SET-Plan Implementation

The Steering Group of the SET-Plan in its last meeting on October 28th, 2010 agreed to speed-up the execution of activities of the Implementation Plans (IPs) of the European Industrial Initiatives (EIIs). It was decided to collectively identify the possibilities for launching joint actions between Member States and/or Member States and the European Commission.

The mapping exercise carried out through this questionnaire builds upon this decision of the Steering Group. It aims to identify topics for leveraging best ongoing efforts with complementary joint actions, as prioritized by the Implementation Plans. In this phase the mapping will focus on projects and activities with a total budget higher than 1 M€.

We trust that you also consider the success of this exercise important for the immediate implementation of the SET-Plan.

MAPPING OF PROJECTS, ACTIVITIES, RESOURCES AND INVESTMENTS

To which EII(s) is your project, activity, resource or investment relevant? (multiple choices are possible)

<table>
<thead>
<tr>
<th>WIND</th>
<th>SOLAR</th>
<th>GRIDS</th>
<th>CCS</th>
<th>NUCLEAR</th>
<th>BIOENERGY</th>
<th>FCs &amp; H2</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td></td>
<td>☐</td>
<td>☑</td>
</tr>
</tbody>
</table>

A. PROJECTS AND ACTIVITIES

GENERAL INFORMATION

<table>
<thead>
<tr>
<th>Name of project:</th>
<th>Emerging DMFC Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acronym:</td>
<td>Give project acronym, if applicable</td>
</tr>
<tr>
<td>Location:</td>
<td>Applicable only for demo/pilot project; enter specific location(s) and Member State(s)</td>
</tr>
<tr>
<td></td>
<td>Denmark</td>
</tr>
</tbody>
</table>
## Project partners:

<table>
<thead>
<tr>
<th>Company</th>
<th>Contact details</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRD Fuel Cells A/S</td>
<td>Bjørn Thorsen, IRD</td>
</tr>
<tr>
<td>Dansk Gasteknisk Center a/s</td>
<td>Kullinggade 31</td>
</tr>
<tr>
<td>(Danish Gas Technology Centre, DGC)</td>
<td>DK-5700 Svendborg</td>
</tr>
<tr>
<td>TRE-FOR Entreprise A/S</td>
<td>Tel.: +45 63633042</td>
</tr>
<tr>
<td></td>
<td>Email: <a href="mailto:bth@ird.dk">bth@ird.dk</a></td>
</tr>
</tbody>
</table>

## Contact details:

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Contact details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bjørn Thorsen</td>
<td>IRD</td>
<td>Kullinggade 31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DK-5700 Svendborg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tel.: +45 63633042</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Email: <a href="mailto:bth@ird.dk">bth@ird.dk</a></td>
</tr>
</tbody>
</table>

## Start date:

<table>
<thead>
<tr>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-2011</td>
</tr>
</tbody>
</table>

## Duration:

<table>
<thead>
<tr>
<th>Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
</tr>
</tbody>
</table>

### SHORT PROJECT DESCRIPTION

Provide a short abstract of max. 100 words

The purpose of the project is to develop, design, and construct a 1-kW DMFC unit and demonstrate it in an end-user environment, with the long-term aim of providing alternative DMFC-based backup-power, auxiliary-power, and micro-CHP solutions to the commercial market.

The DMFC module will be developed in order to fulfil the 2014 Danish DMFC roadmap targets with respect to efficiency, cost, and lifetime. Tests of the DMFC system for emissions and operational window will be executed, the requirements for CE certification will be met, and the system advantages will be demonstrated in a 6-month field test for an IT UPS application.

### PROJECT GOALS & OBJECTIVES

The goal of the ‘Emerging DMFC power’ project is to design, construct, and demonstrate a 1-kW direct methanol fuel cell (DMFC) module with better performance and lower price than the currently available DMFC modules. Significant improvements of a proof-of-concept module with respect to stability and productivity are targeted through the development of different balance-of-plant (BoP) concepts, particularly by reducing the number of connections and components in the BoP.
the partners’ DMFC-based uninterruptible power supply (UPS) solution close to commercialisation through extensive field testing and CE certification is targeted, and moreover an elucidation of commercial possibilities in other markets is sought through tests for applications such as auxiliary power units (APU) and micro combined heat and power (µCHP) systems.

Objectives:
Indicate quantitative objectives (similar to KPIs of the IPs of the EII). Also indicate intermediate milestones where applicable.

In this project the main objective is to develop a DMFC module that is primarily suited for UPS application. The module will, however, be designed with the demands of long-term operation in mind (APU and µCHP) and tested for long term operation. The aim for the module is to meet the Danish roadmap targets for DMFC modules, which are:
- 2012: Sales price: 12000 €/kW @ 100 units, lifetime: 3000 hours on stack basis, efficiency: 25% el.
- 2014: Sales price: 9000 €/kW @ 1000 units, lifetime: 5000 hours on stack basis, efficiency: 25% el.

