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IEA Combustion Agreement
A Collaborative Task on
"Alternative Fuels in Combustion"

Martti Larmi, Finland

The IEA Combustion Agreement, also known as the IEA Implementing Agreement on Energy Conservation and Emissions Reduction in Combustion, functions within a framework created by the International Energy Agency (IEA). Views, findings and publications of the IEA Combustion Agreement do not necessarily represent the views or policies of the IEA Secretariat or of all its individual member countries.

"Alternative Fuels in Combustion"

Focus on

- high efficiency engine combustion
- furnace combustion
- combustion chemistry

Objectives

1. To develop optimum combustion for dedicated fuels by fully utilizing the physical and chemical properties of synthetic and renewable fuels i.e. alternative fuels.
2. A significant reduction of especially CO2, NOX, and particulate matter emissions. (CO2 emission will be significantly reduced if the fuel is made from renewable sources.)
3. To find out the minimum emission levels for dedicated fuels.
4. Meeting future emission standards of engines without or with minimum after-treatment.

Synthetic Fuel Properties and Benefits

Excellent properties:

- Colourless, clean burning
- High cetane number, virtually sulphur-free
- Reduces local pollution even compared to so-called "sulphur-free" diesel
- Convenient and Easy to use

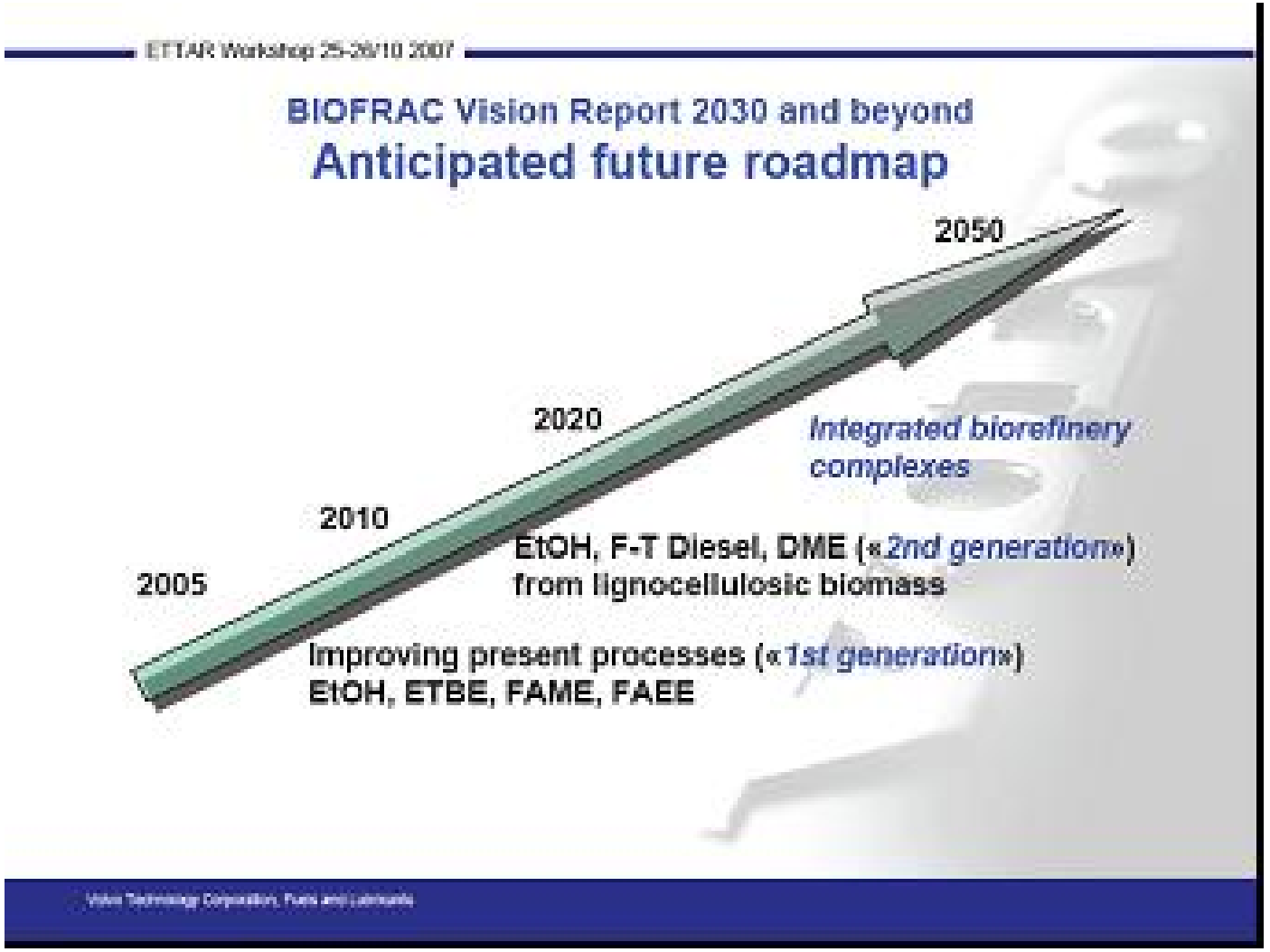
	Synthetic fuel	Refinery diesel
Cetane number	75/80	48/56

