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IEA
Advanced Motor Fuels

Annual Report 2006

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These electronic attachments and other updated information on IEA/AMF is found on

a) www.iea-amf.vtt.fi

b) www.iea.org/impag

February 2007

To IEA

IEA Advanced Motor Fuels

Annual Report 2006

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 2006 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

The year 2006 again saw instability and uncertainty about oil supplies and fuel prices. Again, there was a steep increase in the price of oil during part of the year and a fallback toward the end of the year. Projections are for continued growth in demand for oil while excess production capacity will continue to be very small, lending to the threat of large price fluctuations whenever there is any upset in the supply.

Governments around the world are beginning to give even greater attention to the development of alternatives to traditional petroleum-derived fuels. Biofuels are garnering a lot of attention in many countries, and there are new government initiatives in the U.S. and in Europe that will push the development of biofuels industries and fuels infrastructure and promote the use of these fuels in transportation and in other energy-consuming sectors.

In its supported activities the IEA Executive Committee on Advanced Motor Fuels (AMF) continues to be at the forefront of the issues of the day. 2006 was the second year of the current 5-year strategic plan for which the stated vision AMF remains as follows:

To contribute to the growing market penetration of advanced motor fuels and the widespread deployment of sustainable technologies for transport. Improved emissions and improved energy efficiency and security are the goals of this vision. To achieve its vision the AMF's aim is to become a leading international player in the promotion of international collaboration in R&D, deployment, and dissemination of clean, energy-efficient, and sustainable fuels and related vehicle technology. The AMF will seek annex proposals that are consistent with the goals and objectives of the strategic plan

The 32nd meeting of the Executive Committee was held in Beijing, People's Republic of China in October 2006. China has an interest in joining the AMF Implementing Agreement and, therefore, invited the Executive Committee to meet in Beijing. The meeting was hosted by the China Automotive Technology & Research Center (CATARC). In informal sessions the Committee heard presentations from the Chinese delegation on their activities and their interest in becoming a member of the AMF. The Committee also heard summaries of activities in the U.S., Europe, and Japan. Progress in five current annexes was presented by operating agents, and proposals for five new annexes were delivered. In executive sessions the Committee officially closed Annex XXXII – Future Fuels for Transport and extended the term of the other four current annexes. The Committee also took action to officially start one of the new proposals – Annex XXXIV – Analysis of Biodiesel Options. Two proposals were folded into Annex XXVIII – Information Service and AMF Web Site, and the remaining proposals will require further elaboration.

The Committee officially invited China to join the AMF implementing agreement, and the Chinese delegation accepted the invitation. It was proposed that a short AMF Executive

Committee meeting be held in conjunction with the Society of Automotive Engineers meeting in Detroit, Michigan, April 2007. It was also proposed that a full meeting be planned for the fall of 2007, possibly in Mexico.

The chairman wishes to thank all of the participants for their efforts throughout 2006. Dr. Nils-Olof Nylund and Mr. Shunichi Tokishita have served ably as vice-chairmen, and we thank them for their efforts. Thanks are due also to Dr. Claës Pilo for his work as secretary for the Committee.

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

1. International Situation

World transportation energy situation provides the backdrop for bold new emphases on alternative and substitute fuels

(Prepared by Ralph McGill)

The year 2006 was another year of uncertainty and turmoil in world oil markets, with the price of crude oil spiraling upward to new highs and turning down at the end of the year, as is illustrated in Figure 1 below.

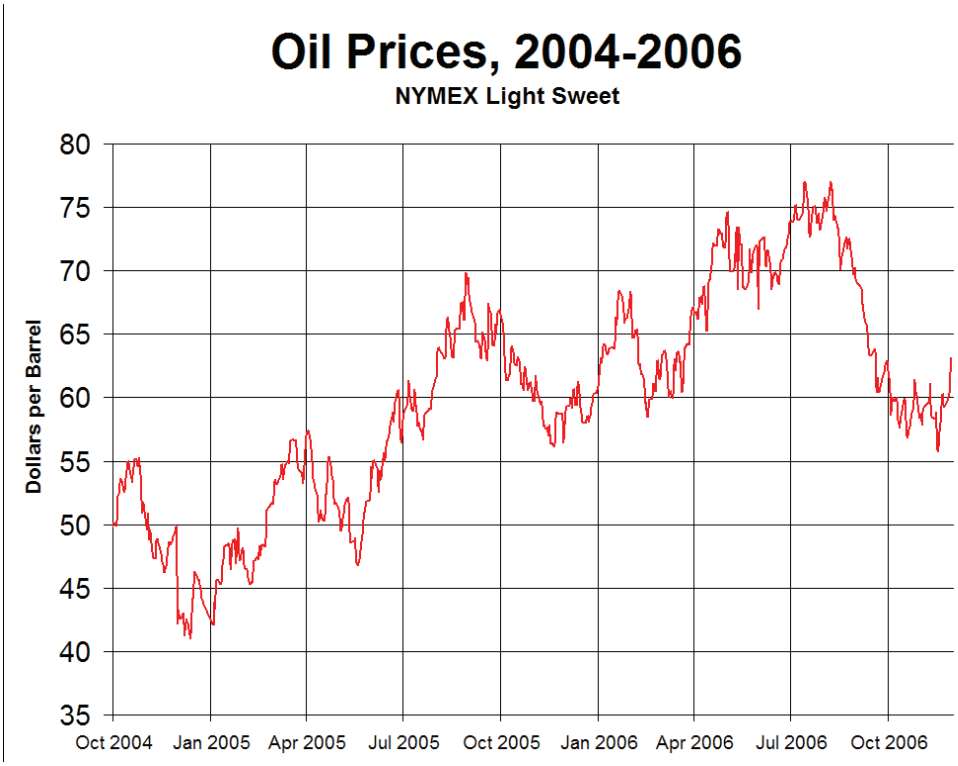

Figure 1 - Oil prices in US dollars - 2004 – 2006

Source: Wikepedia.org: http://en.wikipedia.org/wiki/Oil_price_increases_of_2004_and_2005

