



# **WORK PLAN**

## **HEAVY-DUTY HYBRID VEHICLES ANNEX XII**

version 1  
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## CONTENTS

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1.	INTRODUCTION .....	3
1.1	International Energy Agency	3
1.2	Implementing Agreement for Hybrid and Electric Vehicle Technologies and Programs <sup>3</sup>	
2.	STATUS OF ANNEX XII HEAVY-DUTY HYBRID VEHICLES .....	4
3.	PROJECT FOCUS .....	5
3.1	Objectives	5
3.2	Subtask I: Heavy-Duty Hybrid Vehicle Technologies	5
3.3	Subtask II: Heavy-Duty Hybrid Vehicle Market Situation, Trends and Potential	5
3.4	Subtask III: General Information Gathering and Dissemination	6
3.5	Other Possible Topics:	6
3.6	Deliverables	6
4.	OPERATIONAL APPROACH.....	7
4.1	Operating Agent	7
4.2	Subtask Leaders	7
4.3	All Participants	7
4.4	Dissemination of Results	7
4.5	Optional Activity	8
5.	FINANCIAL ARRANGEMENTS .....	9
5.1	Cost-Sharing Work	9
5.2	Task-Sharing Work	9
5.3	Sponsors	9
6.	BENEFITS FOR PARTICIPATING COUNTRIES AND ORGANIZATIONS .....	11
6.1	Benefits for Countries	11
6.2	Benefits for Organizations	11
7.	SCHEDULE .....	12
8.	CONTACT INFORMATION .....	13
	ANNEX: ORGANIZATIONS INVOLVED IN HEAVY-DUTY HYBRID VEHICLE DEPLOYMENT .	14
	Transit Authorities	14
	Experience Centers	14
	Technology Providers	14

# 1. INTRODUCTION

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## 1.1 International Energy Agency

The *International Energy Agency* (IEA), based in Paris, is an autonomous agency linked with the *Organization for Economic Co-operation and Development* (OECD). The IEA is the energy forum for 26 member countries. IEA member governments are committed to taking joint measures to meet oil supply emergencies. They have also agreed to share energy information, to co-ordinate their energy policies and to co-operate in the development of rational energy programs.

Objectives of the IEA:

- to maintain and improve systems for coping with oil supply disruptions;
- to promote rational energy policies in a global context through co-operative relations with non-member countries, industry and international organizations;
- to operate a permanent information system on the international oil market;
- to improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use;
- to assist in the integration of environmental and energy policies.

## 1.2 Implementing Agreement for Hybrid and Electric Vehicle Technologies and Programs

This annex will be part of the IEA *Hybrid and Electric Vehicle Technologies and Programs* Implementing Agreement. This Agreement is an international collaboration program in which currently 8 countries participate in six annexes that each deal with different aspects related to electric and hybrid vehicles. The Chairman of this Implementing Agreement is Mr. Urs Muntwyler. The Secretary is Mr. Martijn van Walwijk. The Implementing Agreement started in 1994 with a focus on pure electric vehicles. Now the focus is on hybrid and fuel cell vehicles.

The participating countries in the *Hybrid and Electric Vehicle Technologies and Programs* Implementing Agreement are: Austria, Belgium, France, Italy, The Netherlands, Sweden, Switzerland and the United States.

The annexes in this Implementing Agreement are:

- annex I: *Information Exchange on H&EV Technologies and Programs*, new OA is under investigation;
- annex VII: *Hybrid Vehicles*, the OA is Mr. R. van Mieghem from TNO Automotive, the Netherlands;
- annex VIII: *Deployment Strategies*, the OA is Ms. S. Kleindienst from EngineeringOffice, Switzerland;
- annex IX: *Clean City Vehicles*, the OA is Mr. T. Mansson from EnEN AB, Sweden;
- annex X: *Electrochemical Power Sources and Energy Storage Systems for Electric and Hybrid Vehicles*, the OA is the Department of Energy, USA;
- annex XI: *2/3 Wheel Electric Vehicles*, the OA is Mr. U. Schwegler from Büro für Verkehrsplanung, Switzerland;
- annex XII: *Heavy-Duty Hybrid Vehicles*, the OA is Mr. S. Smets from Vito, Flemish Institute for Technological Research, Belgium;
- annex XIII: *Fuel Cells for Vehicles*, the OA is Mr. A. Dorda from the Federal Ministry for Transport Innovation and Technology, Austria.

