July 2010, issue no. 3/2010

AMFI Newsletter

The Deepwater Horizon oil well in the Gulf of Mexico exploded on 20 April 2010 producing a leak of about 4.9 million barrels of oil in three months before the spill was successfully capped (app.restorethegulf.gov). Risks of deepwater drilling have become perfectly clear. However, oil rigs at deep waters continue activities in a number of locations. Photo with courtesy of BP © BP p.l.c. (http://www.bp.com/).

The AMFI Newsletter is prepared for the members of the Implementing Agreement on Advanced Motor Fuels of the International Energy Agency (IEA/AMF).

The AMFI releases four electronic Newsletters each year, with recent news on advanced motor fuels, vehicles, energy and environmental issues in general. The AMFI Newsletter is available online at:

www.iea-amf.vtt.fi

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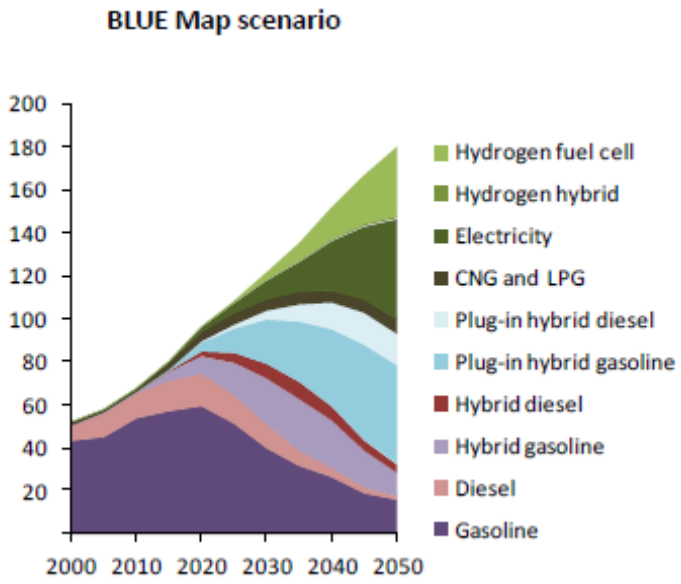
The technology revolution has begun

According to the 2010 IEA Energy Technology Perspectives (ETP), there are some signs that technology revolution to tackle climate change is under way. Investment in renewable energy is increasing. Several countries are considering the possibility of building new nuclear power stations. The rate of energy efficiency improvement is starting to accelerate in OECD countries. Public investment is increasing for low-carbon technology RD&D. In transport, major car companies are adding hybrid and full-electric vehicles to their production lines and many governments have launched plans to encourage consumers to buy these vehicles.

The target to stabilize the long-term temperature rise at 2 to 3°C requires halving global energy-related CO_2 emissions by 2050 compared to 2005 levels. The ETP2010 BLUE Map scenario charts the lowest investments needed to achieve this target. According to this scenario, world oil demand alone would be 27% less than in 2007, but even in this case, fossil fuels would still account for 46% of the primary energy demand in 2050.



Evolution of sales of light-duty vehicles. ETP 2010 © 2010 OECD/IEA. (www.iea.org).

Increased energy efficiency will become the most important "fuel" of the future. Prospects are good for cutting fuel use and CO_2 emissions from light-duty vehicles (LDVs). In addition, fuel savings over the vehicle's lifetime would compensate for the additional investments. Under the BLUE Map scenario over 50% of LDV sales would be either plug-in hybrid or fully electric vehicles by 2050. Commitments could place more than 5 million EVs and PHEVs on the road by 2020. Together, biofuels, electricity and hydrogen would represent 50% of transport fuel use in 2050. Biofuel demand for LDVs would begin to decline after 2030 owing to a strong shift towards electricity and hydrogen fuels. In contrast, the use of biofuels would rise rapidly for trucks, ships and aircraft through 2050, replacing middle distillate petroleum fuels. However, greater effort is needed. In addition, consumers should be encouraged to adopt the technologies and lifestyle choices that underpin the transition from energy-intensive, fossil-fuel based transport systems. *Source: IEA ETP 2010 Executive summary (www.iea.org), Press release, 1 July 2010 Washington D.C (www.iea.org). © 2010 OECD/IEA.*

New growth in transportation energy use

According to the DOE's Energy Information Administration (EIA) International Energy Outlook 2010 fossil fuels will to still represent more than 75% of total energy needs by 2035 if current policies are not changed. The projected use of liquids and other petroleum worldwide will increase from 86.1 bpd in 2007 to 110.6 bpd in 2035. OECD countries are projected to see a 14% increase in energy consumption, whereas non-OECD countries will see an 84% increase.