Such instabilities in the price of such a common and critical commodity lead to personal and national economic disruptions and hardships. This pattern of rising and falling oil prices appears to be repeating itself on an annual basis now and apparently derives from fundamental market realities – rising demand for oil and a diminishing excess capacity for producing oil. In its International Energy Outlook 2206, Chapter 3 (http://www.eia.doe.gov/oiaf/ieo/oil.html) the U.S. Energy Information Administration (EIA) forecasts that world oil demand will increase by 47 percent from 2003 to 2030, and non-OECD Asia, including China and India, will account for 43 percent of the increase. More specifically, EIA forecasts that total petroleum supply in 2030 will need to increase by 38 million barrels per day to 118 million barrels per day from the 2003 level of 80 million barrels per day.

Figure 2 illustrates the forecast for growth in oil consumption by major energy-consuming sectors.

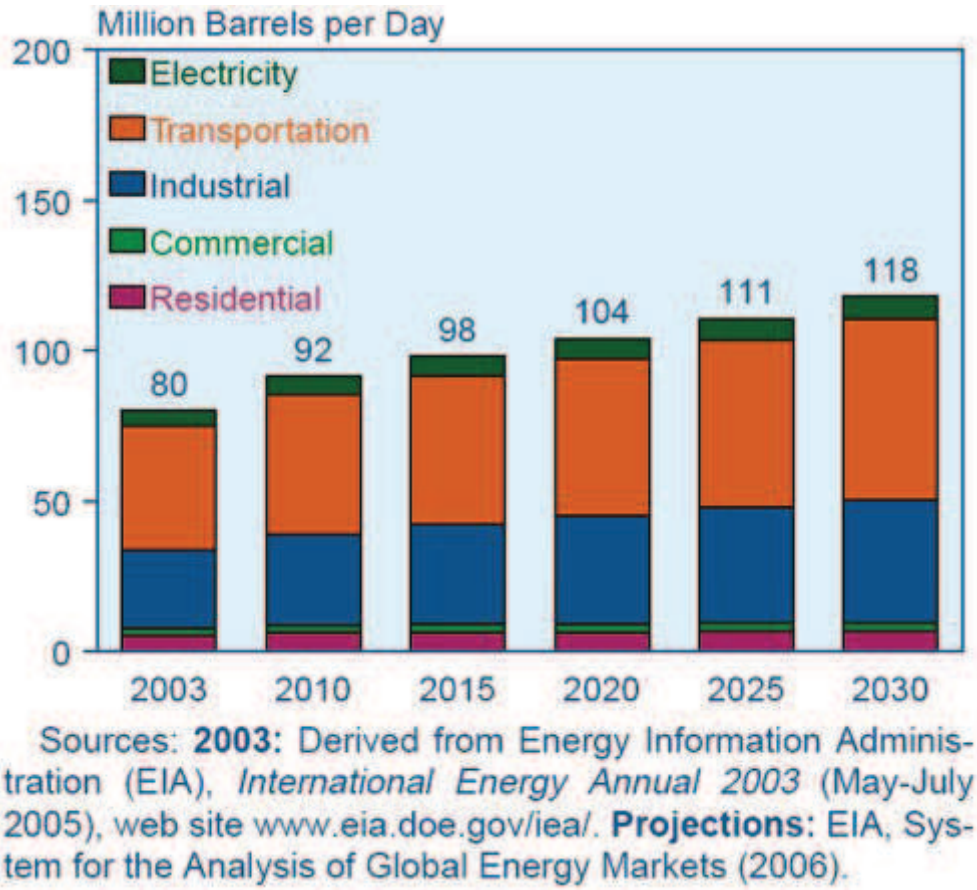

Figure 2 - Growth in oil demand by sector - 2003 – 2030
Source: EIA International Energy Outlook 2006

Clearly, transportation is expected to be one of the big growth sectors in the future demand for petroleum, accounting for 50% of the total growth in demand, and much of that demand growth will be driven by the growing demand for transportation fuels in the expanding economies of Asia. Non-OPEC supplies of both conventional and "unconventional" resources (biofuels, coal-to-liquids, gas-to-liquids) are projected by EIA to **rise to 11.5 million barrels per day and account for 10% of the total world petroleum supply in 2030**.

Two major new government initiatives will greatly contribute to realizing or even exceeding this projection. One is the Advanced Energy Initiative in the U.S., and the other is a similar initiative in Europe, the EU Strategy for Biofuels.

The U.S. Advanced Energy Initiative (AEI) has as its main goal to replace 75% of imported oil from the Middle East by the year 2025. This would be accomplished by utilizing more domestic resources for energy. As part of the AEI the Biofuels Initiative would be a major contributor to reaching the goals. The short-term goal of the Biofuels Initiative is to make cellulosic ethanol competitive with conventional ethanol processes by the year 2012. The program will strive to reach a target ethanol-from-cellulose price of $1.07 by 2012. The longer-term goal is to replace 30% of 2004-level U.S. energy needs with biofuels by the year 2030, the so-called "30-by-30" goal.

The Biomass R&D Technical Advisory Committee, established by the U.S. Congress, envisioned the goal of 30% replacement with biomass-derived fuels and commissioned a study to determine whether U.S. agricultural and forest lands would be able to support such a goal. The study, referred to commonly as "The Billion Ton Study" (http://feedstockreview.ornl.gov/pdf/billion_ton_vision.pdf), concluded that it would require a billion tons of biomass to support the goal and that, in fact, over 1.3 billion dry tons of biomass per year could be harvested from just agricultural and forest lands. This would be more than enough to meet the goal while still continuing to meet food, feed, and export demands.

An implementation plan for accomplishing this goal is presently being developed by government agencies, and the President's proposed 2007 budget includes large increases in funding to the departments and programs that will be involved in implementing the program.