Landmark victories at Le Mans 2006 & 2007

Synthetic fuel enables development of dedicated engines:

- Reduced emissions
- Lower fuel consumption
- Better driveability
- Less noise

An example of the benefits of new fuels (Azman Abd Rashid, Shell International, JSAE F&L, 2007, Kyoto)



Fuel Roadmap by Anders Röj, ETTAR Workshop, Gothenburg, October25-26, 2007

The synthetic and renewable engine fuels to be studied (**not exclusive**)

1. Neat oxygenates like Alcohols and Ethers.
2. Biogas/methane and gas combustion
3. Fuel blends.
4. Dual fuel combustion
5. High CN diesel fuels like synthetic Fischer-Tropsch (FT) diesel fuel and hydrotreated vegetable oil (HVO)
6. Low CN number fuels

Fatty acid methyl ester (FAME) biodiesel and diesel fuel (EN 590 in Europe) and gasoline (EN228) are used as engine reference fuels

IMPLEMENTATION EXAMPLES

1. Fuel spray studies in optical spray bombs
2. Combustion research in optical engines and combustion chambers
3. Studies on reaction kinetics of combustion and emission formation
4. Studies on fuel properties and ignition behavior
5. Combustion studies in research engines
6. Computational combustion studies
7. Combustion optimization
8. Implementing the optimum combustion in research engines
9. Emission measurements

Closely related to HCCI Fuels Task and H2 Task.

OVERALL MILESTONE EXAMPLES

1. 2009 Analysis of the research results already available
2. 2011 Optimum combustion technologies for paraffinic high CN diesel fuels
3. 2012 Optimum combustion technologies for diesel fuels with high concentration of oxygenates and neat oxygenates and dual fuel engines.
4. Optimum combustion technologies for other alternative fuels

OVERALL SCHEDULE, PARTICIPATING COUNTRIES

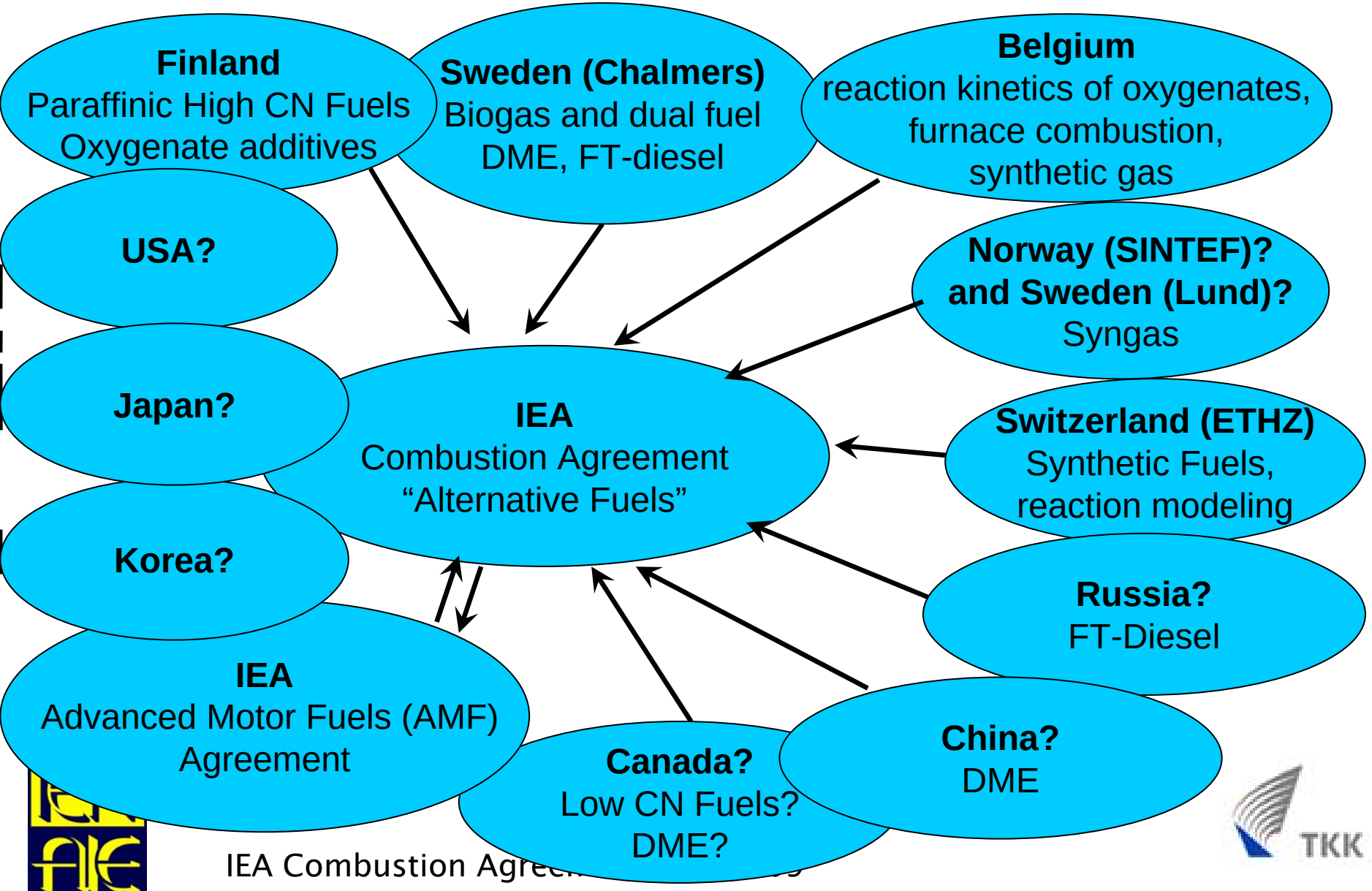
The expected project duration at start: 1.1.2009–31.12.2012.

