL MTC, Sweden
Decision to start	November 2007 (ExCo 34)
Project Duration	November 2007 – December 2009 (2 years)
Participants	CA, FI, SE, and US (4 countries)
Total Budget	€ 150 000 + contributions from industry

Project Leadership Mr. Olle Hådell
Swedish Road Administration
SE-781 87 Borlänge
Phone: +46 243 753 98
Mobile: +46 70 372 43 93
Fax: +46 243 757 26
Mail: olle.hadell@vv.se

Background

In recent year's hydrocarbon, aldehyde and alcohol tailpipe emissions from flexible fuelled vehicles fuelled by alcohols have received an increased attention in Europe together with an increased and expanding interest in alternative fuels for vehicle propulsion.

Due to the fact that alcohol fuel blends have different fuel properties compared to conventional fuels such as gasoline/diesel, it is important to study factors, which affect the reproducibility and repeatability of the HC measurements from such vehicles.

Aldehyde and alcohol tailpipe emission measurements need to be further evaluated i.e. comparing different measurement methods.

Objectives

The aim of the project is to provide crucial information for developing the methodology for measuring HC, aldehyde and alcohol tailpipe emissions from ethanol-powered vehicles. The project also aims to find a simplified method using today's legislative measurement technology that can account for differences in harmfulness between exhausts from gasoline and ethanol powered vehicles.

Content of Work

The project is divided into three different tasks:

Task 1: Fact finding (literature and interviews)

- Regulation (including EU)
- Measurement specification (level, sensitivity, cost indication, time etc)
- Lab experience
- Question area

Task 2: Measurement and Correlation study of HC and ethanol

- FID measurement of ethanol, propane calibration gases with different concentration and oxygen content in carrying gas.
- Measurement of ethanol and propane calibration gases in bags with different waiting time.
- Using different type FID and individuals for measuring ethanol, propane calibration gases.
- Using FID at different sampling and detector temperature for measuring ethanol, propane calibration gases.
- Comparing MS, Photo acoustic and FTIR for measuring ethanol calibration gas.
- Ethanol and propane bomb test in CVS system.
- Measurement of an unknown gas bottle with ethanol and propane mixture in different labs.
- Analyse ethanol solutions at different labs.

Task 3: Vehicle tests

- Emission tests at different temperature (22°C, -7°C, -15°C).
- Emission tests with different CVS flow.
- FTP tests and NEDC tests
- Emission tests with different fuels.
- Comparing FTIR with MS for ethanol measurement
- Comparing photoacoustic with MS for ethanol measurement
- Comparing two MS for ethanol measurement
- Comparing FTIR and cartridge for aldehyde measurement
- Comparing different cartridge setup and sampling flow rate for aldehyde measurement.

The tasks will be performed at different test labs. Some tasks may be combined and performed simultaneously.

Financial Status

The project is still in the start up phase setting up the financing and agreements between the different parties.

Results and Reports

The project status will shortly be reported at the AMF ExCo meetings held while the project is running. All participants will get the technical report after the project is finished and the project final results will be presented at the first ExCo-meeting held after the project has been finished.

5.6 Annex XXXVII Fuel and Technology Alternatives for Buses

Operating Agent	VTT Technical Research Centre of Finland, Finland
Decision to start	May 2008 (ExCo 35)
Project Duration	June 2008 – December 2010 (2,5 years)
Participants	CA, FI, FR, JP, SE, and US (6 confirmed participants) Bioenergy IA (?), and HEV IA (?)
Total Budget	€ 600 000 (confirmed) plus € 500 000 (pending)
Project Leadership	Dr. Nils-Olof Nylund VTT Technical Research Centre of Finland P.O.Box 1000 FIN-02044 VTT, Finland Phone: +358 20 722 5518 Mobile: +358 400 703 715 Fax: +358 20 722 7048 Mail: nils-olof.nylund@vtt.fi nils-olof.nylund@teconsulting.fi

The objectives are:

- to access overall energy efficiency, emissions and costs, both direct and indirect costs, of various technology options for buses
- to provide solid IEA sanctioned data for policy- and decision-makers and
- to bring together the expertise of various IEA Implementing Agreements (Bioenergy, AFC, AMF, AMT, Combustion, HEV, and HIA).

The main targets are:

- Well-to-tank analysis
- Tank-to-wheel analysis
- Well-to-wheel analysis
- Cost estimates

Present time schedule :

- Preparations June 2008 - December 2008
- Actual testing January 2009 - December 2009
- Collecting WTW and WTT data January 2009 - December 2009
- Estimating direct and indirect costs September 2009 - March 2010
- Modeling environmental performance September 2009 - March 2010
- Synthesis of results March 2010 - September 2010
- Final report October 2010

Appendix 1

AMF ExCo Meetings

1984-90 AMF = Alcohols as Motor Fuels
1990-98 AMF = Alternative Motor Fuels
1998- AMF = Advanced Motor Fuels

		Date	*Chairman*	*Secretary*	
a	Madrid	80/3	Staffan Ulvönäs, SE	Folke Schippel, SE	
b	Stockholm	80/7	"	"	
1.	Ottawa	84/5	Gene Ecklund, US	Folke Schippel, SE	
2.	Stockholm	84/11	"	"	
3.	Dearborn	85/7	"	"	
4.	Vancouver	86/2	"	"	
5	Paris	86/10	"	"	
6.	Tokyo	87/5	"	"	
7.	Milano	87/11	"	"	
8.	Kiruna, S	88/6	"	Kjell Isaksson, SE	
9.	Tokyo	88/11	Shinichi Nakayama, JP	Folke Schippel, SE	
10.	Vancouver	89/6	"	"	
11.	Rome	89/11	PierPaolo Garibaldi, IT	"	
12.	Los Angeles	90/6	"	"	
13.	Stockholm	90/11	"	"	
14.	Espoo/Helsinki	91/8	"	"	
15.	Kyoto	92/6	"	"	
16.	The Hague	93/4	Bernie James, CA	Kerstin Larsson, SE	
17.	Antwerpen	94/2	"	Irene Kolare, SE	
18.	Toronto	94/10	"	"	
19.	Saltsjöbaden, S	95/9	"	Lars Vallander, SE	
20.	Oxford	96/6	"	"	
21.	Charleston	97/3	Ben van Spanje, NL	Claës Pilo, SE	
22.	Rovaniemi, FIN	98/1	"	"	
23.	Tokyo	98/10	"	"	
24.	Espoo/Helsinki	99/6	Nils-Olof Nylund, FI	"	
25.	Toronto	00/6	"	"	
26.	Copenhagen	01/5	Arie Brouwer, NL	"	
27.	Milano	02/4	Nils-Olof Nylund, FI	"	
28.	Paris	03/3	"	"	
29.	Linköping	04/1	Steve Goguen, US	"	
30.	Sao Paulo	04/10	"	"	
31.	Prague	05/11	"	"	
-	Toronto	06/06	"	"	(Short planning meeting)
32.	Beijing	06/10	"	"	
33.	Detroit	07/04	"	"	(Mini-meeting)
34.	Honolulu	07/11	"	"	
35.	Vienna	08/05	"	"	
36.	Osaka	08/12	"	"	

Appendix 2

Executive Committee on Advanced Motor Fuels

(Status February 2009)

A. Delegates and Alternates

Austria

Dr. Andreas Dorda — *Delegate*
Deputy Head, Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT)
Managing Director, Austrian Agency for Alternative Propulsion Systems (A3PS)
Donau-City-Strasse 1
A-1220 Vienna, Austria
Phone: +43 1 20501 68 101
Fax: +43 1 20501 68 110
Email: andreas.dorda@a3ps.at
www: www.a3ps.at

Dr. Bernhard Egger — *Alternate*
Austrian Agency for Alternative Propulsion Systems (A3PS)
Donau-City-Strasse 1
A-1220 Vienna, Austria
Phone: +43 1 20501 68 103
Fax: +43 1 20501 68 110
Email: bernhard.egger@a3ps.at
www: www.a3ps.at

Canada

Mr. Jean-Francois Gagné — ***Vice Chairman*** *Delegate*
Manager, Automotive Technologies
Natural Resources Canada (NRCan)
CANMET Energy Technology Centre
580 Booth Street, Ottawa, Ontario
Canada K1A OE4
Phone: +1 613 996 8557
Mobile: +1 613 852 3755
Fax: +1 613 996 9416
Email: jegagne@nrcan.gc.ca

Dr. Craig Fairbridge — *Alternate*
Manager, Fuels & Emissions
Natural Resources Canada (NRCan)

CANMET Energy Technology Centre
1 Oil Patch Drive, Devon, Alberta
Canada T9G 1A8
Phone: +1 780 987 8618
Fax: +1 780 987 8676
Email: craig@nrcan-rncan.gc.ca

China

Mr. Jiaqiang Guo — *Delegate*
Section Chief
China Automotive Technology and
Research Center (CATARC)
Rm. 905, Building 7, Phase II, No. 188
Western Rd, 4th South Ring Rd, Fengtai
Beijing, China 100070
Phone: +86-10-6370 2983
Fax: +86-10-6370 2964
Email: gjq@catarc.com.cn

Mr. Guogang Qian — *Alternate*
Assistant of President
China Automotive Technology and
Research Center (CATARC)
Tianshan Lukou. Chenglin Road
Hedong District.
Tianjin, China 300162
Phone: +86-22-8477 1328
Fax: +86-22-2437 0843
Email: qianguogang@catarc.ac.cn

Denmark

Prof. Jesper Schramm — *Delegate*
Technical University of Denmark (DTU)
Bldg 403
DK-2800 Lyngby
Denmark
Phone: +45 4525 4179
Fax: +45 4593 0663
Email: js@mek.dtu.dk

Mr. Aksel Mortensgaard — *Alternate*
Danish Energy Authority
Amaliegade 44
DK-1256 Copenhagen K
Denmark

Phone: +45 3392 7588
Fax: +45 3311 4743
Email: amo@ens.dk

Finland

Dr. Nils-Olof Nylund — ***Chairman***
VTT Technical Research Centre of Finland — *Delegate*
P.O.Box 1000
FIN-02044 VTT, Finland
Phone : +358 20 722 5518
Mobile : +358 400 703 715
Fax : +358 20 722 7048
Email: nils-olof.nylund@vtt.fi
nils-olof.nylund@teconsulting.fi