A similarly ambitious goal has been embraced by the European Union. The EU Strategy for Biofuels seeks to increase the share of renewables from 4% to 12% of EU's energy by 2010. This would improve the EU's energy security, reduce greenhouse gas emissions, support agricultural policy, and open economic growth for developing countries. Benefits from achieving this goal are viewed as being:

- Stimulating demand for biofuels
- Capturing environmental benefits
- Developing production and distribution of biofuels
- Extending supplies of feedstocks
- Enhancing trade opportunities
- Supporting developing countries
- Research and Development (Industry-led "Biofuel Technology Platform")

The IEA AMF is well positioned to contribute to the international discussion on advanced fuels including biofuels. Recent and past Annexes have included the following topics relevant to recent world developments in biofuels as detailed above:

- Emission Performance of Selected Biodiesel Fuels
- Future Greener Diesel Fuels
- Alcohols and Ethers as Oxygenates in Diesel Fuel
- Standardization of Alternative Motor Fuels
- Animal Fat in Biodiesel
- Fischer-Tropsch Fuels
- Future Fuels for Road Transport
- Analysis of Biodiesel Options (new, ongoing)
- Ethanol as a Fuel for Road Transportation (pending decision)

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 Fuel collaboration programme was launched with 5 participating countries in 1984. Today 11 countries are involved in the Programme and form a very interesting and efficient network.

France joined the Advanced Motor Fuels collaboration programme in 2000, Denmark in 2001, Spain in 2002, and Switzerland in 2004. The Czech Republic and the People's Republic of China have announced that they will join.

The following countries and designated bodies are active today:

Canada	Department of Natural Resources Canada (NRC)
Denmark	Technical University of Denmark (DTU)
Finland	TransEnergy Consulting Ltd (TEC)
France	Agence de l´Environnement et de la Maîtrise de l´Energie (ADEME)
Italy	ENI S.p.A.
Japan	New Energy and Industrial Technology Development Organization (NEDO)
	Organization for the Promotion of Low-Emission Vehicles (LEVO)
Spain	Institute for the Diversification and Saving of Energy (IDAE)
Sweden	Swedish Energy Agency (STEM)
Switzerland	University of Applied Sciences Bern (AFHB)
UK	Department for Transport (DfT)
USA	US Department of Energy (DOE)

Those interested to participate as Observers at the meetings of the AMF Executive Committee (see Para. 3.7) 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, Fax +46 8 15 11 91, E-mail pilo.sdab@swipnet.se

3. The Implementing Agreement and the AMF Programme

(Status February 2007)

3.1 Strategic Plans

A first strategic plan was prepared in 1995 and a second ”Strategic Plan for 1999-2004” in 1998. A third “Strategic Plan 2005-2009” (see IEA/AMF website **www.iea-amf.vtt.fi**) was approved by the IEA Committee on Energy Research and Technology (CERT) in June 2004. (For details see Chapter 3.9).

3.2 Change of the Name

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 Objectives

Every new fuel has impacts on the whole fuel chain, on feedstock, fuel processing, fuel distribution and end-use including environmental impacts and possible vehicle modifications. It is therefore necessary to have a good understanding of the whole complex system when choosing future fuel options.

The objective of the Advanced Motor Fuels collaboration programme is to deal with such aspects by co-operation on research and demonstration, by exchange of information and creation of a network of experts in the field of advanced motor fuels. Participants are concerned about emissions, energy efficiency, field trials as well as system aspects (such as life-cycle analysis on energy use and greenhouse gas emissions). The AMF collaboration programme forms a suitable platform for co-ordinated efforts on an international level to evaluate new fuel options where experts in Advanced Motor Fuels share experiences and results of their endeavours.
The current “Strategic Plan for 2005-2009” sets the emphasis on:

Information & Membership

- Info service & database
- Country-specific updates
- Website for AMF activities
- Promote membership
- Share info with developing countries
- Provide reliable info to policy & decision makers
- Promote awareness of the need for sustainable transport

RDD&D

- Define R&D priorities
- Encourage collaborative actions (member countries and related IAs)
- Seek co-operation with other programs on new fuels and new vehicle technology (EU, World Bank, etc)
- Seek alliances with industry

Market Facilitation

- International harmonization of fuel specifications and standards
- International harmonization of test procedures
  (for vehicles using new types of fuels & propulsion systems)

Participants in the Programme welcome the submission of proposals for exploratory projects on fuels and emission control in areas such as road transport, other transport modes, off-road vehicles and other working machines, lubricants and standardisation of fuels, components and tests.

3.4 Definition of Advanced Motor Fuels

Fuels included under the definition of Advanced Motor Fuels are fuels that fulfil 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

In the current "Strategic Plan 2005-2009" two new, partly overlapping criteria have been added:

- 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

3.5 Participating Countries

Presently, eleven countries participate in the IEA collaboration on advanced motor fuels:

Canada, Denmark, Finland, France, Italy, Japan, Spain, Sweden, Switzerland, 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.

3.6 Executive Committee and Secretariat

The practical work within the IA is co-ordinated by an Executive Committee (ExCo). The ExCo of the IA on AMF is an active and authoritative group of persons, 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 Executive Committee meets twice a year in different participating or new countries, reviews the progress and results of Annexes, approves new Annexes as proposed by Participants, and determines other specific activities.

An IEA/AMF Secretariat assists the Executive Committee in planning meetings, initiating new Annexes, assisting Operating Agents, providing information to the IEA Secretariat, disseminating information and responding to member's inquiries. In its meetings in June 2006 in Toronto and October 2006 in Beijing the Committee prepared guidelines for the functions and duties of the Chairpersons and the Secretary.

3.7 End-of-Term Report 1999-2004

An End-of-Term Report for the period 1999-2004 (see IEA/AMF website **www.iea-amf.vtt.fi**) was presented to and approved by the IEA End-Use Working Party (EUWP) in March 2004.