## **2. STATUS OF ANNEX XII HEAVY-DUTY HYBRID VEHICLES**

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The reason for initiating this annex was the wish of some participants to have a specific annex focusing on heavy-duty hybrid vehicles. This idea originated from the gap between the more general approach of annex VII towards hybrid cars and the diversity of heavy-duty vehicle applications. This leaves room for treating heavy-duty hybrid vehicles and their distinct characteristics as a separate annex. During the ExCo meeting of April 2005, the Netherlands, Sweden and Switzerland showed interest. VTT was encouraged to prepare a proposal for the next ExCo meeting in October 2005.

Due to a lack of time of Juhani Laurikko of VTT, who started the initial preparations, and the reduced interest of Finland in this Implementing Agreement, the task of compiling the proposal of the work plan was taken over by Vito. Also during the ExCo meeting in October 2005 the United States and Belgium expressed their interest in participating in this annex.

Since this meeting, version 2 of this document has been prepared for presentation to the April 2006 ExCo meeting. Version 3 has been prepared taking into account the feedback from the ExCo. At the meeting in October 2006, the ExCo approved the start of this annex, which resulted in the final version of the work plan.

Austria, Belgium, the Netherlands and the United States are willing to participate in this annex from the start. Other countries, as Switzerland, Sweden, Italy and France are possibly interested to join at a later stage.

The kick-off meeting is foreseen February 9<sup>th</sup> 2007 in San Diego, US, in connection with an annex VII Expert Meeting and the SAE symposium on hybrid vehicle technologies.

## **3. PROJECT FOCUS**

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### **3.1 Objectives**

In the first phase, the new annex aims to report a current status of the heavy-duty hybrid vehicles “playing field”. Next to a general description of the heavy-duty hybrid vehicle situation, the status report will focus on the available as well as emerging hybrid vehicle technologies and on the market situation and trends. To collect and organize the required information, three subtasks are proposed for the participants to elaborate.

### **3.2 Subtask I: Heavy-Duty Hybrid Vehicle Technologies**

This technology oriented subtask aims at structuring the information about heavy-duty hybrid vehicle components, systems and configurations. At all levels this subtask needs to identify and illustrate the following items:

- technical requirements, especially highlighting where different from light duty;
- available technologies and their characteristics;
- system integration requirements.

Additionally, there will be a focus on:

- powertrain configurations (topologies);
- powertrain strategies for high efficiency and low emissions.

Based on existing experience and insights, possibly successful hybrid vehicle applications will be identified in subtask II. For each of these applications the expected optimal configuration will be explained.

A more in depth approach may involve simulations to back performance expectations and identify which technology/configuration combination best fits which application.

### **3.3 Subtask II: Heavy-Duty Hybrid Vehicle Market Situation, Trends and Potential**

This annex will also study the application area of hybrid technology for heavy-duty vehicles. First the current situation of existing hybrid prototypes and standard vehicles needs to be investigated. The information gathering will focus on the applied technology, as well as the costs and the merits in a broad sense. In this way it complements subtask I.

This subtask aims also at increasing the insights in these applications and provide essential information for future hybrid vehicle deployment projects. The lessons learned will not only focus on the technical barriers to overcome but also on the required framework (training, support, ...) for successful project implementations.

To address the potential of heavy-duty hybrid vehicles it is useful to identify niche applications that may benefit to a great extent from hybridization. Today in a lot of heavy-duty applications the gearbox PTO of the powertrain is used to provide power for auxiliary systems. In most cases, this is a cheap but energy inefficient solution. Here hybrid vehicle technology may provide a more energy efficient solution. When considering other benefits like lower emissions and noise levels, the advantage of going for a hybrid version becomes more apparent. In this way the barrier to switch to hybrid vehicles for these applications can be lowered.

It is essential to involve experience centers and technology providers in participating countries in this process. A non-exhaustive list of such experience centers and technology providers is provided in an annex to this document. Either the local

participant involves them in this study and/or these organizations are invited to attend those expert meetings that take place close to their offices.

### **3.4 Subtask III: General Information Gathering and Dissemination**

The operating agent will gather general information about heavy-duty hybrid vehicles and distribute it to the participants. The collected information will also be structured in a report.

To increase the attractiveness of participating in the annex, the operating agent will prepare papers and presentations dealing with the contents and the results from this annex to be presented at relevant conferences. Also, he will encourage the participants to take similar initiatives.