Ms. Marjatta Aarniala — *Alternate*
Finnish Funding Agency for Technology
and Innovation (TEKES)
P.O. Box 69
FI – 00101 Helsinki
Phone: +358 10 605 5736
Mobile : +358 50 557 7875
Fax: +358 10 605 5905
Email: marjatta.aarniala@tekes.fi

France

Mr. Patrick Coroller — *Delegate*
ADEME
500 route de Lucioles
F-06560 Valbonne
Phone: +33 4 9395 7932
Fax: +33 4 9395 7986
Email: patrick.coroller@ademe.fr

M. Jean-François Gruson — *Alternate*
Institut Français du Pétrole (IFP)
BP 311
F-92508 Rueil-Malmaison Cedex
Phone: +33 1 4752 6920
Fax: +33 1 4752 7014
Email: j-francois.gruson@ifp.fr

Italy

Mr. Fausto Alberici — *Delegate*
ENI S.p.A. Divisione Refining & Marketing
Centro Ricerche San Donato Milanese
Via Felice Maritano 26
I-20097 San Donato Milanese (MI)
Phone: +39 02 5205 6604

Fax: +39 02 5205 6612
Email: fausto.alberici@eni.it

Prof. Felice Corcione — *Alternate*
Istituto Motori (IM)
Viale G. Maraconi 8
I-80125 Napoli
Phone: +39 81 717 7130
Fax: +39 81 239 6097
Email: f.corcione@motori.im.cnr.it

Japan/NEDO

Mr. Kazunori Nagai — ***Vice Chairman***
General Director — *Delegate*
New Energy & Industrial Technology
Development Organization (NEDO)
1310 Oomiya-Cho Saiwai-Ku Kawasaki-City,
Kanagawa, 212-8554, Japan
Phone: +81-44-520-5281
Fax: +81-44-520-5283
Email: nagaikzn@nedo.go.jp

Dr. Nobuo Iwai — *Alternate*
Director
New Energy and Industrial Technology
Development Organization (NEDO)
1310 Oomiya-Cho Saiwai-Ku Kawasaki-City,
Kanagawa, 212-8554, Japan
Phone: +81-44-520-5281
Fax: +81-44-520-5283
Email: iwainbo@nedo.go.jp

Japan/LEVO

Mr. Nobuichi Ueda — *Delegate*
Chief Director
Organization for the Promotion
of Low Emission Vehicles (LEVO)
YPC Building 4F, 2-14-8 Yotsuya, Shinjuku-ku
Tokyo, 160-0004, Japan
Phone: +81 3 3359 8461
Fax: +81 3 3353 5439
Email: n-ueda@levo.or.jp

Dr. Yutaka Takada — *Alternate*
General Manager
Organization for the Promotion
of Low Emission Vehicles (LEVO)
YPC Building 6F, 2-14-8 Yotsuya, Shinjuku-ku
Tokyo, 160-0004, Japan
Phone: +81 3 3359 9008
Fax: +81 3 3353 5439

Email: y-takada@levo.or.jp

Spain

Mr. Juan Luis Plá de la Rosa — *Delegate*
IDAE
Madera, 8
ES-28004 Madrid
Phone: +34 91 456 5044
Fax: +34 91 523 0414
Mobile: +34 600 497 032
Email: jlpla@idae.es

Mr. Carlos López-López — *Alternate*
IDAE
Madera, 8
ES-28004 Madrid
Phone: +34 91 456 4994
Fax: +34 91 523 0414
Email: carlopez@idae.es

Sweden

Mr. Olle Hådell — *Delegate*
Swedish Road Administration (SRA)
SE-781 87 Borlänge
Phone: +46 243 753 98
Mobile: +46 70 372 43 93
Fax: +46 243 757 26
Email: olle.hadell@vv.se

Mrs. Alice Kempe — *Alternate*
Swedish Energy Agency
Box 310
SE - 631 04 Eskilstuna
Phone: +46 16 544 2092
Mobile: +46 70 398 72 47
Fax: +46 16 544 2261
Email: alice.kempe@energimyndigheten.se

Switzerland

Prof. Jan Czerwinski — *Delegate*
University of Applied Sciences Bern (AFHB)
Lab. for Exhaust Emissions Control
Gwerdtstrasse 5
CH-2560 Nidau, Switzerland
Phone: +41 32 321 6680
Fax: +41 32 321 6681
Email: jan.czerwinski@bfh.ch or
csj1@bfh.ch

	Dr. Joerg Loepfe SwissTS Technical Services AG Richtistrasse 15 CH-8304 Wallisellen, Switzerland Phone: +41 32 675 8010 Fax: +41 32 675 8011 Email: joerg.loepfe@bluewin.ch	*Alternate*
Thailand	Dr. Paritud Bhandhubanyong Senior Expert, Alliance Development Office National Science and Technology Development Agency (NSTDA) 111 Thailand Science Park Paholyothin Road, Klong 1, Klong Luang Pathumthani 12120, Thailand Phone : +66 2564 7000/1503 Fax : +66 2564 7084 Email : paritud@nstda.or.th	*Delegate*
	Prof. Siriluck Nivitchanyong Assistant Director, National Metal and Materials Technology Center National Science and Technology Development Agency (NSTDA) 114 Thailand Science Park Paholyothin Road, Klong 1, Klong Luang Pathumthani 12120, Thailand Phone : +66 2564 6500/4011 Fax : +66 2564 6503 Email : siriluck@mtec.or.th	*Alternate*
UK	Mr. Chris Parkin Department for Transport (DfT) Zone 2/15, Great Minster House 76 Marsham Street UK-London SW1P 4DR Phone: +44 20 7944 2958 Fax: +44 20 7944 2605 Email: chris.parkin@dft.gsi.gov.uk	*Delegate*
	-	*Alternate*

USA

Mr. Kevin Stork *Delegate*
Freedom CAR & Vehicle Technologies Program
Office of Energy Efficiency and Renewable Energy
US Department of Energy (DOE)
Forrestal Bldg, EE-2G
1000 Independence Avenue, S.W.
Washington, D.C. 20585, USA
Phone: +1 202 586 8306
Fax: +1 202 586 2476
Email : kevin.stork@ee.doe.gov

Dr. Larry R. Johnson *Alternate*
Director Transportation R&D Center
Argonne National Laboratory (ANL)
9700 S. Cass Avenue
Argonne, IL 60439, USA
Phone: +1 630 252 5631
Mobile: +1 630 400 8276
Fax: +1 630 252 4211
Email: johnson@anl.gov

B. Representatives of Operating Agents

Annex XXVIII

Ms. Päivi Aakko-Saksa
VTT Technical Research Centre of Finland
P.O.Box 1000 (Biologinkuja 5)
FI-02044 VTT
FINLAND
Phone: +358 40 5055750
Fax: +358 20 722 7048
Email: paivi.aakko@vtt.fi

Mr. Björn Rehnlund
Atrax Energi AB
Allévägen 38
SE-178 52 Ekerö
Sweden
Phone: +46 8 564 000 52
Mobile : +46 73 384 24 46
Email: bjorn.rehnlund@atrax.se

Annex XXXIII

Prof. Jan Czerwinski
University of Applied Sciences Bern
Lab. for Exhaust Emissions Control
Gwerdtstrasse 5
CH-2560 Nidau
Switzerland
Phone: +41 32 321 6680
Fax: +41 32 321 6681
Email: jan.czerwinski@hti.bfh.ch or
csj1@hti.bfh.ch

Annex XXXIV

Dr. Ralph McGill
Fuels, Engines, & Emissions Consulting (FEEC)
305 Sugarwood Drive
Farragut, TN 37934
USA
Phone: +1 865-966-3512
Mobile : +1 865-207-9137
Fax: +1 865-675-2866
Email: rnmcgill@chartertn.net

Annex XXXV Prof. Jesper Schramm
Technical University of Denmark (DTU)
Bldg 403
DK-2800 Lyngby
Denmark
Phone: +45 4525 4179
Fax: +45 4593 0663
Email: js@mek.dtu.dk

Annex XXXVI Mr. Olle Hådell
Swedish Road Administration (SRA)
SE-781 87 Borlänge
Phone: +46 243 753 98
Mobile: +46 70 372 43 93
Fax: +46 243 757 26
Email: olle.hadell@vv.se

Annex XXXVII Dr. Nils-Olof Nylund
VTT Technical Research Centre of Finland
P.O.Box 1000
FIN-02044 VTT, Finland
Phone : +358 20 722 5518
Mobile : +358 400 703 715
Fax : +358 20 722 7048
Email: nils-olof.nylund@vtt.fi
nils-olof.nylund@teconsulting.fi

C. Secretariat

ANL : Responsible for Handling the AMF Finances

Dr. Larry R. Johnson
Director Transportation R&D Center
Argonne National Laboratory (ANL)
9700 S. Cass Avenue
Argonne, IL 60439, USA
Phone: +1 630 252 5631
Mobile: +1 630 400 8276
Fax: +1 630 252 4211
Email: johnson@anl.gov

Dr. Don Hillebrand
Argonne National Laboratory (ANL)
9700 S. Cass Avenue
Argonne, IL 60439, USA
Phone: +1 630 252 6502
Mobile: +1 630 400 ……
Fax: +1 630 252 ……
Email: hillebrand@anl.gov

IEA Paris

Ms. Carrie Pottinger
Energy Technology Co-ordinator
Office of Energy Technology and R&D
International Energy Agency (IEA)
9, rue de la Fédération
F-75739 Paris Cedex 15
France
Phone: +33 1 4057 6761
Fax: +33 1 4057 6759
Email: carrie.pottinger@iea.org

IEA/AMF Secretariat

Lic.Eng. Claës Pilo
SDAB Transport & Environment
Karlavägen 93
SE-115 22 Stockholm
Phone: +46 8 15 11 90
Mobile: +46 70 57 57 181
Email: pilo.sdab@swipnet.se

MAIN RESULTS OF COMPLETED AMF PROJECTS/ANNEXES

(Annex I – XXXIV)

Detailed information about participating countries and their contributions is found in Tables A-D at the end.

Annex I — Alcohols and Alcohol Blends as Motor Fuels

Operating Agent: SDAB (SE)

This initial project/annex resulted in a state-of-the-art publication in three volumes printed in 2 000 copies which became a best seller in 1986.