The report summarized the **financial commitments** since start:

Period		*Total budget (1 000 $)*	*Project budget (1 000 $)*
1984-1992	(4 proj)	1 193	298
1993-1998	(7 proj)	1 379	197
1999-2004	(12 proj)	3 018	252
Running projects	(6 proj)	1 252	209
		---	---
	Total	6 842	236

The **involvement of industry** during the period 1999-2004 was summarized as follows:

- Chemical industry — Akzo-Nobel
- Catalyst industry — Haldor Topsöe, Ecocat
- Energy industry — Amoco, Fortum, Statoil
- Vehicle industry — Ford, Honda R&D, PSA, Renault, Volvo Trucks
- Engine industry — Sisu Diesel

Some **examples of added value** were given in the End-of-Term Report:

- Getting access to: Analysis, R&D Results, Market Experiences, R&D Teams, Lab Equipment, Fuels, Vehicles
- Developing international fuel standards
- Facilitating future market introduction
- Creating international contacts: Government, Fuel & Vehicle Industry, Research

3.8 Projects/Annexes

Altogether, 27 collaborative projects (Annexes) have been completed (see Table 3 and 4) since the programme started in 1984.

5 others are presently running (see Table 1 and 2).

In the End-of-Term Report are summarized the following areas covered:

	Annexes
• General information	IX, XXIV, XXVIII
• New fuels	XIV, XVIII, XIX, XX, XXV, XXXIII
• Emissions – particles	XIII, XXII, XXV, XXXIII
• Health effects	XXX
• Test procedures	XVII, XXIX, XXXIII
• Lubricants	XVI, XXXIII
• Non-road engines	XXV
• Standardization	XXVII
• Implementation	XV, XXI
• Operational experience	XXVI

3.9 Strategic Plan 2005-2009

A Strategic Plan for the period 2005-2009 (is found on the IEA/AMF website **www.iea-amf.vtt.fi**) was approved by the IEA Committee on Energy Research and Technology (CERT) in June 2004.

Some important **challenges in the transport sector** are summarized in the plan as a background:

- Number of vehicles increase rapidly around the world
- Energy conservation, security of supply and sustainability become increasingly important
- Transport related CO2 emissions increase – in contrast to other sectors
- Technology leaps and major changes in consumer behaviour are needed to reduce CO2 emissions substantially
- The choice of technical options is widening. How pick the best alternatives?

The **AMF Objectives** are described in Chapter 3.3.

The **AMF Mission** is defined as follows:

- To become a leading international player in RDD&D of clean, energy efficient and sustainable fuels and related vehicle technology
- To remain a fuel neutral platform for RDD&D and a respected clearing-house for information

AMF should have **main focus** on:

- Forming policies and strategies to facilitate the market introduction of advanced motor fuels and related vehicle technology

Examples of **future projects** are also mentioned:

- Cost-effectiveness of various ways to reduce CO2 emissions from transport
- Production capacity of various fuels
- Fuels and emissions – Marine transport
- Concerted demonstration activities
- Joint efforts for market deployment of clean fuels and clean vehicles
- Technology transfer to developing markets

3.10 Recent Initiatives

During its last meetings ExCo 30 in October 2004 in Sao Paulo, Brazil, and ExCo 31 in November 2005 in Prague, Czech Republic, and ExCo 32 in October 2006 in Beijing, China, the Executive Committee took a number of initiatives.

ExCo 30 took place in Brazil 2004

- An End-of-Term Report 1999-2004 was adopted.
- A new Strategic Plan 2005-2009 was adopted.
- Two new Annexes (XXXI and XXXIII) were started and one Annex (XXVII) closed.
- Brazil and the Czech Republic announced that they were interested to join.

ExCo 31 took place in the Czech Republic 2005

- The Czech Republic declared that they would join in 2006.
- Four proposals for new Annexes were presented and three Annexes (XVI, XXVI and XXX) closed.
- The new electronic newsletter AMFI was published with four issues in 2005. Each newsletter includes a special article on a highly topical matter, e.g. biofuels, CTL, NO_2 emissions etc. The newsletter is distributed to a wide audience: Delegates, Alternates, Operating Agents, governmental representatives, industry, other Implementing Agreements, etc.
- Decision was taken to produce an "Outlook Report" on projections for transportation energy, vehicle technology and advanced/alternative fuels within the AMFI information system in 2006.

- It was decided to arrange an informal planning meeting in June 2006 in connection with the Windsor Workshop.

ExCo 32 took place in China 2006

- China announced that they were interested to join.
- A new procedure for electing AMF Secretary was introduced.
- New Guidelines for the Chairman and Vice Chairpersons as well as for the Secretary will be added to the present text of the Implementing Agreement (IA).
- Argonne National Laboratory will take over the responsibility for handling the AMF finances from 1st January 2007.
- A number of initiatives were proposed in order to activate the AMF program. They will be discussed during a planned short ExCo 33 meeting in April 2007 in Detroit.
- It was decided to prepare an "Outlook on Standardization" with all member countries participating.
- A new Annex XXXIV on "Analysis of Biodiesel Options" was started and three Annexes were prolonged.
- Two preliminary proposals for new Annexes were presented: "Ethanol as a Fuel for Road Transportation" and "Formulation of diesel fuels for the next years – Impacts of synthetic fuels and new biodiesels".
- An exchange of information between the two Implementing Agreements AMF and Bioenergy is planned.
- An informal planning meeting to discuss AMF strategy and direction took place in June 2006 in Toronto, Canada.
- A special short ExCo 33 meeting will be arranged in Detroit in connection with the SAE World Congress in Detroit in April 2007.
- The next full size ExCo 34 meeting will hopefully take place in Mexico in October 2007.

3.11 IEA/AMF on Internet

- As a part of the new Information System, Annex XXVIII, the AMF website was completely reworked in 2005. Public reports are now easily accessible. 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 2007)

Table 1. Running Projects/Annexes

The following five projects/annexes are presently running.