### **3.5 Other Possible Topics:**

The following topics are not yet further elaborated:

- collect data on national programs and initiatives;
- evaluate benefits of hybridization vs. cost;
- estimate market acceptance and deployment.

Depending in the interest of candidate members, one or more of these topics can be further detailed. Also, when convenient or useful, some of these topics may also be integrated in the elaborated topics mentioned above.

### **3.6 Deliverables**

Each subtask will result each year in a report internal to the project. The subtask reports as well as other documents will be accessible for the members through the annex website. By using a document management system, the exchange of working documents, final reports and other information will be enhanced.

The preparation of papers summarizing the whole topic or highlighting certain aspects is on a voluntary basis, but to be encouraged. By publication in international journals and presentation at conferences, the annex as well as the Implementing Agreement gains exposure to a wider professional public.

## **4. OPERATIONAL APPROACH**

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### **4.1 Operating Agent**

Vito (Belgium) acts as operating agent (OA) of this annex.

The OA organizes two expert meetings per year in participating countries in turn and makes the practical arrangements in co-operation with the host organization for each meeting. Each meeting includes a technical visit to the participant's facilities and/or other interesting projects or events. This allows the local participant to illustrate his capabilities and infrastructure in the field of heavy-duty hybrid vehicle technology. The OA chairs the meetings, prepares agendas and minutes, and reports to the Executive Committee of the Implementing Agreement. He/she provides project management and coordination, to ensure that activities are implemented and objectives are achieved.

The OA also works to increase participation in the work and makes the annex better known through publications in technical journals, participation in conferences, ... . A common fund will be established allowing the OA to fulfill these tasks.

### **4.2 Subtask Leaders**

A sub-task leader will be designated for each of the three main objectives. The OA is best placed for leading the topic of information exchange, i.e. subtask III. The subtask leaders for the other two topics will be assigned once the tasks are fully defined. Their tasks is to prepare a working plan for each topic. This allows to distribute the efforts to complete over all participants. The subtask leader coordinates the progress for his/her subtask and completes the report.

### **4.3 All Participants**

All participants in the annex take part in the information exchange, i.e. subtask III. Concerning the other objectives and subject areas, participation and contribution is on a voluntary basis. The total amount of professional service time depends on the resources available and the expertise of participating organizations. For the total task force the participating organizations are expected to set aside at least one man-month of professional service time per year.

### **4.4 Dissemination of Results**

The results of this annex will consist of at least three reports as well as several papers and presentations. These documents will be managed with the document management system of the annex's website.

The papers and presentations are public matter once published in proceedings and presented at conferences. From that moment the document management system can make them publicly available. The reports have a more proprietary nature. Therefore they will initially only be made available to member countries. A timing as well an approval system to make these reports publicly available still needs to be established in this working plan.

The organization of workshops linked to large conferences allows to disseminate the results of the annex in a more structured manner. It also draws more attention to the annex's activities. Therefore this possibility needs to be pursued.

## **4.5 Optional Activity**

If the participants are willing to meet the additional costs of EUR 12600, the operating agent could prepare an “overview report” similar to the overview reports of annex VII Phase I and II. This requires an additional 2 man-months professional service time per participating country for preparing topic reports that form the basis of the overview report.

## **5. FINANCIAL ARRANGEMENTS**

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Work under this task force will be carried out on a partly cost-sharing, partly task-sharing basis.

### **5.1 Cost-Sharing Work**

Each participant will be required to contribute an equal share to the common fund. The target budget amounts to EUR 36000 per year, which covers the management cost of the project leader, i.e. operating agent. These management cost include:

- general co-ordination of the activities of this annex;
- organization of two expert meetings (agenda, minutes, ...);
- travel costs for two expert meetings;
- participation in HEV ExCo meetings (travel, preparation, ...);
- work to increase participation in this annex;
- hosting a website for this annex as well as posting information on the website.

Similar to annex VII, the target is to have a contribution per country of EUR 6000 for the period 01/01/2007 to 31/12/2007, EUR 6000 per country for the period 01/01/2008 to 31/12/2008 and EUR 6000 per country for the period 01/01/2009 to 30/11/2009 (i.e. the end of the third phase of the Hybrid and Electric Vehicles Implementing Agreement). The target is to have 6 participating countries (or more).