Annex II — Technology Information Exchange on Alternative Motor Fuels

Operating Agent: SDAB (SE)

A number of studies on specific issues concerning various alternative motor fuels were reported in a series of ”TRENDS”. Altogether 21 different reports were prepared and distributed to the participating countries.

Annex III Alcohol Diesel Field Trials

Operating Agent: Sypher (CA)

Data were collected, assessed and disseminated on the use of various methanol fuels in heavy-duty compression ignition engines used in trucks and buses as well as in rail, marine and stationary applications. The project resulted in 13 reports.

Annex IV Production of Alcohols and Other Oxygenates from Fossil Fuels and Renewables

Operating Agent: Natural Resources Canada (CA)

The activities of the Annex were conducted in two phases. The second phase, which was completed in 1995, consisted of four studies, dealing with

- Natural Gas Supply, Demand and Price;
- Economic Comparisons of the LNG, Methanol and Synthetic Distillate;
- A Comparison of the Production of Methanol and Ethanol from Biomass;
- Greenhouse Gas and Other Emissions to Air Resulting from Ethanol and Methanol Use as Alternative Fuels.

These studies demonstrated that feedstock availability for production of alternative fuels is not of concern, especially with regard to fossil fuels-based processes.

The production cost of alternative fuels, including the costs of feedstock, processing and transportation, has been provided for a large number of locations around the world.

The environmental benefits, as expressed in carbon dioxide-equivalent vehicle emissions, showed a great reduction for biomass-derived fuels, but minor variations for fossil fuel-based alternative fuels.

Annex V Cold Test Emissions

Operating Agent: VTT Processes (FI)

The first final report was published in March 1995 as a restricted report. After completing the later approved addendum on diesel vehicles, a new final report was published in February 1996 as a public report, according to decisions taken by the Executive Committee.

Altogether 3 engines and 14 cars were measured at 5 ambient temperatures, using new sophisticated emission analysis methods. The fuels used were different types of gasoline and diesel fuels as well as methanol and ethanol blends, LPG and CNG. The results indicated that M85 fuel can give lower emissions than gasoline in warm conditions, though the emission of unburned methanol must be controlled. Natural gas and LPG proved to be inherently clean fuels, which, using up-to-date engine technology, give low emissions in all conditions.

Annex VI Natural Gas as Motor Fuel

Operating Agent: Sypher (CA)

Assistant: SDAB (SE)

International information and experience of present and future use of natural gas as a motor fuel was collected, analysed and synthesised. The project included the use of compressed natural gas (CNG) and liquefied natural gas (LNG) in light-duty vehicles and heavy-duty vehicles. The potential of methane produced from biomass (biogas) was also explored.

Annex VII Comparison of Relative Environmental Impacts of Alternative and Conventional Fuels

Operating Agent: ORNL (US)

Assistant: Phase 1: SDAB (SE). Phase 2: Innas (NL)

Results of the project were (1) a paperback book detailing the findings of the study and (2) an addendum to the book updating the findings with results of more recent research on environmental impacts of alternative fuels. Both publications are useful to policy makers when a decision is necessary on whether to employ alternative fuels in transportation.

Annex VIII Heavy-Duty Vehicles on Alternative Fuels

Operating Agent: VITO (BE)

This annex was carried out in two phases. In the first phase an analysis of the results of 73 different demonstration projects set up in several countries around the world was carried out. Because demonstration projects have different goals, use different test methods and procedures, it was hard to compare the results. A unification of test methods, especially for emissions and energy consumption, will increase the value of the outcome of a demonstration for third parties.

In a second phase a leaflet with recommendation for demonstrations was developed based on the results of the first phase and on the results of a workshop with demonstration experts.

Annex IX Automotive Fuels Information Service (IEA AFIS)

Operating Agent: Innas (NL)

Assistant: Atrax Energi och Miljö AB (SE)

The result of this annex is an independent information service (IEA AFIS) that can answer strategic questions on automotive fuels. This information service has assisted in many other annexes of the Advanced Motor Fuels Implementing Agreement.

During the three operating years of the annex, five books have been produced in a series "Automotive Fuels Survey".

The first two volumes "Raw Materials and Conversion" and "Distribution and Use" describe the relevant aspects of the well to wheel fuel chain of automotive fuels. Fuels included are: gasoline, diesel oil, LPG, natural gas, alcohol fuels, vegetable oils and biodiesels, hydrogen and dimethyl ether. Aspects covered are for example: energy consumption, emissions, costs, technology, infrastructure, legislation and safety.

The third volume "Comparison and Selection" describes a method to use the enormous amount of available information when a decision on automotive fuels has to be made.

Examples are presented to clarify the working method. The examples include the fuels that are addressed in the first two volumes.

Volume four "Innovations or Illusions" addresses some special fuels that are not discussed in the first two volumes. Volume five "Mobile Machinery: Sector analysis" describes energy consumption and emissions of the mobile machinery sector, compared to road vehicles. It also discusses the role of alternative fuels in this sector.

Annex X Characterisation of New Fuel Qualities

Operating Agent: VTT Processes (FI)

The final report was distributed in September 1997 as a restricted report.

The results showed that the traditional cetane number measurement well describes the ignition delay of heavy-duty engines at low and medium loads, but is more suitable for hydrocarbon fuels than for alternative fuels. Thus, the cetane number does not describe the combustion process with advanced light-duty vehicles. The cetane number overestimates the effect of cetane improvers, especially for biodiesels. Esters were also found to act as effective lubricity additives according to HFRR tests.

Annex XI Forecasting and Planning Tools for Alternative Fuels and Related Infrastructure

Operating Agent: Sypher (US)

The final report provided an overview of the major computer models studied. Detailed comparisons were made of the U.S. DOE´s TAFVM, California's CALCARS, Canada's AFIM, and the Netherlands´ Electric Vehicle Impact models. The Canadian alternative fuels infrastructure model (AFIM) was tested using Australian and New Zealand experience. The AFIM model was also used to predict electric vehicle demand in Finland.

Annex XII Particulate Emissions from Alternative-fuelled Vehicles

Operating Agent: ETSU (UK)

Annex XIII Emission Performance of Selected Biodiesel Fuels

Operating Agent: VTT Processes (FI)

Assistant: ORNL (US)

Oak Ridge National Laboratory (ORNL) and Technical Research Centre in Finland (VTT) carried out the project with complementary work plans. The work generated an extensive analysis of the exhaust emissions using biodiesel in new diesel engines. Several different engines were tested at the two sites, and some engines were tested also with emission control catalysts, both at ORNL and at VTT. ORNL concentrated on light and medium duty engines, while VTT emphasized a heavy-duty engine and also used a light duty car as a test bed. Common test fuels for two sites were rape methyl ester in 30 % blend and neat, soy methyl ester in 30 % blend and neat, used vegetable oil methyl ester (UVOME) in 30 % blend, and the Swedish environmental class 1 reformulated diesel (RFD). Results covered regulated emissions, aldehydes, composition of particulate matter, polyaromatic hydrocarbons and limited results of Ames tests on the mutagenicity (particulate matter).

Generally, the biodiesel fuels had higher NOx emissions but lower values of HC, CO, and particulates. Unregulated emissions varied greatly between fuels and engines. VTT's tests showed that the particulates generally seemed to be less harmful for neat bioesters than for diesel fuel. The changes in emissions were not as significant when 30 % bioester blends were compared with EN590 or RFD as when neat esters were used. No major differences were seen in emission performance between RME, SME (soy bean oil methyl ester) and UVOME, even though some benefit was seen for the UVOME fuel regarding CO, HC and aldehyde emissions with the TDI vehicle. The ethanol emulsion fuel gave some emission benefits regarding particulates. The hydrated tall oil blend gave worse emission figures than the other fuels, which is believed to be due to differences in the base fuel.

Both laboratories, ORNL and VTT, prepared final reports. In addition two publications are available.

Annex XIV — Investigation into the Feasibility of Dimethyl Ether as a Fuel in Diesel Engines

Operating Agent: TNO (NL)

Annex XIV has been split up in the following seven tasks lead by different industrial enterprises.

- *Trade-off fuel quality versus costs:* Haldor Topsoe (DK) and Statoil (NO)
- *Safety investigation (DME distribution and vehicles):* Renault (FR), Akzo-Nobel (NL), TNO-WT and TNO-MEP (NL) and NRCanada (CA)
- *Design guidelines:* AVL-List (AT), AET (CA), Renault (FR) and DTU (DK)
- *DME from renewable feedstock:* IEA AFIS (Atrax Energi, SE)
- *Life cycle analysis (LCA):* IEA AFIS (Innas, NL), Amoco (US), Statoil (NO), Haldor Topsoe (DK), Volvo Truck (SE), Renault (FR) and TN-WT (NL)
- *Costs of DME infrastructure:* IEA AFIS (Innas), Statoil (NO) and Amoco (US)
- *Workshops / newsletters:* TNO-WT (NL)

Annex XV — Implementation Barriers of Alternative Fuels

Operating Agent: Innas (NL)

The report that has been produced under this annex presents an overview of the practical barriers associated with the introduction of an alternative fuel and analyses alternative fuels in broad terms with respect to these practical barriers. Fuels addressed in the report are: LPG, natural gas, ethanol, methanol, biodiesel and hydrogen. Also electric vehicles are included. Some remarks are made on the barriers that may be expected for dimethyl-ether.

Annex XVI — Environmental and Economical Aspects of Implementing Biodegradable Lubricants in Vehicle Engines

Operating Agent: DTU (DK)

The results of the project are described in 3 reports that were published in 1999, 2002 and 2004 respectively. Report 1 one was a state-of-the-art report. Report 2 was describing performance experiments, carried out with a diesel vehicle, where an ester based biodegradable lubricant was applied. This situation was compared to experiments where a reference lubricant was applied. In both cases the lubricants where applied in connection with conventional diesel fuels and biodiesel. Report 3 was describing performance experiments, carried out with a gasoline vehicle, where the same ester based biodegradable lubricant was applied. This situation was then compared to experiments where a reference lubricant was applied. In both cases a reference gasoline fuel was applied together with E85.

Annex XVII Real Impact of New Technologies for Heavy-Duty Vehicles

Operating Agent: VITO (BE)

The final report was distributed between the participants in December 2000.