Annex	Title	Run time	Operating Agent	Participating Countries
Annex XXVIII	Information Service & AMF Website (AMFI)	2004 - - - -	TEC (FIN)	11
Annex XXIX	Heavy-Duty Urban Vehicles	2004 – 2007	VTT (FIN)	4
Annex XXXI	Fischer-Tropsch Fuels	2004 – 2007	Atrax (S)	3
Annex XXXIII	Particle Emissions of 2-S Scooters	2004 – 2007	AFHB (CH)	6
Annex XXXIV	Analysis of Biodiesel Options	2007	FEEC (USA)	5

Table 2. Running Projects/Annexes

Participation and financial commitments are shown in the following table.

Annex	Participating Countries and their Contributions Œ denotes the Operating Agent. Amounts are given in 1 000 €.											
	CDN	**CH**	**DK**	**ES**	**FIN**	**FR**	**I**	**J**	**S**	**UK**	**US**	**Total**
XXVIII Information Service & AMF Website	X	X	X	X	Œ X	X	X	X	X	X	X	20*
XXIX Heavy-Duty Urban Vehicles	56				Œ 140	40					152	388
XXXI Fischer-Tropsch Fuels			40		30				Œ		60	130
XXXIII Particle Emissions of 2-S Scooters	0	Œ 20	0		0	0	0					20
XXXIV Analysis of Biodiesel Options	15				15		15	15			Œ 15	75
TOTAL												**633**

* Annual basic budget

5. Progress Reports by the Operating Agents

(Status February 2007)

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 (11 countries)
Total Budget	€ 20 000 in 2005, € 36 000 in 2006, € 40 000 in 2007 Paid via the AMF Fund
Project Leadership	Ms. Päivi Aakko 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.

AFIS was replaced by a new information system, AMFI (Advanced Motor Fuels Information, Annex XXVIII) in 2004. 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 joint 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, eight issues have been distributed, one in October 2004, four in 2005 and three in 2006. 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 special article. The following focus themes were discussed in special articles:

- Preparing for heavy-duty Euro 4/5 emission regulation
- Biofuels policy survey – Europe
- Nitrogen dioxide dilemma
- Coal to liquids – CTL boom in sight
- 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 also the Members of the Advanced Motor Fuels Implementing Agreement. For the Members, a special password protected area is provided.

A highly topical "Outlook Report" on projections for transportation energy, vehicle technology and advanced/alternative fuels has been prepared in 2006.

Future plans

Björn Rehnlund, Atrax, has earlier presented proposals on "Co-operation with ISO and CEN on Standardization" and "International Standard for Fuel Ethanol". It has now been decided to include this work with modified content in the AMFI Annex XXVIII in the form of an "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 have been allocated from the AMF Fund to include Atrax's work on "Outlook on Standardization" in Annex XXVIII during 2007.

5.2 Annex XXIX Evaluation of Duty Cycles for

Heavy-Duty Urban Vehicles

Operating Agent	VTT, Finland
Assistants	West Virginia University (WVU), USA Environment Canada, Canada North American Liaison Officer: Dr. Ralph McGill, USA
Sponsors	National Technology Agency (Tekes) Helsinki City Transport
Decision to start	January 2004 (ExCo 29)
Project Duration	2004 – March 2007 (3,5 years)
Participants	CDN, FIN, FR, and USA (4 countries)
Total Budget	€ 388 000
Project Leadership	Dr. Nils-Olof Nylund TEC TransEnergy Consulting Ltd Teknikantie 14 FIN – 02150 Espoo Phone: +358 9 2517 2360 Fax: +358 9 2517 2361 E-mail: nils-olof.nylund@teconsulting.fi West Virginia University: Nigel.Clark@mail.wvu.edu Environment Canada: Greg.Rideout@ec.gc.ca North American Liaison Officer : mcgillrn@ornl.gov

Background

Standardized emission certification methods for heavy-duty applications are based on stand-alone engine tests on engine dynamometers. However, this method has several limitations. Firstly, engine testing does not account for the properties of the vehicle itself (vehicle weight, drive train, body structure etc.). Moreover, engine testing is very impractical when evaluating in-service vehicles. Dismounting the engine from a vehicle is very laborious as such, and because the engine is coupled with forever more complex electrical system of the complete vehicle, even more work is needed to make the engine run as a stand-alone unit.

Testing complete vehicles on a chassis dynamometer resolves many problems and overcomes the barriers mentioned above. Additionally, complete vehicle testing generates truthful specific emissions in grams per kilometer or mile instead of per difficultly approachable grams/kilowatt-hour. A number of test cycles have been developed for heavy-duty vehicles, especially for buses. The problem is that there are no universally recognized standards for

testing of heavy-duty vehicles. It is also difficult to compare and interpret results generated with various cycles.

Objectives

The main objective is to compare a number of duty cycles with several heavy-duty vehicles aiming at the following goals:

- to generate understanding of the characteristics of different duty cycles
- to produce a key for cross-interpretation of emission results generated with different cycles
- to study the interaction between vehicle and fuel technologies and test procedures
- to pin-point the need for international harmonization in emission testing

Methodology and test program

7 new buses will be run using the 7 most well known duty cycles on chassis dynamometer. Different vehicle weights will be simulated. The test vehicles will be 3 European and 4 North American vehicles:

- diesel (Euro 3) without exhaust after-treatment (European)
- diesel (Euro 4/5) with exhaust after-treatment (SCR, European)
- natural gas, (Euro 5/EEV, European)

- diesel (US 2004 specification), with EGR and particle filter (North American)
- natural gas (US specification)
- diesel (Canadian specification)
- 1 diesel-electric hybrid bus (Canadian specification)

The measurements include both modal analysis of emissions and integrated values over the whole cycle. The operating parameters of the engines (derived from the engine control module) are recorded. Also fuel consumption will be measured.