The transportation sector is the second largest consumers of total end-use energy. Almost 30% of the world's total delivered energy is used for transportation, most of it as liquid fuels. The transportation share of the total liquid consumption across the globe increases from 53% in 2007 to 61% in 2035 in the reference case.

World oil prices reached historically high levels in 2008, before a slowdown in the transportation sector due to the impact of the global economic recession. With robust economic recovery expected to continue in China, India, and other non-OECD nations, a growing demand for raw materials, manufactured goods, and business and personal travel is expected to support a rise in energy use for transportation. In the IEO2010 reference case, non-OECD transportation energy use will grow by 2.6% per year from 2007 to 2035.

The transportation energy use in the OECD nations will not begin to grow again before late 2010. Moreover, some of the OECD countries have instituted new policy measures to increase the fuel efficiency of their vehicle fleets. Thus, if OECD transportation energy use grows by only 0.3% per year over the entire projection period, it would not return to its 2007 level until after 2020.

In the long term, a steadily increasing demand for personal travel is one of the primary factors in projected increases in the energy demand for transportation. Increases in the transport of goods are expected to result from continued economic growth in both OECD and non-OECD economies. For freight transportation, trucking is expected to lead the rise in demand for transportation fuels. In addition, as trade among countries increases, the volume of freight transported by air and marine vessels is also expected to increase rapidly. *Source: DOE/EIA, 2010 International Energy Outlook, May 2010. (www.eia.doe.gov).*

Certification for sustainable biofuels

The European Commission encourages industry, governments and NGOs to establish certification schemes for all types of biofuels, including those imported to the EU. This will help implement the EU's requirements for biofuels with much lower GHG emissions and which do not come from forests, wetlands or nature protection areas. The rules for certification schemes are part of the guidelines of the Renewable Energy Directive that come into effect in December 2010. The package especially focuses on the sustainability criteria for biofuels and what is to be done in order to ensure that only sustainable biofuels are used. *Source: Press release, IP/10/711, 10 June 2010 (europa.eu).*

European strategies for clean vehicles

The European Commission has proposed a strategy to encourage the development and adoption of clean and energy efficient heavy- and light-duty vehicles as well as two- and three-wheelers and quadricycles. This strategy follows two tracks: promoting clean and energy-efficient vehicles based on conventional internal combustion engines and facilitating the deployment of breakthrough technologies in ultra-low carbon vehicles. The following fuels and powertrains are considered:

- Alternative fuels, including liquid biofuels, LPG, CNG and biogas
- Electric vehicles. For battery EVs, the forecast of the market share in new car sales is 1-2% in 2020 and to 11-30% in 2030. For plug-in hybrid vehicles, the share would be 2% in 2020 and 5-20% by 2030.
- Hydrogen fuel cell vehicles. The development and deployment of battery and hydrogen fuel cell vehicles is mutually complementary as they share many similar electrical drivetrain components.

Green vehicles have very low environmental impacts throughout their lifecycle: they use low-carbon energy sources, have low exhaust and noise emissions and can be easily recycled. The strategy is a vital part of the Europe 2020 initiative to promote new technologies that modernise and decarbonise the transport sector. The global car fleet is predicted to double from 800 million to 1.6 billion vehicles by 2030. This calls for a change to ensure sustainable mobility in the long term. *Source: COM(2010)186 final, 28.4.2010 (eur-lex.europa.eu).*

Drop in transport emissions

A drop in travel volumes due to the global economic crisis has decreased GHG emissions from the transport sector in many countries. However, in the long-term, the trend is increasing CO_2 emissions from travel activity. According to the ITF report, global CO_2 emissions from transport grew by 45% from 1990 to 2007. From 2007 to 2030, transport emissions will continue to grow by approximately 40%. This is only slightly lower than pre-crisis estimates and already takes many planned efficiency improvements into account.