Within this project, three city bus technologies were selected to compare emissions and fuel consumption in real traffic (city and rural), in several vehicle test cycles (CBDC, DUBDC, De Lijn) and in the main official engine test cycles (ESC, ETC, US-FTP, Japan 13-mode). The purpose was to look for clear relations between these test procedures.

The three buses were a Euro-2 diesel bus, a natural gas bus with stoichiometric fuel control and three-way catalyst and a natural gas bus with lean burn fuel control.

The stoichiometric natural gas bus reached very low emission levels compared to the diesel bus (regulated emissions were about 10 times lower). The lean burn natural gas bus needed some adjustments in the lambda control settings to lower its relatively high NO_x emissions.

The test results showed that there is no unique relation between real city traffic emissions and the different engine or vehicle test cycles. The relation depends on engine technology, gearbox (and gear shifting strategy), and the engine load vs. speed distribution during the test cycle.

Annex XVIII Future Greener Diesel Fuels

Operating Agent: Battelle Memorial Institute (US)

In order to support the use of oxygenates in diesel fuels, this annex provided data on the miscibility, flash point, cloud point, water tolerance, vapour pressure, and ignition quality over a range of diesel fuel-oxygenate blends and environmental temperatures through laboratory tests with diesel fuel and oxygenate samples.

The diesel fuels included a USA reference diesel, a Fischer-Tropsch diesel, and an oil sands diesel. The oxygenates tested included:

1. dipentyl ether,
2. tripropylene glycol monomethyl ether,
3. glycerol tributrate (tributrin),
4. 2-ethoxyethyl ether (diethylene glycol diethyl ether),
5. dibutyl maleate,
6. dibutoxymethane (butylal), and
7. diethyl maleate [Only limited work because of miscibility difficulties].

Oxygenate blend levels were 0 (diesel only), 5, 10, 30, and 100 (oxygenate only) volume percent. Test temperatures ranged from -30 to 30 C. Vapour pressure measurements were made using a gas chromatographic technique that distinguished fuel and oxygenate contributions to the total vapour pressure. Ignition quality measurements were made using the IQT constant volume combustion apparatus.

Annex XIX New Fuels for New Engines

Operating Agent: Innas (NL)

The final report was published in January 2001 as volume 6 in the Automotive Fuels Survey series of IEA AMF/AFIS under the title "Fuels for HCCI engines". It describes homogeneous charge compression ignition (HCCI) operation in four-stroke, two-stroke and free piston engines. The relation between fuel characteristics and HCCI operation is discussed. The report contains an extensive list of references and also lists organizations working on HCCI engines. Outside AMF the report has been distributed within the Clean Diesel III consortium, co-ordinated by SwRI in the USA.

Annex XX DME as an Automotive Fuel II

Operating Agent: TNO (NL)

The result of the Annex XX is twofold:

A) Technical research in the area of DME fuel injection systems.
B) Support for international cooperation to stimulate the development of DME as a new fuel.

This was supported by organising workshops and distributing newsletters.
The work also resulted in the foundation of the International DME Association and in a EU project about the development of a DME fuelled truck.

The technical work:
- A test procedure to test material (wear) properties with DME
- Advise on wear resistant coatings for DME fuel injection system parts
- Selection of elastomers suitable for sealing DME fuel systems
- Determination of influence of additives on DME lubricity and viscosity.

Annex XXI Deployment Strategies for Hybrid, Electric and Alternative Fuel Vehicles

Operating Agent: Innas (NL)

In the last years the harmful effects and the greenhouse gases resulting from the use of conventional vehicles created many concerns on continuing in the same direction. Hybrid or electric vehicles and alternative fuels like natural gas, ethanol or hydrogen are considered an essential element in reducing urban pollution and greenhouse gases. But only a wide dissemination of „clean vehicles and fuels“ can have noticeable effects on the environment. Therefore governments, in addition to the support of research and development, more and more implement measures with the aim of promoting the market introduction of these new vehicle technologies – with different approaches and various effects.

Between 2000 and 2002 an international task force collected information on more than 100 programs run in 18 countries. Evaluations and analyses of case studies showed that some approaches are successful, but they also identified weaknesses that are often repeated. The report elaborated by the task force provides recommendations on the base of conclusions drawn by the analyses. They will help government officials responsible for administering fleets, incentives and regulations with assessing the most promising strategy for their country for the market introduction of hybrid, electric and alternative fuel vehicles.

Annex XXII Particle Emissions at Moderate and Cold Temperatures Using Different Fuels

Operating Agent: VTT Processes (FI)

The Annex XXII was active from 2000 to 2003 as a task sponsored by the (IEA/AMF). The research work on particulate emissions of road traffic has been carried out at normal ambient temperature. Even a slight reduction in temperature can increase particulate emissions. For many years, it has been obvious that the knowledge of the total particulate mass emissions is not enough. Quality of these particles, like polyaromatic hydrocarbon content, has already been studied widely. Now there is also a need to gain more information on fine particles. Especially, the possible effect of temperature on particle size has not been studied much. This project was targeted to cover different fuel and engine technologies, including gaseous fuels and biodiesel. Research work focused on different light-duty technologies. However, preliminary tests were conducted with a medium-duty engine to evaluate the suitability of different measuring techniques at low-test temperatures. Light-duty vehicles were as follows: two diesel cars (direct and indirect-injection), stoichiometric gasoline fuelled car (multi-port fuel-injection), direct-injection gasoline car, FFV car running with E85 fuel, CNG and LPG cars. Four fuels with diesel cars were studied: European grade diesel, Swedish Environmental Class 1 fuel and blends of these fuels and RME.

With medium-duty engine the effect of temperature on particles was clear and seen both in the particle mass and number results, which was assumed to be related to the condensed hydrocarbons. Generally, both particle mass and number emissions were high with diesel cars when compared to the other cars. Particle emission increased as test temperature decreased in

the beginning of the test (cold start) with both diesel cars, but the effect of temperature diminished when engine warmed up. RME showed benefit concerning particle mass emissions, but indication of higher number of particles and peak at lower size class was seen when compared to EU2000 at -7 °C, but similar effect was not seen when RME was blended with the reformulated diesel fuel. Particle emissions were extremely low at +23 °C with MPI, E85, CNG and LPG cars, but significantly higher with the G-DI car. Particle mass and number emission from MPI, E85, LPG and G-DI cars after cold start increased to some extent as temperature decreased. The particle mass and number emissions from the CNG car stayed at the "zero" level at all temperatures studied. Typically, if the effect of temperature on particle results was seen, it occurred after the cold start and diminished as engine, catalyst and/or EGR system warmed-up.

Annex XXIV Information Exchange IEA AMF/AFIS

Operating Agent: Innas (NL)

Three newsletters were produced and distributed annually under this Annex. Distribution was inside the AMF community and also to a large audience outside AMF. The newsletters provided the latest worldwide news on advanced motor fuels. In every issue there was a section describing activities and results of the Implementing Agreement, including the results of the work in other Annexes.

Annex XXV Fuel Effects on Emissions from Non-Road Engines

Operating Agent: VTT Processes (FI)

The Annex came active on May 2001 and was completed summer 2003. Existing data has been put on the IEA AMF web site since the autumn of 2001. Measurements were carried out with small gasoline engines and non-road diesel engines. The objective of this Annex was to study how fuel quality affects the exhaust emissions from engines mentioned above.

The measured small engines were a 2-stroke chainsaw engine, and a 4-stroke OHV engine, which could be used in different applications. Measurements were done with three different fuels, with and without catalyst. The results clearly demonstrate that using a good quality fuel (e.g. low sulphur, low aromatics) and a catalyst gives the best outcome in overall emission levels from these small engines.

In the second part two different diesel engines were tested with five different fuels. Two of the fuels were biodiesel blends. The engines were chosen to represent old and new engine technology. The old engine (MY 1985) was produced before EU emission regulations were in place, and the new engine fulfilled the current EU Stage 2 emission limits. With the new engine comparison with and without oxidation catalyst was done using two fuels. The results in general are similar compared to the results from the small gasoline engines: fuel quality has an effect on the emissions and when combining a good quality fuel (e.g. low sulphur, low aromatics) and an oxidation catalyst the emission levels are significantly reduced.

Annex XXVI Alcohols and Ethers as Oxygenates in Diesel Fuel

Operating Agent: Befri Konsult (SE) & TEC TransEnergy Consulting Ltd (FI)

In Milan in April 2002, at its 27th meeting, the Executive Committee of the IEA Implementing Agreement of Advanced Motor Fuels (AMF) decided to start a new Annex on alcohols and ethers as oxygenates in diesel fuel (Annex XXVI). Originally the Annex was designed to focus on practical experiences of using alcohols/ethers as oxygenates in diesel fuel. Compared with the original project plan, a more detailed chapter about fuel properties was added to the final report, also dealing with limitations of blending low-boiling components into diesel fuel. Befri Konsult of Sweden carried out the initial part of the work. The report was finalised by TEC TransEnergy Consulting Ltd (Finland) in cooperation with Turku Polytechnic (Finland).

Storage and handling regulations for fuels are based on the flash point. The problem with, e.g., ethanol blended into diesel is that ethanol lowers the flash point of the blend significantly even at low concentrations. Regarding safety, diesel-ethanol blends fall into the same category as gasoline. Currently, various standards and specifications set rather tight limits for diesel fuel composition and properties. It should be noted that, e.g., E-diesel does not fulfill any current diesel specification and it cannot, thus, be sold as general diesel fuel. Some blends have already received approvals for special applications.

The critical factors of the potential commercial use of these blends include blend properties such as stability, viscosity and lubricity, safety and materials compatibility. The effect of the fuel on engine performance, durability and emissions is also of importance. So far, no engine manufacturers have indicated they will extend warranty coverage to their equipment when operating with E-diesel.

The reports on field tests with oxygenated diesel fuels are rather scarce, especially reports on recent tests. There are, however, some reports available on engine tests and tests with trucks, buses and even off-road equipment. Most of the available test results identified fuel economy and cost as the only appreciable differences between E-diesel and conventional diesel fuel. Most emissions tests with heavy-duty engines confirm the effect of a substantial reduction in PM when running with E-diesel. The typical range for PM reduction is 20 – 40 %. Most studies also report reduced NO_x emissions. Earlier, there were a lot of activities with E-diesel in Sweden. For the time being, California and Brazil are leading the development of E-diesel.