VTT will measure the European vehicles. West Virginia will test two North American buses with conventional drive train, and Environment Canada will test one conventional bus and one bus with hybrid drive train. A description on VTT's new heavy-duty test facility can be found at: www.vtt.fi/

Each laboratory will use 3 common cycles: the German Braunschweig bus cycle, the US Orange County bus cycle and the RATP Parisian bus cycle. In addition, each laboratory will run tests on at least 4 additional cycles. VTT has included the SORT cycles developed by UITP (International Association of Public Transport).

The project combines both Cost Sharing and Task Sharing.

Expected outcome

The expected outcome is a decoder, which will make it possible to compare and normalize data that have been generated using various test cycles. As the test vehicles represent a number of different technologies, the testing will demonstrate how running conditions affect the performance of various technologies. Vehicles with advanced exhaust after-treatment can be expected to be sensitive to e.g. load and exhaust temperature. Energy savings with hybrid drive trains will be highly cycle dependent. The project will also contribute to worldwide harmonization of test methods.

A report of the Finnish tests has been prepared and the final report is expected to be ready by March 2007.

5.3 Annex XXXI Production and Use of Synthetic Vehicle Fuels made by Fischer-Tropsch Technique

Operating Agent	Atrax Energi AB, Sweden
Assistants	DTU, Denmark TFK, Sweden
Decision to start	October 2004 (ExCo 30)
Project Duration	Nov 2004 –March 2007 (2,5 years)
Participants	DK, FIN, and USA (3 countries)
Total Budget	€ 130 000 (FIN 30 000 +DK 40 000 + USA 60 000)
Project Leadership	Mr. Björn Rehnlund Atrax Energi AB Box 30192 SE-104 24 Stockholm Sweden Phone: +46 73 384 24 46 E-mail: bjorn.rehnlund@atrax.se

Background

Synthetic fuels for vehicle use, as paraffins (synthetic diesel oil) and alkylates (synthetic gasoline) are more and more being regarded as sustainable future alternative fuels for the transport sector. The main reasons are that they can be produced from natural gas as well as from almost all types of gasified biomass including garbage and sewage sludge and that the possibility to adjust them by the use of FT technique to different types of engine requirements are very good. FT-fuels are also most promising with regard to emissions and engines

performance. However, for the moment the knowledge of FT-fuels, their production and use is spread among many different sources like companies and universities and not always in a form that is easy to read and understand for policy and decision makers in government and industry.

Objectives

The main objective is to present an analysis of the FT-Fuels role in the future transportation system in an easy accessible way for politicians and other decision makers for example in the industry

Content of Work

- Collect and analyse data concerning production and use of FT-fuels for vehicle purpose (Responsible: Atrax).
- Carry out vehicle dynamometer tests with different FT-fuels with the purpose to measure engine performance as well as tail pipe emissions (Responsible: Atrax).
- Carry out life cycle analysis concerning production and use of FT-fuels produced from different raw materials in USA and the Scandinavian countries (Responsible: DTU).
- Analyse FT-fuels´ possible role in a future transport system (Responsible: TFK).

Financial Status

Total budget € 130 000. A first invoice has been sent out in February 2005 A final invoice will be sent out in December 2005/January 2006 when the annex is finally reported

Results and Reports

A draft report has been prepared in September 2006. A final report is expected in March 2007.

Future Plans

If there is an interest among the annex participants and/or other IEA/AMF participants the work of the annex can be prolonged in a second phase concerning LCA-scenarios for other regions as for example southern Europe, Japan, and India. A second phase could also include an economical study on the possibility of FT-Fuels future to be established on the fuel market.

5.4 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	Jesper Schramm, DTU, Denmark
Decision to start	October 2004 (ExCo 30)
Project Duration	July 2004 –December 2007 (option 5 years)
Participants	CDN, CH, DK, F, FIN, I, and JRC EU Laboratories (6 countries + EU)
Total Budget	No AMF budget. Task-sharing. Total costs € 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
- AMF Annex XXXIII: 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)

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 for Annex XXXIII (B169) the activities and results of following institutes have been shortly presented:

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

In the 2nd information report for Annex XXXIII (B189) the following activities have been presented:

- AFHB, Automotive Division Biel, CH of the University of Applied Sciences Bern, CH
- EMPA Federal Laboratories, CH
- ENEA & Municipality of Rome, I
- Technical University Graz, A
- EMITEC, D
- ADEME, F
- Other activities from literature

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

- Further research of:
  - influences of oils and fuels
  - influences of catalyst technology
  - special wire mesh filter - catalyst (WFC) and other filtration materials
- Adaptation of the results to the engine/vehicle technology, oils and fuels from other markets
- Further studies of health effect
- Support by legal authorities

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.

5.5 Annex XXXIV Analysis of Biodiesel Fuels

Operating Agent	Fuels, Engines, & Emissions Consulting (FEEC), USA
Assistant	TEC TransEnergy Consulting Ltd, Finland
Decision to start	October 2006 (ExCo 32)
Project Duration	January – December 2007 (1 year)
Participants	CDN, FIN, I, J, USA (5 countries)
Total Budget	€ 75 000 (each country € 15 000)
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

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.

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 will be ready by August 2007 and the final report will be distributed to the Participants by December 2007.