Across the economy, the crisis of 2008 has contributed to a drop in emissions, which could translate into a 5-8% decrease in 2020 emissions from their pre-crisis projected levels. Some countries, notably France, Germany and Japan, saw their road CO_2 emissions stabilise or decrease even before the recession of 2008-2009, despite economic and road freight growth over the same period. *Source: International Transport Forum (ITF), Reducing transport greenhouse gas emissions, Trends & Data 2010, May 2010. (www.internationaltransportforum.org).*

The future of global transport

The ITF report, Transport Outlook 2010, provides scenarios on the evolution of global mobility until 2050. According to this report, the optimisation of the fuel economy needs to be the core strategy for reducing transport-related CO_2 emissions over the next two decades. Stabilizing GHG emissions from light-duty vehicles alone will require the fuel economy to roughly double. CO_2 emissions from cars would have to attain 90 g/km in 2050 as a global average. Nonetheless, the energy base of transport needs to be transformed in order to keep emissions from increasing after 2050. Demand management in transport can help to reduce emissions. *Source: ITF, Transport Outlook 2010. May 2010. (www.internationaltransportforum.org).*

FEEDSTOCKS

The crop yields of Jatropha may drop in the future

Jatropha curcas L. is acclaimed as a biofuel crop with a high potential to sustainably replace fossil fuels. Reliable yield assessments with conventional methods require agroclimatic and physiological knowledge that is not yet available for Jatropha. Trabucco et al. tested a novel two-step approach integrating knowledge from biogeography and population biology with available Jatropha field data. Jatropha seed yield in response to the climate was mapped worldwide for current climate conditions (averages for 1950–2000) and for the future as well (2020). The modelled Jatropha seed yield was validated against a set of on-field yield assessments. Jatropha has a pan-tropical distribution and specific adaptability to hot temperate areas. Climate variables significantly affect yield response.

Jatropha requires higher annual precipitation than previously thought to achieve significant biofuel production. In addition, the study shows that climate changes over the next decade will lead to decreased yields in zones with reduced precipitation and increased yields in regions with reduced frost risks.

Source: Trabucco, A. et al. Global mapping of Jatropha curcas yield based on response of fitness to present and future climate. GCB Bioenergy, Volume 2 Issue 3, Pages 139 – 151. June 2010.

GASEOUS FUELS

Emissions and fuel efficiency for HD methane engines

A report from the IEA/AMF Annex XXXIX “Enhanced emission performance and fuel efficiency for HD methane engines” was published in May 2010. This literature survey was conducted in order to define the state-of-the-art for methane-fuelled engines to be used in heavy-duty vehicles. The use of methane can increase energy security, mitigate CO_2 emissions, and potentially reduce toxic exhaust emissions.

Historically, the use of methane in heavy-duty engines has often been hampered by poor efficiency, but current engines might be within 5-10% (relative) of the efficiency of diesel engine technology. Future emission regulations could have a negative impact on the fuel efficiency of diesel engines, which may present an opportunity for heavy methane-fuelled engines. The reliability and durability of the exhaust aftertreatment devices for methane-fuelled engines has also given rise to some concerns.

There are two categories of HD methane engines available: retrofitted engines and those developed specifically as factory-built engines or vehicles (OEM). Additionally, both these categories can include engines that use the Otto or diesel combustion cycles.

When adapting a HD diesel engine to run on methane, two options are available: the combustion system can be changed to the Otto cycle or modified to use the Diesel Dual Fuel (DDF) cycle. The Diesel Dual Fuel cycle can offer some benefits since it uses diesel injection to ignite of the methane/air mixture “like a liquid” spark plug. Additionally, DDF systems can use either the original diesel injectors when methane is injected into the air intake, allowing the use of methane and/or diesel for more flexibility. Otherwise, a specially designed gas/diesel injector can be employed to incorporate only a small range of diesel injection. This does not allow the engine to be operated on 100% diesel, but allows for more diesel substitution by methane over the full operating range of the engine.

The fuel used in methane-fuelled engines is CNG, LNG, compressed biomethane or liquefied biomethane (LBM). LNG/LBM is the preferred fuel for long haul trucks since it has significantly higher energy density compared to compressed gas. For vehicles that operate in a local area, compressed methane might be the most suitable alternative. Other combinations of methane fuels could also be used as fuel within the transportation sector such as blends of fossil and renewable fuels with hydrogen-enriched natural gas, hythane (HCNG).