Annex XXVII Standardization of Alternative Motor Fuels

Operating Agent: Atrax Energi och Miljö AB (SE)

The annex was established by IEA/AMF in April 2002. During Phase I a state of the art report was produced concerning standardization of alternative fuels in Canada, Finland, France, Japan, Sweden, USA and the European Standardisation Organisation CEN as well as the International Standardisation Organisation ISO. During Phase I was also a first investigation carried out concerning a possible co-operation between IEA/AMF and CEN and/or ISO. The result of Phase I was presented to the ExCo in January 2004 and a written report was distributed to all IEA/AMF participants.

In March 2003 IEA/AMF decided to start a Phase II of the Annex with the purpose to further and more thoroughly analyse the possibility and if so also the forms for a co-operation between IEA/AMF and CEN and/or ISO. The result was presented to IEA/AMF in October 2004 and a written report was distributed to all IEA/AMF participants. The result of Phase II was a recommendation to IEA/AMF to seek for co-operation with both CEN and ISO since it would be of importance for IEA/AMF in its work to i.a. disseminate knowledge and experiences from work done with support from IEA/AMF and also would contribute to make IEA/AMF more known by countries around the world. For the moment is a proposal being discussed concerning how to carry out such a co-operation. The proposal is to establish a new Annex for co-operation with CEN and ISO concerning standardization of alternative as well as advanced motor fuels.

A report covering data and information collected during Phase I as well as proposals for future work has been distributed in November 2003.

In October 2004 a report of Phase II concerning co-operation between IEA/AMF and CEN and/or ISO was distributed

Both reports are publicly available through Atrax, the ExCo members and the AMF Secretary. *The reports can also be downloaded from the AMF website ("Downloadable Documents").*

Annex XXVIII Information Service & AMF Website (AMFI)

Sub-task No.1 Outlook on Standardization

Operating Agent: Atrax Energi och Miljö AB (SE)

Sub-task 1, "Outlook on Standardization", of IEA/AMF Annex XXVIII, "AMFI Information Service", was established in November 2006 by the IEA/AMF ExCo meeting in Beijing, China. Sub-task 1 can be seen as a follow up or to some extent a prolongation of Annex XXVII "Standardization of Alternative Motor Fuels".

The intention of Sub-task 1 was to collect and present as much as possible of all available information concerning standardization of alternative fuels. With information was meant not only facts and data about already existing standards but also pre-standards, ongoing work and discussions about standards as well as planned work on this item. Country specific standards and information as well as regional and global standards should be covered in the report.

In May 2008 a first draft report was presented at the ExCo 35 meeting in Vienna, Austria and in August a final draft was sent out by e-mail to all Delegates and Alternates.

In the report information can be found concerning standardization of liquid as well as gaseous alternative fuels. The following organizations/ countries and organizations/regions are presented in the report:

- APEC (Asia-Pacific Economic Cooperation)
- ASTM (covering i.a. the U.S. and Canada
- Brazil
- CEN (Europe)
- India
- ISO (global level)
- Japan
- People's Republic of China
- South Africa
- Thailand

In the report there is also some information concerning standards on test methods for alternative fuels.

The work on Sub-task 1 was financed by all participants in IEA/AMF through its Common Fund. The report is publicly available (see *AMF website for "Downloadables").*

Annex XXIX Heavy-Duty Urban Vehicles

Operating Agent: VTT Processes (FI)

The Annex was established in 2004, and completed in 2007. Three laboratories, VTT, Environment Canada and West Virginia University measured standard size urban buses driving various duty cycles on chassis dynamometers. The number of transient test cycles per laboratory varied from 6 to 16. Included in the vehicle matrix were European and North American diesel and natural gas vehicles. Environment Canada performed a comparison of a conventional diesel vehicle and a diesel-electric hybrid vehicle. Fuel consumption as well as exhaust emissions were measured.

The main objective of the project was to evaluate how various duty cycles affect fuel consumption and exhaust emission figures. As could be expected, the results vary significantly not only by test cycle, but also by vehicle technology. In some cases increased fuel consumption or load results in increased emissions, in other cases reduced emissions. However, for most, vehicles emissions can be directly proportioned to the amount of fuel consumed. In this respect NOx-emissions from SCR-vehicles form an exception, as well as particle emissions from vehicles producing very low absolute particle emission levels. Scaling factors to be used for comparing emission results generated with different duty cycles were developed.

Most of the evaluated test cycles provide coherent fuel consumption and emission results. Some specific test cycles result in abnormalities, and must therefore not be considered representative for buses. All three laboratories performed measurements on three common cycles, the ADEME/RATP Paris bus cycle, the Orange County Transport Authority cycle and the Braunschweig bus -cycle. This made it possible to also compare European vehicles and North American vehicles with each other. However, such a comparison is only indicative, as

there are differences in vehicle specifications, testing equipment and also in test procedures and testing conditions.

The results of the Annex are presented in a public report which can be downloaded via VTT's website at http://www.vtt.fi/inf/pdf/tiedotteet/2007/T2396.pdf or via the IEA AMF website at http://virtual.vtt.fi/virtual/amf/download.html.

Annex XXX Biosafety Assessment: Animal Fat in Biodiesel

Operating Agent: ATFCAN (CA)

Annex XXX of the IEA's AMF began in 2004 and was completed in 2006. The final report "Biodiesel from Specified Risk Material Tallow" resulting from the biodiesel workshop and research concluded that biodiesel made from specified risk material tallow, such as tallow potentially contaminated with bovine spongiform encephalopathy (BSE), poses negligible risk to human and animal health.

The potential for BSE contamination of bovine tissues has led government regulatory agencies to designate certain high risk tissues as specified risk material (SRM), and prohibit their inclusion in either human or ruminant food, or in various other products such as biologicals, pharmaceuticals, medical devices, cosmetics and fertilizers. Subsequently, a substantial tonnage of animal tissue that would otherwise have been used in commercial enterprises is destroyed. The use of SRM to produce tallow for biodiesel production is one possible means to recoup at least some of this lost resource.

The report, written by leading experts on transmissible spongiform encephalopathies (TSE) and BSE, animal rendering, and vehicular emissions, provides an in-depth study of BSE, from the first incident until 2006. It then examines the biodiesel production process using SRM-infected tallow, and the potential effects of using the end product (biodiesel fuel manufactured from specified risk material). As the BSE concern is constantly changing around the world, an addendum is included in the report, which can be obtained by emailing biodiesel@atfcan.com or from the AMF website. Also identified in the study were several gaps in current knowledge where additional research would be beneficial prior to undertaking a quantitative risk assessment.

To supplement the data currently available, the University of Toronto is developing a methodology for testing various biodiesel production processes, to assess deactivation capabilities. A screening method for proteins in non-aqueous media is also being developed at Queen's University. This methodology should become a valuable tool for confirming the absence of TSE-inducing agents in biodiesel produced from SRM and other animal waste products. In a separate segment of work, the Saskatchewan Research Council is creating new in-house capacity to produce protein materials for use in related research programs.

Annex XXXI Fischer-Tropsch Fuels

Operating Agent: Atrax Energi och Miljö AB (SE)

Subcontractors: The Swedish Transport and Research Institute (TFK)
Technical University of Denmark (DTU)

In October 2004, at its 31st ExCo-meeting, IEA/AMF decided to start a project concerning production and use of synthetic vehicle fuels produced by Fischer-Tropsch (FT) technology. The project was carried out as Annex XXXI, with financial support from Denmark, Finland and USA. Atrax Energi AB was appointed as Operating Agent for Annex XXXI. The work in the annex was carried out in co-operation with TFK, Sweden and DTU, Denmark.

The final report was delivered to Denmark, Finland and USA in June 2007. In the report the possibilities to produce synthetic gasoline and synthetic diesel oil from biomass, and also from natural gas, by FT-technology are analyzed and discussed.

After an introduction of the technology as such, environmental aspects and the life cycle perspective of synthetic gasoline and diesel oil are discussed.

To visualise the effect on the logistic system that a future large-scale biomass based production system will have, four different scenarios are assessed in terms of, e.g., the number of production plants needed and truck arrivals to the plant.

- Denmark and Poland, with a feedstock of cultivated energy forest (Salix),
- Finland from forest residues
- USA from natural gas.

Furthermore vehicle emission tests with synthetic gasoline carried out at DTU are described and discussed in the report.

Based on the result of the analysis and the vehicle emission tests presented in the report, a first SWOT analysis of Fischer-Tropsch technology is presented, and finally some main conclusions are drawn.

During the execution of the Annex the following installations were visited: Sasol in South Africa, Nykomb Synergetics in Sweden, Chemrec in Sweden, the Technical University of Denmark, VTT in Finland, the Värnamo gasification research project in Sweden, and the Black liquor gasification project in Piteå, Sweden.

Annex XXXIV Biomass Derived Diesel Fuels

Sub-task No. 1 Analysis of Biodiesel Options

Operating Agent: Fuels, Engines, and Emissions Consulting (US)

Assistant: VTT Technical Research Centre of Finland (FI)
??????????????????

Table A. Completed Projects (Annex I – XV)

The following 15 projects/annexes have been completed during the period 1984-2000.