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, S	Folke Schippel, S	
b	Stockholm	80/7	"	"	
1.	Ottawa	84/5	Gene Ecklund, US	Folke Schippel, S	
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, S	
9.	Tokyo	88/11	Shinichi Nakayama, J	Folke Schippel, S	
10.	Vancouver	89/6	"	"	
11.	Rome>	89/11	PierPaolo Garibaldi, I	"	
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, CDN	Kerstin Larsson, S	
17.	Antwerpen	94/2	"	Irene Kolare, S	
18.	Toronto	94/10	"	"	
19.	Saltsjöbaden, S	95/9	"	Lars Vallander, S	
20.	Oxford	96/6	"	"	
21.	Charleston	97/3	Ben van Spanje, NL	Claës Pilo, S	
22.	Rovaniemi, FIN	98/1	"	"	
23.	Tokyo	98/10	"	"	
24.	Espoo/Helsinki	99/6	Nils-Olof Nylund, FIN	"	
25.	Toronto	00/6	"	"	
26.	Copenhagen	01/5	Arie Brouwer, NL	"	
27.	Milano	02/4	Nils-Olof Nylund, FIN	"	
28	Paris	03/3	"	"	
29	Linköping	04/1	Steve Goguen, USA	"	
30	Sao Paulo	04/10	"	"	
31	Prague	05/11	"	"	
-	Toronto	06/06	"	"	(short planning meeting)
32	Beijing	06/10	"	"	
33	Detroit	07/04	"	"	(planned short meeting)

Appendix 2

Executive Committee on Advanced Motor Fuels

(Status February 2007)

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Electronic Attachment No 1
AMF Annual Report 2006

MAIN RESULTS OF COMPLETED AMF PROJECTS/ANNEXES

(ANNEX I – XXVII, and XXX)

Detailed information about participating countries and their contributions is found in Tables 3 and 4 at the end.

Annex I

Alcohols and Alcohol Blends as Motor Fuels

Operating Agent: SDAB (S)

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 (S)

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 (CDN)

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 (CDN)

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 (FIN)

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 (CDN).
Assistant: SDAB (S)

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 (USA).
Assistant: Phase 1: SDAB (S). 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 (B)

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 (S)

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 (FIN)

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 (USA)

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 (FIN).
Assistant: ORNL (USA)

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 (N)
- *Safety investigation (DME distribution and vehicles):* Renault (F), Akzo-Nobel (NL), TNO-WT and TNO-MEP (NL) and NRCanada (CDN)
- *Design guidelines:* AVL-List (A), AET (CDN), Renault (F) and DTU (DK)
- *DME from renewable feedstock:* IEA AFIS (Atrax Energi, S)
- *Life cycle analysis (LCA):* IEA AFIS (Innas, NL), Amoco (USA), Statoil (N), Haldor Topsoe (DK), Volvo Truck (S), Renault (F) and TN-WT (NL)
- *Costs of DME infrastructure:* IEA AFIS (Innas), Statoil (N) and Amoco (USA)
- *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 (B)

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 (USA)

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 organisations 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 (FIN)

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-portfuel-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 (FIN)

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 (S) & TEC TransEnergy Consulting Ltd (FIN)

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 fulfil 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
Standardisation of Alternative Motor Fuels

Operating Agent: Atrax Energi AB (S)

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 XXX

Biosafety Assessment: Animal Fat in Biodiesel

Operating Agent: ATFCAN (CDN)

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.

Table 3a. Completed Projects (Annex I – XV)

The following 15 projects/annexes have been completed during the period 1984-2006.

Annex	Title	Run time	Operating Agent	Participating Countries
Annex I	Alcohols and Alcohol Blends as Motor Fuels	1984 – 1986	SDAB (S)	5
Annex II	Technology Information Exchange on Alt Motor Fuels	1984 – 1992	SDAB (S)	7
Annex III	Alcohol Diesel Field Trials	1987 – 1992	Sypher (CDN)	6
Annex IV	Production of Alcohols and other Oxygenates	1987 – 1994	Energy, Mines and Resources (CDN)	5
Annex V	Performance Evaluation of Alt Fuel/Engine Concepts	1990 – 1995	VTT (FIN)	9
Annex VI	State-of-the-art Report on Natural Gas as a Motor Fuel	1990 – 1992	Sypher (CDN) SDAB (S)	6
Annex VII	Environmental Impacts of Alternative and Conventional Fuels	1992 – 1997	ORNL (USA) Phase 1: SDAB (S) Phase 2: Innas (NL)	8
Annex VIII	Heavy-Duty Vehicles on Alternative Fuels	1994 – 1998	VITO (B)	8
Annex IX	Automotive Fuel Information Service (AFIS)	1995 – 1999	Innas (NL) Atrax (S)	7
Annex X	Characterisation of New Fuel Qualities	1995 – 1997	VTT (FIN)	7
Annex XI	Forecasting and Planning Tools for Alternative Fuels	1995 – 1996	Sypher (USA)	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 (FIN) ORNL (USA)	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 3b. Completed Projects (Annex XVII - XXVII)

The following 12 projects/annexes have been completed during the period 1997-2006.

Annex XVI	Biodegradable Lubricants	1998 – 2004	DTU (DK)	6
Annex XVII	New Technologies for Heavy-Duty Vehicles	1998 – 2000	VITO (B)	7
Annex XVIII	Future Greener Diesel Fuels	1997 – 2002	Battelle (USA)	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 (FIN)	6 +2 sponsors *)
Annex XXIV	Information Exchange IEA AMF/AFIS	2000 – 2004	Innas (NL)	10
Annex XXV	Non-Road Engines	2000 – 2003	VTT (FIN)	4 **)
Annex XXVI	Oxygenates in Diesel	2002 – 2005	Befri (S) TEC (FIN)	4
Annex XXVII	Standardization of Alternate Fuels	2000 – 2004	Atrax (S)	4-6
Annex XXX	Animal Fat in Biodiesel	2004 – 2006	ATFCan (CDN)	4
Annex XXXII	Future Fuels for Road Transport	Never started	-	-

*) 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 4a. Completed Projects (Annex I-X)

Participation and financial commitments are shown in the following table.

Annex	Participating Countries and their Contributions Œ denotes the Operating Agent. Amounts are given in 1 000 USD.													
	B	CDN	DK	ES	FIN	FR	I	J	NL	NZ	S	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 4b. Completed Projects (Annex XI-XXX)

Participation and financial commitments are shown in the following table.