For many years, dedicated methane-fuelled city buses have used lean-burn technology or worked under stoichiometric operations. Recently, there has been increased interest in Diesel Dual Fuel concepts due to its potential benefits in infrastructure requirements, fuel efficiency and total costs. The challenge for DDF is to reach very low emission levels while offering cost-efficient solutions. *Source: IEA/AMF Annex XXXIX report, May 2010 (http://virtual.vtt.fi/.../annex39_final.pdf).*

Rise in natural gas resources

The IEA publication Medium-Term Oil and Gas Markets 2010 calls for timely and adequate investment, even though the resource base seems to be adequate. Long lead times for oil and gas projects require commitments to new supply projects years in advance. In addition, the continuing depletion of oil and gas production, geopolitical risks, and potential deepwater project delays after the recent Gulf of Mexico disaster may change the situation. In the natural gas area, there is a rise of non-conventional gas and liquefied natural gas (LNG) capacity, which will bring new gas supplies to markets over the next few years. An oversupply of gas puts pressure on prices. *Source: IEA Medium-Term Oil and Gas Markets 2010, Press release, 23 June 2010 (www.iea.org).*

Another IEA report points out that the rise of the supply of natural gas liquids (NGLs) and condensate can act as a pressure valve for the global oil market, at a time when economic, regulatory and geopolitical uncertainties are delaying the expansion of the global crude oil supply. According to IEA estimates up to 60% of expected oil supply increases through the middle of this decade derive from NGLs. *Source: Natural Gas Liquids, Supply Outlook 2008-2015. (c) 2010 OECD/IEA. (www.iea.org).*

The natural gas production in North America has started to rise after a decline until 2005. In the US, shale gas accounted for about 80% of the increase from 2007 to 2008 with coal bed methane accounting for the other 20%. Combined shale gas and coal bed methane production increased from 15% to 20% of total US production. Shale gas discoveries have led to an increase in proved gas reserves in the US. By the end of 2008, shale gas made up 13% of proven gas reserves in the US, and it may comprise 33% of the country's potential gas reserves. Unconventional natural gas is starting to come online in Canada, and the decline in total Canadian gas production is expected to end in 5-10 years. Shale gas has become feasible thanks to the development of horizontal drilling with hydraulic fracturing. Concerns regarding possible ground water contamination present some risk for future production growth. *Source: Globe and Mail, 17 May 2010 (www.theglobeandmail.com).*

DOE/EIA's Annual Energy Outlook 2010 also reported that one major factor in near-term US energy use is the production of natural gas from shale and tight sands. These unconventional sources of natural gas are currently projected to lead to significant increases in domestic natural gas production keeping imports of liquefied natural gas at low levels. *Source: DOE/EIA, Annual Energy Outlook 2010, May 2010. (www.eia.doe.gov).*

Well-to-Wheels analysis of landfill gas-based pathways

A report entitled "Well-to-Wheels Analysis of Landfill Gas-Based Pathways and Their Addition to the GREET Model" discusses biomethane resources from landfills (LFG) and the pathways by which these resources can be turned into vehicle fuel and utilised. When used as a vehicle fuel, the following figures are given on a "well-to-wheel" (WTW):

- CNG produced from LFG: 1.5–18.4 kg of CO_{2e} per million Btu
- CNG from fossil natural gas: 78.2 kg of CO_{2e} per million Btu
- LFG-based LNG: 22 kg CO_{2e} per million Btu, if grid electricity is used
- LFG based LNG: 1.5–7.7 kg $CO2_e$ per million Btu, if some of the LFG is used to generate electricity
- petroleum gasoline: 97.5 kg of CO_{2e} per million Btu

LFG-based natural gas can be one of the lowest GHG-emitting fuels for light- or heavy-duty vehicles.

Source: US Well-to-Wheels Analysis of Landfill Gas-Based Pathways. The Center for Transportation Research at the Energy Systems Division, Argonne National Laboratory, May 2010 (www.transportation.anl.gov).

ALCOHOLS, (BIO)GASOLINE

Bio-methanol plant in the Netherlands

The largest second generation biofuel plant in the world was opened in June 2010 in the Netherlands. The production capacity of BioMCN's plant is 250 million litres/a (198 million tons). Bio-methanol is produced through a process patented by BioMCN. Feedstock is crude glycerin, a sustainable biomass that is a residue from processing vegetable oils and animal fats. Sustainability was also taken into account in the construction of the plant. Instead of building a whole new plant, BioMCN revitalized an old plant that produced methanol from natural gas from the 1970s until 2005.