Annex	Title	Run time	Operating Agent	Participating Countries
Annex I	**Alcohols and Alcohol Blends as Motor Fuels**	**1984 – 1986**	**SDAB (SE)**	**5**
Annex II	**Technology Information Exchange on Alt Motor Fuels**	**1984 – 1992**	**SDAB (SE)**	**7**
Annex III	**Alcohol Diesel Field Trials**	**1987 – 1992**	**Sypher (CA)**	**6**
Annex IV	**Production of Alcohols and other Oxygenates**	**1987 – 1994**	**Energy, Mines and Resources (CA)**	**5**
Annex V	**Performance Evaluation of Alt Fuel/Engine Concepts**	**1990 – 1995**	**VTT (FI)**	**9**
Annex VI	**State-of-the-art Report on Natural Gas as a Motor Fuel**	**1990 – 1992**	**Sypher (CA) SDAB (SE)**	**6**
Annex VII	**Environmental Impacts of Alternative and Conventional Fuels**	**1992 – 1997**	**ORNL (US) Phase 1: SDAB (SE) Phase 2: Innas (NL)**	**8**
Annex VIII	**Heavy-Duty Vehicles on Alternative Fuels**	**1994 – 1998**	**VITO (BE)**	**8**
Annex IX	**Automotive Fuel Information Service (AFIS)**	**1995 – 1999**	**Innas (NL) Atrax (SE)**	**7**
Annex X	**Characterisation of New Fuel Qualities**	**1995 – 1997**	**VTT (FI)**	**7**
Annex XI	**Forecasting and Planning Tools for Alternative Fuels**	**1995 – 1996**	**Sypher (US)**	**3**
Annex XII	**Particulate Emissions from Alternative-Fuelled Vehicles**	**1996 –1997**	**ETSU (UK)**	**6**
Annex XIII	**Emission Performance of Selected Biodiesel Fuels**	**1997 – 1999**	**VTT (FI) ORNL (US)**	**7**
Annex XIV	**Feasibility of DME as a Fuel in Diesel Engines**	**1997 – 2000**	**TNO (NL)**	**7 +4 sponsors *)**
Annex XV	**Implementation Barriers of Alternative Fuels**	**1998 – 1999**	**Innas (NL)**	**5**

*) Sponsors: AVL from Austria and IFP, PSA, and Renault from France

Table B. Completed Projects
(Annex XVI - XXXIV)

The following 16 projects/annexes/sub-tasks have been completed during the period 1997-2008.

(Annex XXIII and Annex XXXII have never been carried through)

Annex XVI	**Biodegradable Lubricants**	**1998 – 2004**	**DTU (DK)**	**6**
Annex XVII	**New Technologies for Heavy-Duty Vehicles**	**1998 – 2000**	**VITO (BE)**	**7**
Annex XVIII	**Future Greener Diesel Fuels**	**1997 – 2002**	**Battelle (US)**	**7**
Annex XIX	**New Fuels for New Engines**	**2000 – 2001**	**Innas (NL)**	**5**
Annex XX	**DME as Automotive Fuel II**	**2000 – 2002**	**TNO (NL)**	**7**
Annex XXI	**Deployment Strategies**	**2000 – 2003**	**Innas (NL)**	**4 from AMF 7 from HEV**
Annex XXII	**Low Temperature Particles**	**2000 – 2003**	**VTT (FI)**	**6 +2 sponsors *)**
Annex XXIV	**Information Exchange IEA AMF/AFIS**	**2000 – 2004**	**Innas (NL)**	**10**
Annex XXV	**Non-Road Engines**	**2000 – 2003**	**VTT (FI)**	**4 **)**
Annex XXVI	**Oxygenates in Diesel**	**2002 – 2005**	**Befri (SE) TEC (FI)**	**4**
Annex XXVII	**Standardization of Alternate Fuels**	**2000 – 2004**	**Atrax (SE)**	**4-6**
Sub-task No 1 Annex XXVIII	**Outlook on Standardization**	**2007 – 2008**	**Atrax (SE)**	**15**
Annex XXIX	**Heavy-Duty Urban Vehicles**	**2004 – 2007**	**VTT (FI)**	**4**
Annex XXX	**Animal Fat in Biodiesel**	**2004 – 2006**	**ATFCan (CA)**	**4**
Annex XXXI	**Fischer-Tropsch Fuels**	**2004 – 2007**	**Atrax (SE)**	**3**
Sub-task No 1 Annex XXXIV	**Analysis of Biodiesel Options**	**2006 – 2008**	**FEEC (US)**	**5**

*) Industrial partners: Ford Motor Co and Honda R&D Europe

**) Industrial partners: Fortum Oil and Gas Oy (fuels), Ecocat (former Kemira Metalkat Oy) (catalysts), and Sisu Diesel Oy (CI engines)

Table C. Completed Projects (Annex I-X)

Participation and financial commitments are shown in the following table.

Table in USD!

Annex	Participating Countries and their Contributions Œ denotes the Operating Agent. Amounts are given in 1 000 USD.													
	BE	CA	DK	ES	FI	FR	IT	JP	NL	NZ	SE	UK	US	Total
I Alcohols as Motor Fuels		35						35		15	Œ 25		35	145
II Information Exchange Phase 1 (1984-88) Phase 2 (1988-92)		40 60			60		40 60	40 60		30	Œ 40 60		40 60	200 390
III Alcohol Diesel Field Trials		Œ 40.5			5		40.5	40.5			40.5		40,5	208
IV Production of Alcohols Phase 1 (1987-89) Phase 2 (1990-94)		Œ 60 40					32.1	40			40		40	60 192
V Cold Test Emissions Phase 1 (1990-93) Phase 2 (1993-94) Phase 2 (1994-95)	30 7	20 30			Œ 36 50 21		20	32.3 29 7	12 17.5 7		20 30 7	12.5 7	20 37 7	160 236 63
VI Natural Gas as Motor Fuel		Œ 41.7			41.7		41.7	41.7			41.7		41.7	250
VII Environmental Impacts Phase 1 (1992-95) Phase 2 (1996-97)	25 8	25 8			25 8		25	25 8	25 8		45 8		Œ 45 8	235 56
VIII Heavy-Duty Vehicles Phase 1 (1994-98) Addend (1996-98)	Œ 5 5	5 3.5			5 5			5 3.5	5 5		5 3.5	5 3.5	5 5	40 34
IX Information Service AFIS	35	30			45				Œ 108		124	68.4	67.7	478
X New Fuel Qualities	8	8			Œ 40			8	8		12		8	92

Table D. Completed Projects (Annex XI-XXV)

Participation and financial commitments are shown in the following table.

Table in USD!

Annex	Participating Countries and their Contributions Œ denotes the Operating Agent. Amounts are given in 1 000 USD.												
	(BE) CH	CA	DK	ES	FI	FR	IT	JP	NL	SE	UK	US	Total
XI Forecasting and Planning Tools		15			10							Œ 50	75
XII Particulate Emissions	22.7	22.7			22.7				22.7		Œ 22.7	22.7	136
XIII Biodiesel Fuels	32	32			Œ 75			39.7	32	42		95	348
XIV DME as Fuel I		110	90		20			40	Œ 85	180		80	787*
XV Implementation Barriers					13			13	Œ 13	13		13	66
XVI Biodegradable Lubricants			Œ 62,7		27,7		20	20	7,7	27,7		32,7	199
XVII Heavy-Duty Vehicles	Œ 80				40		0**	40	40	40		40	280
XVIII Future Greener Diesel Fuels		5			10	10		10	10	10		Œ 10	65
XIX New Fuels for New Engines		8			8				Œ 8	8		8	40
XX DME as Fuel II			10		10	30	10	10	Œ 20	10		10	150***
XXII Low Temperature Particles		22,5			Œ 91,5		22,5	22,5		28,5		22,5	210
XXIV Information Exchange IEA AMF/AFIS		X	X	X	X	X	X	X	Œ X	X	X	X	58
XXV Non-Road Engines					Œ 60	20				20		20	120
TOTAL													$ 5 616

*) In the sum USD 787 000 are included also contributions from the Sponsors IFP/PSA/Renault (FR) with USD 55 000 and AVL (AT) with USD 32 000. The former IA member Norway contributed USD 95 000.

**) Italy contributed to this annex on a task sharing base carrying out engine tests.

***) In the sum USD 150 000 are also included contributions from the Sponsors PSA and Renault (FR), TNO and Helvoet (NL) with each USD 10 000.

Table E. Completed Projects (Annex XXVI-XXXIV)

Participation and financial commitments are shown in the following table.

Table in EURO!

Annex	Participating Countries and their Contributions Œ denotes the Operating Agent. Amounts are given in 1 000 €.												
	CA	**CH**	**DK**	**ES**	**FI**	**FR**	**IT**	**JP**	**NL**	**SE**	**UK**	**US**	**Total**
XXVI Oxygenates in Diesel	**8**				**Œ**		**8**	**8**		**(Œ) -**	**8**		**32**
XXVII Standardization of Alternate Fuels	**24**				**10**	**15**		**27**		**Œ 30**		**27**	**133**
XXVIII Sub-task No 1 Outlook on Standardization										**Œ 20**			**20**
XXIX Heavy-Duty Urban Vehicles	**56**				**Œ 140**	**40**						**152**	**388**
XXX Animal Fat in Biodiesel	**Œ 413**				**13**							**50**	**476**
XXXI Fischer-Tropsch Fuels			**40**		**30**					**Œ 0**		**60**	**130**
XXXIV Sub-task No 1 Analysis of Biodiesel Options	**15**				**15**		**15**	**15**				**Œ 15**	**75**
TOTAL													**€ 1 254**

Electronic Attachment No 2
AMF Annual Report 2008

AMF REPORTS

(ANNEX I – XXXIV)

List of Annual Reports 1994-2008
and all reports prepared within the AMF Annexes

Most of the recent reports and documents can be found in electronic form at "Downloadable Documents" www.iea-amf.vtt.fi

Annual Reports

- IEA Alternative Motor Fuels. Annual Report 1994, NUTEK, B 1995:5 (ISBN 91-7318-2885)
- IEA Alternative Motor Fuels. Annual Report 1995, NUTEK, B 1996:9 (ISBN 91-7318-3008)
- IEA Alternative Motor Fuels. Annual Report 1996, NUTEK, B 1997:6 (ISBN 91-7318-3083-SE)
- IEA Alternative Motor Fuels. Annual Report 1997, STEM, EB 4:1998 (ISBN 91-89184-03-3)
- IEA Advanced Motor Fuels. Annual Report 1998, STEM, EB 2:1999 (ISBN 91-89184-12-2)
- IEA Advanced Motor Fuels. Annual Report 1999, STEM, EB 1:2000 (ISBN 91-89184-16-5)
- IEA Advanced Motor Fuels. Annual Report 2000, STEM, EB 1:2001 (ISBN 91-89184-26-2)
- IEA Advanced Motor Fuels. Annual Report 2001, STEM, EB 2:2002 (ISBN 91-89184-28-9)
- IEA Advanced Motor Fuels. Annual Report 2002, STEM, ET 7:2003 (ISBN 91-89184-28-9)
- IEA Advanced Motor Fuels. Annual Report 2003, STEM, ET 1:2004
- IEA Advanced Motor Fuels. Annual Report 2004 (see **www.iea-amf.vtt.fi**)
- IEA Advanced Motor Fuels. Annual Report 2005 "
- IEA Advanced Motor Fuels. Annual Report 2006 "
- IEA Advanced Motor Fuels. Annual Report 2007 "
- IEA Advanced Motor Fuels. Annual Report 2008 "

Annex I Alcohols and Alcohol Blends as Motor Fuels

Operating Agent: SDAB (SE)

Results were reported in an IEA/STU publication ”Alcohols and Alcohol blends as Motor Fuels”. This report was printed in 2 000 copies for the participants. *Publicly available through SDAB.*

Annex II Technology Information Exchange on Alternative Motor Fuels

Operating Agent: SDAB (SE)

Phase 1:

Results were reported in a series of ”TRENDS”.
Available only for Participating IEA-countries through SDAB.