Annex	Participating Countries and their Contributions Œ denotes the Operating Agent. Amounts are given in 1 000 USD.												
	(B) CH	CDN	DK	ES	FIN	FR	I	J	NL	S	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
XXVI Oxygenates in Diesel		8			Œ		8	8		(Œ) -	8		32
XXVII Standardization of Alternate Fuels		24			10	15		27		Œ 30		27	133
XXX Animal Fat in Biodiesel		Œ 413			13							50	476
TOTAL													6 257

*) In the sum USD 787 000 are included also contributions from the Sponsors IFP/PSA/Renault (France) with USD 55 000 and AVL (Austria) 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 (France), TNO and Helvoet (NL) with each USD 10 000.

Electronic Attachment No 2
AMF Annual Report 2006

AMF REPORTS

(ANNEX I – XXX)

List of Annual Reports 1994-2006
and all reports prepared within the AMF Annexes

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 (see **www.iea-amf.vtt.fi**)
- IEA Advanced Motor Fuels. Annual Report 2006 (see **www.iea-amf.vtt.fi**)

Annex I

Alcohols and Alcohol Blends as Motor Fuels

Operating Agent: SDAB (S)

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 (S)

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 (CDN)

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 (CDN)

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

Performance Evaluation of Alternative Fuel/Engine Concepts

Operating Agent: VTT Processes (FIN)

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

State-of-the-art Report on Natural Gas as a Motor Fuel

Operating Agent: Sypher (CDN).
Assistant: SDAB (S)

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 (USA)
Assistant: Phase 1: SDAB (S). 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 Using Alternative Fuels

Operating Agent: VITO (B)

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

Annex IX
The Automotive Fuels Information Service (AFIS)

Operating Agent: Innas (NL).
Assistant: Atrax (S)

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 (FIN)

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 (USA)

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

Annex XII
Size and Compositional Analysis of 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 (FIN).
Assistant: ORNL (USA)

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 (B)

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 (USA)

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 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

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 Temperature Using Different Fuels

Operating Agent: VTT Processes (FIN)

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 (FIN)

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, Iterim 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 (S) & TEC TransEnergy Consulting Ltd (FIN)

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 now available for downloading at www.iea-amf.vtt.fi

Annex XXVII
Standardisation of Alternative Motor Fuels

Operating Agent: Atrax Energi AB (S)

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

Operating Agent: TEC TransEnergy Consulting Ltd (FIN)

- One AMFI Newsletter in 2004
- Four Newsletters in 2005
- Three Newsletters in 2006
- Draft AMF Outlook report in 2006

Annex XXIX
Evaluation of Duty Cycles for Heavy-Duty Urban Vehicles

Operating Agent: VTT Processes (FIN)

A report of the Finnish tests has been prepared and the final report is expected to be ready by March 2007.

Annex XXX
Animal Fat in Biodiesel

Operating Agent: ATFCan (CDN)

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 will be available as a downloadable PDF at ATFCAN's website (www.atfcan.com) on March 5, 2007.

Annex XXXI

Production and Use of Synthetic Vehicle Fuels made by Fischer-Tropsch Technique

Operating Agent: Atrax Energi AB (S)
Subcontractors: The Swedish Transport and Research Institute (TFK)
Technical University of Denmark (DTU)

A report will be distributed in March 2007covering 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.

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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.

Electronic Attachment No 3
AMF Annual Report 2006

AMF WORKSHOPS

The following Workshops have been arranged during recent years.

- Heavy-Duty Vehicles on Alternative Fuels, Annex VIII
  Organized by: VITO (B) in Brussels, 5 December 1996

- 1st DME Workshop: DME as Fuel, Annex XIV
  Organized by: TNO (NL) in Delft, 14-15 November 1996

- 2nd DME Workshop: DME as Fuel, Annex XIV
  Organized by: TNO (NL) in Delft, 26-27 June 1997

- 3rd DME Workshop: DME as Fuel, Annex XIV
  Organized by: TNO (NL) in Naperville, Illinois, USA, 26-27 February 1998

- 4th DME Workshop: DME as Fuel, Annex XIV
  Organized by: TNO (NL) in Delft, 1-2 October 1998

- Clean Energy Vehicle Forum to discuss clean energy vehicle programmes in Japan and EU
  Organized by: NEDO, LEVO and JARI in Tsukuba, Japan, 21 October 1998

- 5th DME Workshop: DME as Fuel, Annex XIV
  Organized by: AVL (Austria) in Graz, 24-26 March 1999

- 6th DME Workshop: DME as Fuel, Annex XIV
  Organized by: Volvo (Sweden) in Göteborg, 2-3 December 1999

- Kick-off Workshop: Deployment Strategies, Annex XXI
  Organized by: Muntwyler (Switzerland) in Glattbrugg, 24-25 February 2000

- 7th DME Workshop: Dimethyl-ether as an automotive fuel II, Annex XX
  Organized by: AVL PTI (USA) in Plymouth [MI], 1-2 June 2000

- 8th DME Workshop: Dimethyl-ether as an automotive fuel II, Annex XX
  Organized by: The community of Växjö (Sweden), 17-18 January 2001

- Deployment Strategies, Annex XXI
  Workshop to discuss advanced vehicle programmes in Japan and the progress of Annex XXI
  Organized by: LEVO and NEDO in Kyoto, Japan, 6-7 June 2001

- IEA Information Centres Meeting
  Organized by: IEA, IEA HQ in Paris, 3 May 2002

- Deployment Strategies, Annex XXI
  Workshop to discuss 'Evaluation as a key to learning lessons/Defining goals of government promotion' and the progress of Annex XXI
  Organized by: Muntwyler in Vancouver, Canada, 10-11 June 2002

- Clean City Vehicles
  Workshop on "Clean City Vehicles with a special focus on Developing Countries"
  Organized by: T Månsson, EnEN, IEA HQ in Paris, 24-26 September 2002

- Clean City Vehicles
  Working meeting
  Organized by: T Månsson, EnEN, IEA HQ in Paris, 9 December 2002