In comparison to regular methanol, bio-methanol reduces CO_2 emissions by 78%. Bio-methanol can be used as a feedstock for sustainable transportation fuels, such as MTBE, DME or hydrogen. Bio-methanol can also be used as a blend with gasoline (M85). *Source: BioMCN News, 25 June 2010 (www.biomcn.eu).*

Bio-methanol plant in Sweden

VärmlandsMetanol AB has selected Uhde, a ThyssenKrupp company, as a technology supplier and engineering partner for a biomass-to-methanol plant in Hagfors, Sweden. The annual production of fuel-grade methanol from forest-residue biomass will be 100,000 tonnes. In addition to the methanol, the plant can deliver district-heating water at 15 MW (thermal). VärmlandsMetanol's goal is to have the Hagfors plant operational by the end of 2013. *Sources: Wärmlands Methanol, Press release, 23 July 2010 (www.varmlandsmetanol.se) and history (www.varmlandsmetanol.se/VMhistorik.pdf).*

E10 suitability for cars in Europe

In Europe, E10 gasoline containing up to 10% ethanol will be introduced to the market at the beginning of 2011. Vehicle suppliers are currently studying which car models can tolerate E10. The new gasoline quality is suitable for most cars. Gasoline containing a maximum of 5% ethanol (E5) will be available for older cars that do not tolerate E10. For most countries, the lists of car models that can use E10 gasoline are available (e.g. *www.E10bensiini.fi*).

Neste Oil sells the ETBE plant

Neste Oil has sold its Portuguese subsidiary Neste Oil Portugal, which includes an ETBE plant in Sines, to Repsol. The Sines plant has an annual capacity of 50,000 tonnes of ETBE (Ethyl Tert-Butyl Ether), which is a bioethanol-based gasoline component. *Source: Neste Oil, Press release, 30 June 2010. (www.nesteoil.com).*

SYNTHETIC AND RENEWABLE DIESEL

Galp and Petrobras plan biodiesel production

Petrobras and Galp Energia plan to build a biodiesel production plant in Portugal. The plant will produce 250,000 tons of biodiesel per year starting in 2015. The feedstock will be the palm oil produced in the Brazilian state of Pará. The project will be implemented via a parity joint venture yet to be formally constituted. *Source: Petrobras, Press release, 3 May 2010 (www2.petrobras.com.br).*

Toyota, Hino and Showa Shell to test paraffinic fuels

Toyota Motor Corporation (TMC), Hino Motors Ltd. (Hino) and Showa Shell Sekiyu K. K. (SSSKK) plan to begin trials on a diesel-electric hybrid transit bus fuelled by a mixture of Fischer-Tropsch diesel (FTD, Shell's GTL) and hydrogenated vegetable oil (HVO), both of which are paraffinic fuels.

The trials aim to verify whether a FTD-HVO mixture can be used for extended periods with unmodified vehicle components, such as fuel hoses and fuel injectors. During the trials a Hino Blue Ribbon City Hybrid transit bus already in service by the Tokyo Metropolitan Government Bureau of Transportation, will be used on various Tokyo routes until the end of December 2010. *Source: Toyota, Press release, 30 June 2010 (www2.toyota.co.jp).*

OTHER FUELS AND VEHICLES

IEA reports on Solar, Geothermal and Nuclear Power energy

Solar electricity could represent up to 25% of global electricity production by 2050 based on the solar photovoltaic (PV) and concentrating solar power (CSP) roadmaps released by the IEA. PV mostly provides electricity for on-grid distributed generation in many regions and CSP, largely providing dispatchable electricity at utility scale from regions with bright sunlight and clear skies. PV also helps provide energy access off grid in rural areas. The organization predicts that both could generate 9,000 TWh of power in 2050. *Sources: IEA Technology Roadmaps, 12 May 2010. SP (www.iea.org/../pv_roadmap.pdf) CSP (www.iea.org/.../csp_roadmap.pdf).*

IEA's Roadmap for Nuclear Energy targets a nuclear capacity of 1,200 GW by 2050, providing around 24% of global electricity (around 9,600 TWh). This would make nuclear power the single largest source of electricity by that time, and hence a major contributor to the "decarbonisation" of electricity supply. *Source: Nuclear Energy 16 June 2010 © OECD/IEA and OECD/NEA, 2010 (www.iea.org/.../nuclear_roadmap.pdf).*

Geothermal power production could increase up to more than 1,000 TWh by 2050, according to the IEA's Geothermal Essentials report. Basic facts and prospects for geothermal energy are reported. This report shows how geothermal can be used for generating electricity and providing direct heat for numerous applications. *Source: Geothermal Essentials. 29 July 2010 (www.iea.org).*