However, this annex is started with 4 countries, agreed to participate with a yearly contribution of EUR 6000 each or an initial yearly budget of EUR 24000. If the ambitions of the annex will be limited, because of the limited budget, will be decided by the participants during the starting period.

If new countries join the annex, the contribution per country to the common fund will be kept the same. In case the annual budget rises above EUR 36000, the participants together will decide on the spending of the additional budget or possible refunds at the end of the period.

In case optional activities are deployed with the agreement of the participants, such as the preparation of an overview report, workshop or presentation of a paper at a symposium, the participants will contribute an equal share to the common fund resulting in additional budget for the operating agent.

### **5.2 Task-Sharing Work**

In addition to the cost-sharing, participating organizations will be expected to set aside a certain amount of professional service time to participate in the technical work and the meetings of this annex. This amount of time required, is estimated to be at least one man-month per year.

In addition, participants will be expected to finance their own travel and accommodation cost for the expert meetings.

Finally, each participant will be expected to host an expert meeting in turn. This cost collectively is known as task-sharing cost.

### **5.3 Sponsors**

Sponsors can participate during the meetings and contribute to the tasks. They have no voting right. The proposed annual contribution to the budget for sponsors is EUR 3000.

All members will seek for sponsors in the industry (vehicle constructors and component suppliers) as well as in user groups.

## **6. BENEFITS FOR PARTICIPATING COUNTRIES AND ORGANIZATIONS**

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### **6.1 Benefits for Countries**

The high price of crude oil and the resulting high fuel costs make energy efficient vehicles a hot topic. Heavy-duty hybrid vehicles can fulfill a part in reducing the fuel consumption.

Compared to light duty vehicles, the success of heavy-duty vehicles is not global yet. In the United States the number of hybrid buses and trucks is higher than in the rest of the world. In Europe most vehicles are part of demonstration projects and do not yet get beyond this point.

This annex will provide essential information for member countries to better understand the current situation and the prospects.

### **6.2 Benefits for Organizations**

The automotive research organizations participating in this work are among the most prestigious in the world. They will broaden and deepen their own expertise in hybrid vehicles by participating in this annex and will strengthen the network among themselves. This will give them access to research that they have not done themselves and keep them informed of recent developments in other countries and of the state of the art of the technology.

## **7. SCHEDULE**

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This annex starts on January 1<sup>st</sup> 2007 and ends on November 30<sup>th</sup> 2009, i.e. the end of the third phase of the Hybrid and Electric Vehicles Implementing Agreement. Experience from other annexes has learnt that this period of almost three years is required to gain sufficient momentum.

The kick-off expert meeting will be held in San Diego on February 9<sup>th</sup> 2007, in connection with the annex VII expert meeting (February 5<sup>th</sup>-6<sup>th</sup>) and the SAE symposium on hybrid vehicle technologies (February 8<sup>th</sup>-9<sup>th</sup>).

## **8. CONTACT INFORMATION**

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## **ANNEX: ORGANIZATIONS INVOLVED IN HEAVY-DUTY HYBRID VEHICLE DEPLOYMENT**

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### **Transit Authorities**

- US: Indygo, Indianapolis; King County, Washington; Long Beach Transit, Los Angeles Department of Transportation; New York City Transit; Seattle, Washington; SunLine Transit, California; ...;
- Europe: Genua, Italy; Luxemburg; Phileas Eindhoven, the Netherlands; Stockholm, Sweden;... .

### **Experience Centers**

- US: ACEEE, American Council for an Energy-Efficient Economy; ANL, Argonne National Laboratories; Consortium for Advanced technology Development, Electricore; CTE, Center for Transportation and the Environment, University of North Carolina; DARPA, Defense Advanced Research Projects Agency; EPRI, Electric Power Research Institute; H-TUF, Hybrid Truck Users Forum, CalStart/WestStart; NREL, National Renewable Energy Laboratories; SCAQM, South Coast Air Quality Management District; ... ;
- Europe: INRETS; TNO; Vito; ... ;
- Japan: JARI, Japanese Automotive Research Institute; NEDO, New Energy and Industrial Technology Development Organization; ... .

### **Technology Providers**

- US: BAE; DaimerChrysler, Orion; EATON; Enova; GM Allison; ISE; ... ;
- Europe: IVECO, IrisBus; MAN; Scania; Vito; Volvo; ... ;
- Japan: HINO; Mitsubishi; ... ;
- other: Hyundai; Korea; ... .