- No 86:1 ”(Alcohol Fuels in) Sweden”
- No 87:2 ”USA - Policy”
- No 87:3 ”Europe - Environment”
- No 88:1 ”Utilisation of Alcohol Fuels” (State-of-the-art report)
- No 88:2 ”New Publications”
- No 88:3 ”Fuel Alcohol Formulations”
- No 88:4 ”Alcohol Fuels in Japan”

Phase 2:

Results were reported in a series of ”TRENDS”.
Available only for participating IEA-countries through SDAB.

- No 88:5 ”Diesel Exhausts. Environmental and Health Effect”
- No 89:1 ”U.S. Study on Flexible & alternative Motor Fuels”
- No 89:2 ”Catalysts and filters on Diesel Engines”
- No 89:3 ”Carbon dioxide”
- No 89:4 ”Clean Motor Fuels in the U.S.”
- No 90:1 ”California Clean Air”
- No 90:2 ”Reformulated Gasoline”
- No 91:1 ”Unregulated Emissions”
- No 91:2 ”Alcohol Vehicle Emissions”
- No 91:3 ”Vehicle Emissions and Cancer Risks”
- No 91:4 ”Catalytic Treatment of Emissions”
- No 92:1 ”Future Electric Vehicles”
- No 92:2 ”Automotive Emissions Test Systems”
- No 92:3 ”Trends in Canada”

Annex III Alcohol Diesel Field Trials

Operating Agent: Sypher (CA)

The following output has been submitted. *Available only for Participants in the Annex.*

- ”IEAMAIN” data collection system, Computer software, user guide and up-dates
- On-line methanol fuels database and access facilities
- Report (Nov. 1987), ”Catalytic Converters for Emissions Control on Methanol Engines - Current Research and Development”
- Report (May, 1988), ”Comparative Review of World-wide Emissions, Legislation & Trends in Correlating Methanol Emissions Data
- Report (May, 1988), ”Annex III field Trials, Data Collection Status
- Report (Oct, 1988), ”Progress Report on Annex III
- Report (Nov, 1988), ” Comparative Review of World-wide Emissions, Legislation & Trends in Correlating Methanol Emissions Data”, revised
- Report (May, 1989), ”Diesel Exhaust Emissions Legislation and Alcohol Fuelled Engines”
- Report (Oct, 1989), ”Alcohol Fuels for Heavy Duty Engines - A survey of Current Status”
- Report (Oct, 1989), ”Diesel Exhaust Emissions Legislation and Alcohol Fuelled Engines”, revised
- Report (June, 1990), ”Alcohol Fuels for Heavy Duty Engines - A survey of Current Status”, revised
- Final Report, June 1992

Annex IV Production of Alcohols and Other Oxygenates from Fossil Fuels and Renewables

Operating Agent: Natural Resources Canada (CA)

Phase 1

The results have presented in a final report, which was printed in 1990. *Available to all IEA countries through Natural Resources Canada.*

The contents are:

- Methanol production from coal, natural gas and biomass
- Production of methanol and higher alcohols
- Transportation of methanol and other oxygenates
- Ethanol production by fermentation
- Culture of fermentation precursors
- MTBE production
- Biomass liquefaction

In addition, the OA developed a series of computer models and databases.

Phase 2

Available only for participating IEA-countries through Natural Resources Canada.

- ”Natural Gas Supply, Demand, and Price”
- ”Economic Comparisons of LNG, Methanol and Synthetic Distillates
- ”A Comparison of the Production of Methanol and Ethanol from Biomass”
- ”Greenhouse Gas (and other) Emissions from Methanol and Ethanol Production Processes”

A final report ”Production of Alcohols and Oxygenates from Fossil Fuels and Renewables” was published in 1995. *Publicly available through Natural Resources Canada.*

Annex V Cold Test Emissions

Operating Agent: VTT Processes (FI)

Phase 1

Available only for Participants of the Annex through VTT.

- Current status of Phase 1, ”Engine tests”, 1992
- Cold-start and Cold Start Emissions of alcohol fuelled Light-Duty engines, *A literature study*, 1992

Phase 2

Available only for Participants of the Annex through VTT.

- Final report of Phase 2, also including the work of Phase 1:
  ”Performance Evaluation of Alternative Fuel/Engine Concepts”, 1995

- A final public report ”Performance Evaluation of Alternative Fuel/Engine Concepts 1990 -1995” including an addendum on diesel vehicles was published in 1996. *Publicly available through VTT.*

- Nylund, N.-O. & Lappi, M. Evaluating Alternative Fuels for Light-Duty Applications. Presented at: International Fall Fuels & Lubricants Meeting, October 1997, Tulsa. Society of Automotive Engineers, 1997. 18.p. (SAE Paper 972974).

Annex VI Natural Gas as Motor Fuel

Operating Agent: Sypher (CA)

Assistant: SDAB (SE)

The final report, ”Methane as Motor Fuel” (May 1992), was printed in book form. *Publicly available*.

The objective of this study was to provide the International Energy Agency with a ”state-of-the-art” report regarding the current and potential future use of methane as a fuel for motor vehicles. In support of this overall objective, the study addressed the following topics:

- World-wide reserves and availability of natural gas; gas extraction, processing and distribution systems; potential supplies of biogas, adaptability of current situation to the transportation industry

- Current technologies used for operating vehicles on impressed and liquefied natural gas, and future trends in engine and vehicle development

- The economic and environmental consequences of expanding the use of methane as a vehicle fuel, and

- Technical and institutional barriers, which could act against the expansion of natural gas in the road transportation sector

The report provides conclusions regarding the current status of methane as a vehicle fuel, and recommendations for maximising the benefits of methane as a vehicle fuel, and expanding its use on a worldwide basis.

Annex VII — Comparison of Relative Environmental Impacts of Alternative and Conventional Fuels

Operating Agent: ORNL (US)

Assistant: Phase 1: SDAB (SE). Phase 2: Innas (NL)

The final report ”Comparison of Relative Environmental Impacts of Alternative and Conventional Motor Fuels” was printed in book form 1995. *Publicly available through ORNL/DOE.*

Annex VIII — Heavy-Duty Vehicles on Alternative Fuels

Operating Agent: VITO (BE)

A final report ”Heavy-duty Vehicles on Alternative Fuels” and a report ”Workshop on Demonstrations with Heavy-Duty Vehicles Running on AMF’s - Report of the Workshop” have been distributed to the Executive Committee. *Further distribution has not yet been decided upon.*

Annex IX — Automotive Fuels Information Service (IEA AFIS)

Operating Agent: Innas (NL)

Assistant: Atrax Energi och Miljö AB (SE)

Five volumes have been published. *They are publicly available through Innas.*

- Raw Materials and Conversion (Dec 1996)
- Distribution and Use (Dec 1996)
- Comparison and Selection (Jan 1998)
- Innovations or Illusions (Jan 1999)
- Mobile Machinery: Sector analysis (May 1999)

Annex X — Characterisation of New Fuel Qualities

Operating Agent: VTT Processes (FI)

A final restricted report ”Characterisation of New Fuel Qualities” was published and distributed to the Participants of the Annex in 1997.

- Nylund, N-O. & Aakko, P., Characterization of new fuel qualities. Presented at: State of Alternative Fuel Technologies 2000. Warrendale: Society of Automotive Engineers, 2000. 10 p. (SAE Paper 2000-01-2009).

Annex XI — Forecasting and Planning Tools for Alternative Fuels and Related Infrastructure

Operating Agent: Sypher (US)

A detailed progress report has been provided to the Participants of the Annex.

Annex XII — Particulate Emissions from Alternative-fuelled Vehicles

Operating Agent: ETSU (UK)

Interim report ”Size and Compositional Analysis of Particulate Emissions from Alternative-fuelled Vehicles”. *Available only for Participants of the Annex through ETSU.*

Annex XIII — Emission Performance of Selected Biodiesel Fuels

Operating Agent: VTT Processes (FI)

Assistant: ORNL (US)

Two final reports, which are available through ORNL and VTT.

- Aakko, P., Westerholm, M., Nylund, N.-O., Moisio, M., Marjamäki, M., Mäkelä, T., Hillamo, R. IEA/AMF Annex XIII: Emission Performance of Selected Biodiesel Fuels - VTT's Contribution. 2000. VTT report ENE5/33/2000.

- Storey, J., Irick, D., Lappi, M., McGill, R. IEA/AMF Annex XIII: Emission performance for selected biodiesel fuels - ORNL's contribution. 2001. Oak Ridge National Laboratory. Research Report

Two publications, which are available through FISITA and SAE Organisation.

- Aakko, P., Nylund, N.-O., Westerholm, M., Marjamäki, M., Moisio, M., Hillamo, R. and Mäkelä, T. The emissions from heavy-duty engine with and without aftertreatment using selected biofuels. 29th FISITA World Automotive Congress. Helsinki, FI, 2 - 7 June 2002.

- McGill, R., Storey, J., Wagner, R., Irick, D., Aakko, P., Westerholm, M., Nylund, N.-O. and Lappi, M. Emission performance of selected biodiesel fuels. JSAE/SAE International Spring Fuels & Lubricants Meeting, Yokohama, 19 - 22 May 2003. SAE Technical Paper 2003-01-1866.