Participating countries expressing interest and contribution (status in September 2009): Belgium, Finland, Norway, Sweden, Switzerland.

Contribution in TLM 2009 by China and Germany

"Alternative Fuels"
Collaboration between agreements
Combustion and AMF

- The project is a collaborative task in Combustion Agreement with task-share principle.
- A parallell but financially independent cost-share project of will be carried out within IEA AMF Agreement.
- Mutual reporting between agreements is the way to co-operate.
- The reporting of the AMF project progress could be done in the TLM meetings. Our Combustion agreement would report once a year the task progress in AMF ExCo. The reports include a ppt-presentation or a poster and an extended summary of the main results.
- Possible co-operation with IEA Bioenergy agreement, too.


Finland
Paraffinic High CN Fuels
Oxygenate additives
Sweden (Chalmers)
Biogas and dual fuel
DME, FT-diesel
Belgium
reaction kinetics of oxygenates,
furnace combustion,
synthetic gas
USA?
Norway (SINTEF)?
and Sweden (Lund)?
Syngas
Japan?
IEA
Combustion Agreement
"Alternative Fuels"
Switzerland (ETHZ)
Synthetic Fuels,
reaction modeling
Korea?
Russia?
FT-Diesel
IEA
Advanced Motor Fuels (AMF)
Agreement
Canada?
Low CN Fuels?
DME?
China?
DME

"Alternative Fuels in Combustion" in Lake Louise, Alberta, Canada

WEDNESDAY, September 23, 2009

07:00 – 08:50		Breakfast
08: 50	Alternative Fuels Collaborative Task	Collaborative task: alternative fuels in combustion, an IEA combustion and IEA AMF co-operation, *Martti Larmi, Helsinki University of Technology, Finland*
09:10		Emissions characterization of urban transit buses: fuel and technology alternatives, *Debbie Rosenblatt, Environment Canada, and Jean-François Gagné, Natural Resources Canada, Canada*
09:30		Towards a global reaction model for future 'designer' fuels, *A. Vandersickel, Y.M. Wright, K. Boulouchos, ETH Zurich, Switzerland*
09:50		Studies on reaction kinetics of combustion and emission formation: neat oxygenated compounds, *Jacques Vandooren and Véronique Dias, Université catholique de Louvain, Belgium*
10:10		Critical evaluation of substitution of natural gas by biogas, *Frank Behrendt, Technische Universitaet Berlin, Germany*
10:30 – 10:50		Break
10:50		DME as alternative fuel for CI engine and vehicle - progress in China, *Huang Zhen, Shanghai Jiao Tong University, China*
11:10		High cetane number paraffinic diesel fuels and emission reduction, *Martti Larmi, Aki Tilli, Ossi Kaario, Yesun Gong, Eero Antila, Teemu Sarjovaara, Harri Hillamo, Kari Häkkinen, Kalle Lehto, Helsinki University of Technology, Anders Brink ÅAU University, and Päivi Aakko-Saksa VTT, Finland*
11:30		**Subtask 1.4G:** Mixture Formation Process in a Spark-Ignition Engine with Ethanol Blended Gasoline, *Nobuyuki Kawahara and Eiji Tomita, Okayama University, Japan*
11:50		**Subtask 1.4G:** LDA/PIV Measurements of gas flow in a 4-stroke motored engine, *Tomio Obokata, Masaaki Kato and Tsuneaki Ishima, Gunma University, and Makoto Kaneko, Fuji Heavy Industries, Ltd., Japan*
12:10		Overview of the DOE Advanced Combustion Engine R&D, *Gurpreet Singh, Department of Energy, and Dennis Siebers, Sandia National Laboratory, USA*
12:30 – 14:00		Lunch