MISCELLANEOUS

Emission regulations to be incorporated

The European Commission proposes simplifying and reducing European legislation on car type approval to end duality between EC Directives and UNECE Regulations. *Source: EC Press release, IP/10/732, 15 June 2010 (europa.eu).*

Europe to exceed limits for NO_x pollution

The European Environment Agency (EEA) predicts that in 2010, around half of the EU's Member States will fall short of one or more of the legal limits set by the National Emission Ceilings (NEC) Directive. EU Member States have the greatest difficulty meeting the emission limits for NO_x. Road transport is a major contributor to NO_x emissions in Europe. NO_x emissions from road transport have decreased since 1990, but the reduction has not always been as large as expected. The transport sector, in contrast, has grown more than predicted, and vehicle emissions have not always delivered the foreseen level of NO_x reductions. *Source: EEA Press release, 4 May 2010 (www.eea.europa.eu).*

IEA & IEA/AMF News

From the Executive Committee

The 39th IEA/AMF Executive Committee Meeting was held in Ottawa, Canada on 12-14 May 2010. A number of interesting international overviews were presented during the informal part of the ExCo meeting. Presentations addressed the situation in the EU, Canada, Norway, Japan, Germany, The Netherlands, and Sweden and also provided an overview on avant-garde engine technology.

The election of the new secretary, who will take office for a two-year period starting on 1 January 2011 was held at the 39th ExCo Meeting. A job description was given on the AMF website in January 2010. The Executive Committee unanimously elected Ms. Dina Bacovsky, Bioenergy 2020+, Austria, as the IEA-AMF Secretary. The current secretary, Mr Claës Pilo, will work together with Ms. Dina Bacovsky until 31 December 2010.

Progress of Annexes

Annex XXVIII Information Service & AMF Website: Work continues on four annual AMFI newsletters and the website. Work on Alternative Fuels Information System has started.

Annex XXXIII Particle Emissions of 2-S Scooters: The Annex has already been closed (ExCo 38), and the final report is under progress.

Annex XXXIV Sub-task No. 2 Biomass Derived Diesel Fuels, Algae as a Feedstock for Biofuels: The task Leader for Bioenergy Task 39 is working in co-operation with the AMF Annex 34 Sub-task 2 Leader on a study to gauge the potential of algae as a feedstock for transportation fuels. A single IEA joint AMF-Bioenergy report will be published.

Annex XXXVI Measurement Technologies for Emissions: A final report was prepared in January 2010 and published on the IEA-AMF Website (*link*). The results of the Annex have been published in an SAE Report 2010-01-1557 and presented at the International Powertrains, Fuels & Lubricants Meeting in Sao Paulo, Brazil, May 5, 2010.

Annex XXXVII Fuel and Technology Alternatives for Buses: This Annex is AMF's largest and it brings three IAs together (AMF, Bioenergy and HEV). The objectives are: 1) to produce data on the overall energy efficiency, emissions and costs (direct and indirect) of various technology options for buses 2) to provide solid IEA sanctioned data for policy- and decision-makers, and 3) to bring together the expertise of various IEA IAs. The Annex is progressing as planned.

40th ExCo Meeting

The 40th ExCo Meeting will be held on 9-11 November 2010 in Thessaloniki, Greece.

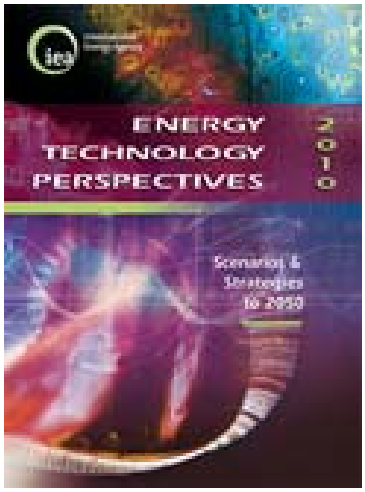
Annex XXXIX report

The Report entitled "Enhanced emission performance and fuel efficiency for HD methane engines" is available on the website (*link*).

Annex XXXVIII Environmental Impact of Biodiesel Vehicles: The Annex is progressing as planned.

Annex XXXIX Enhanced Emission Performance of HD Methane Engines: A final report was prepared in May 2010 and is published on the IEA-AMF Website (*link*). The first phase of the project, the literature survey, was closed.

PUBLICATIONS



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- Transport Outlook 2010. International Transport Forum, ITF. May 2010 (*www.internationaltransportforum.org*).
- US Algal Biofuels Roadmap. (*www1.eere.energy.gov*).

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