Annex XIV Investigation into the Feasibility of Dimethyl Ether as a Fuel in Diesel Engines

Operating Agent: TNO (NL)

Task 1:

- ***End-Report of Annex XIV of the IA/AMF of IEA: "DME as an Automotive Fuel"***
  Number: 00.OR.VM.065.1/AvD Date: August 2000

Task 2:

- ***Toxicity aspects of Dimethylether in comparison with automotive fuels currently in use***
  Number: TNO-MEP-R99/015 Date: January 1998

- ***Proposal for safety provisions for DME fuelling systems and their installation in vehicles***
  Number: 98.OR.VM.051.1/JV Date: September 1998

- ***Failure mode and effect analysis DME vehicle storage tank systems***
  Number: TNO-MEP-R98/449 Date: November 1998

- ***Conversion of lPG distribution guidelines into DME distribution guidelines***
  Number: TNO-MEP-R99/050 Date: February 1999

Task 3:

- ***Dimethylether as an Automotive fuel Annex XIV***
  Number: BE 0472 (AVL) Date: March 1999

Task 4:

- ***DME from Biomass***
  Number: (Atrax) Date: February 1999

Task 5:

- ***Environmental effects of DME compared to other automotive fuels***
  Number: (Innas) Date: June 1999

Task 6:

- ***Automotive DME distribution infrastructure costs***
  Number: (Innas) Date: July 1999

Task 7:

- ***Workshop Dimethylether as an automotive fuel***
  Number: 97.OR.VM.003.1/RV Date: January 1997
  97.OR.VM.091.1/RV Date: December 1997
  98.OR.VM.016.1/RV Date: March 1998
  98.OR.VM.065.1/JV Date: November 1998
  99.OR.VM.025.1/JV Date: May 1999

- ***DME Newsletter***
  Number: 1 (June 1998), 2 (December 1998) and 3 (June 1999)

Annex XV — Implementation Barriers of Alternative Fuels

Operating Agent: Innas (NL)

A final report ”Implementation barriers of alternative fuels” was published in February 1999. *Publicly available through Innas.*

Annex XVI — Environmental and Economical Aspects of Implementing Biodegradable Lubricants in Vehicle Engines

Operating Agent: DTU (DK)

- van Walwijk, M., Hagenau, J., Schramm, J. “Biodegradable Lubricants”, IEA Advanced Motor Fuels Agreement – Annex XVI. Report published by Dep. of Energy Engineering on behalf of IEA Advanced Motor Fuels Agreement, December 1999.
- Schramm, J. “Biodegradable Lubricants – Phase 2. Diesel Type Vehicles.”, IEA Advanced Motor Fuels Agreement – Annex XVI. Report published by Dep. of Energy Engineering on behalf of IEA Advanced Motor Fuels Agreement, December 2002.

Annex XVII — Real Impact of New Technologies for Heavy-Duty Vehicles

Operating Agent: Vito (BE)

A final restricted report Pelkmans L., De Keukeleere D., IEA-AMF, Annex XVII: Real Impact of New technologies for Heavy Duty Vehicles, VITO-report, December 2000' has been distributed to the Participants of the Annex. *Available only for Participants of the Annex through VITO.*

Annex XVIII — Future Greener Diesel Fuels

Operating Agent: Battelle Memorial Institute (US)

A final report on “Future Greener Diesel Fuels” was completed in April 2002. *Available only for Participants of the Annex through Battelle.*

Annex XIX New Fuels for New Engines

Operating Agent: Innas (NL)

A final report has been published in January 2001 as volume 6 in the Automotive Fuels Survey, and is titled "Fuels for HCCI Engines**". *Publicly available through Innas.***

Annex XX DME as an Automotive Fuel II

Operating Agent: TNO (NL)

- TNO report: "The effect of DME on wear of fuel pump parts", December 2000
- TNO report: End report of Annex XX of the IEA/AMF: "DME as an Automotive Fuel II, Part 1", November 2001
- DTU report: End report of Annex XX of the IEA/AMF: "DME as an Automotive Fuel II, Part 2". November 2001

Available only for Participants of the Annex through TNO.

Annex XXI Deployment Strategies for Hybrid, Electric and Alternative Fuel Vehicles

Operating Agent: Innas (NL)

A final report "Deployment strategies for hybrid, electric and alternative fuel vehicles" has been published on CD-rom in December 2002. *Publicly available through Innas. Will soon be downloadable from www.ieahev.org.*

Annex XXII Particle Emissions at Moderate and Cold Temperatures Using Different Fuels

Operating Agent: VTT Processes (FI)

Three interim reports and one final report were distributed to the Participants of the Annex. *They are available only for Participants of the Annex through VTT.*

- Aakko, P. The results with the medium-duty engine. The 1st Interim report, May 2001. Restricted.
- Aakko, P. The results with two diesel cars. The 2nd Interim report, October 2001. Restricted.

- Aakko, P. The results with stoichiometric gasoline car and CNG car. The 3rd Interim report, April 2002. Restricted.

- Aakko, P. and Nylund, N.-O. IEA/AMF Annex XXII: Particle emissions at moderate and cold temperatures using different fuels. VTT report PRO3/P5057/03. Restricted.

The following publications are p*ublicly available through SAE and VTT.*

- Aakko, P. and Nylund, N.-O. Particle emissions at moderate and cold temperatures using different fuels. SAE Technical Paper 2003-01-3285

- Paper for Windsor Workshop, June 2004 (Windsor Workshop in 2003 was cancelled)

Annex XXIV Information Exchange IEA AMF/AFIS

Operating Agent: Innas (NL)

Three newsletters "IEA AMF/AFIS Fuels Update" per operating year.

Publicly available through Innas, the ExCo members and the AMF Secretary. Can be downloaded from www.innas.com/fuel news.

Annex XXV Fuel Effects on Emissions from Non-Road Engines

Operating Agent: VTT Processes (FI)

The complete final report is for the participants only and available through VTT. A public version of the final report can be downloaded on IEA-AMF web pages (http://www.vtt.fi/virtual/amf/annex_xxv/annexxxv.html).

- Murtonen, T. Fuel Effects On Emissions From Non-Road Engines, Interim Report, October 2002

- Murtonen, T. and Nylund, N.-O. Fuel Effects On Emissions From Non-Road Engines, Final Report, June 2003

Annex XXVI Alcohols and Ethers as Oxygenates in Diesel Fuel

Operating Agent: Befri Konsult (SE) & TEC TransEnergy Consulting Ltd (FI)

A final report "Alcohols/Ethers as Oxygenates in Diesel Fuel: Properties of Blended Fuels and Evaluation of Practical Experiences" was completed in June 2005. The report is available for downloading at www.iea-amf.vtt.fi

Annex XXVII Standardization of Alternative Motor Fuels

Operating Agent: Atrax Energi och Miljö AB (SE)

A report covering data and information collected during Phase I as well as proposals for future work has been distributed in November 2003.

In October 2004 a report of Phase II concerning co-operation between IEA/AMF and CEN and/or ISO was distributed

Both reports are now publicly available (see *AMF website for "Downloadables").*

Annex XXVIII Sub-task No.1
Outlook on Standardization

Operating Agent: Atrax Energi och Miljö AB (SE)

A report covering data and information collected concerning standardization of alternative fuels on global, regional as well as country specific level has been distributed in August 2008.

This report is now publicly available (see *AMF website for "Downloadables").*

Annex XXVIII Information Service & AMF Website (AMFI)

Operating Agent: TEC TransEnergy Consulting Ltd (FI)

- One AMFI Newsletter in 2004
- Four Newsletters in 2005
- Three Newsletters in 2006
- Four Newsletters in 2007
- Four Newsletters in 2008

(see *AMF website for "Downloadables")*

A highly topical "Outlook Report" on projections for transportation energy, vehicle technology and advanced/alternative fuels was distributed as a restricted version to the Executive Committee in February 2007.

A condensed version of the "AMF Outlook" report was prepared in co-operation with EU Bioenergy NoE:

Nylund, N-O., Aakko-Saksa, P. and Sipilä, K. Status and outlook for biofuels, other alternative fuels and new vehicles. VTT Research Notes 2426. 2008.

This report is now publicly available (see *AMF website for "Downloadables").*

Annex XXVIII Information Service & AMF Website (AMFI)

Sub-task No.1 Outlook on Standardization

Operating Agent: Atrax Energi och Miljö AB (SE)

A report covering data and information collected concerning standardization of alternative fuels on global, regional as well as country specific level has been distributed in August 2008.

This report is publicly available (see *AMF website for "Downloadables").*

Annex XXIX Heavy-Duty Urban Vehicles

Operating Agent: VTT Processes (FI)

The results of the Annex are presented in a public report, which can be downloaded via VTT's website at http://www.vtt.fi/inf/pdf/tiedotteet/2007/T2396.pdf or via the IEA-AMF website at http://virtual.vtt.fi/virtual/amf/download.html.

Annex XXX Biosafety Assessment: Animal Fat in Biodiesel

Operating Agent: ATFCAN (CA)

The complete final report "Biodiesel from Specified Risk Material Tallow: An Appraisal of TSE Risks and their Reduction" is available in hardcopy format. Copies have been distributed to the participants of the Biosafety Workshop in Ottawa, Canada, on June 2005. To obtain a hardcopy of the report, please email biodiesel@atfcan.com or info@atfcan.com. An electronic version of the report is available as a downloadable PDF at ATFCAN's website (www.atfcan.com), alternatively via AMF website/"Downloadable Documents".

Annex XXXI Fischer-Tropsch Fuels

Operating Agent: Atrax Energi och Miljö AB (SE)

Subcontractors: The Swedish Transport and Research Institute (TFK)
Technical University of Denmark (DTU)

A report was distributed in June 2007 covering literature survey, analysis of relevant life cycle data, 4 different scenario calculations including a well-to-wheel perspective and finally an environmental evaluation including new data from emission tests carried out at DTU on synthetic (FT) gasoline. The report is publicly available.

Annex XXXIII
Particle Emissions of 2-S Scooters

Operating Agent: Univ. of Applied Sciences Bern
Lab. for Exhaust Emissions Control (CH)

1st Information Report about international activities 2004/2005 is available.
2nd Information Report about international activities 2005/2006 is available.
3rd Information Report about international activities 2006/2007 is available.

Annex XXXIV Biomass Derived Diesel Fuels

Sub-task No. 1 Analysis of Biodiesel Options

Operating Agent: Fuels, Engines, and Emissions Consulting (US)

Assistant: VTT Technical Research Centre of Finland (FI)

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