PERFORMANCE OF THE PROJECT

Fuel cells convert fuel and air directly to electricity, heat, and water in a pollution free electrochemical process. In principle a fuel cell operates like a battery. However, unlike a battery, it will not discharge since it is continuously supplied with fuel. IRD has 20 years of experience within polymer electrolyte membrane (PEM) fuel cell (FC) technology. A later development of PEMFC is the DMFC, which is also part of the IRD core competence. The advantage of the DMFC is the combination of the advantages of the methanol fuel being liquid (high energy density, established supply infrastructure) with the advantages of the PEMFC technology (clean energy, no noise, high efficiency). The DMFC technology is particularly attractive for small-scale stationary and mobile power generators. From today’s perspective, due to system simplicity and easy fuel handling, the DMFC has the potential to act as a market driver, where market penetration could occur via early niche markets.

Assumed state-of-the-art:
Describe quantitatively the state-of-the-art that the project objectives are based upon
Currently small DMFC generators (25–90 W) are available on the market from Smart Fuel Cell who has sold >15,000 units. This sale proofs that the concept of a DMFC-based generator is viable and that the technology is mature for the small systems. The DMFC stack and system development in Denmark (at IRD) was until 2004 solely funded by private resources and through EU-funded projects. Now, together with several Danish publicly funded projects this work has brought IRD to a world-leading position within the DMFC technology. IRD is presently one of the few industrial players with a DMFC-stack portfolio ranging from 100 W to 2 kW. The DMFC-stack technology has been demonstrated in UPS and APU proof-of-concept systems in three national projects.

The work in the present project brings the technology closer to commercialisation. The project is founded on the DMFC-module proof-of-concept obtained in earlier projects, including modules with IRD DMFC stacks being tested as battery charger in 2009 in a boat, which is still in operation, and as a backup system. The modules proved fully functional, but too complex with respect to production and long-term reliability.

Achievements so far:
If intermediate results are available, please indicate the current achievements (qualitative and/or quantitative)

N/A – recently started.

Difficulties and potential risks:
Indicate briefly problems encountered or to be encountered in the short term (e.g. overall legislative context, public acceptance, permitting, etc.)

N/A

FUNDING & BUDGET

Funding programme:
Give the name of funding programme

The Energy Technology Development and Demonstration Programme (EUDP)
Funding public entity:
Indicate which public entity is in charge of /manages the programme

| The Danish Energy Agency, Danish Ministry of Climate and Energy |

Total (public & private) project budget (€):
2.06 million

Public funding (€):
1.14 million

Total effort (person-months)
114.5

DISSEMINATION OF PROJECT RESULTS
Publications, presentations in conferences and workshops, and other dissemination means:
Give highlights only

Above all patentable results will be patented. Public dissemination awaits the exhaustion of all patent possibilities. All information about project goals and the results obtained in reaching them will constitute a deliverable for dissemination purposes. Publication in scientific and trade journals as well as contributions to conferences and in the relevant IEA annex is targeted. However, all information from the project will first be treated in strict confidence and the consortium agreement will regulate all publications. A milestone (M0.1) of publishing at least four papers with project results has been defined. At the end of the project, a non-confidential final report will be delivered, according to the rules.

TOWARDS COMMERCIALISATION
Indicate (new) products and/or services expected from the project. Are new business models required for commercialisation of the project results?
Highlight expected commercialisation benefits, e.g. patents, spin-offs, new products, business partnerships

The project contains research, development, and demonstration. The project will demonstrate a DMFC unit in an end-user environment and hereby give valuable knowledge to IRD and its partners concerning the further R&D effort necessary to reach target markets with commercial DMFC units. The industrial partners intend to file patents on the most important results.

SYNERGIES WITH THE IMPLEMENTATION PLANS OF THE EUROPEAN INDUSTRIAL INITIATIVES – NETWORKING – KNOWLEDGE SHARING
Contribution to/Relevance with the IPs: To your opinion, to which activities of the IPs of the EIIs is this project related to? Indicate contributions / complements.
Please note that reference here is made to the activities of the IPs as published in http://setis.ec.europa.eu/activities/implementation-plans

The project is related to Fuel Cells and Hydrogen
Potential synergies with other projects and activities: Can you identify any other project(s) in your country, another MS or at European level that could be synergetic with this project?

**NexGenDMFC**
*Eurostar-2010-E!5211*
*Participants:* IRD, AVL
*Project period:* 2010-2013

**TailorPEM Part-I**
*National Danish EUDP programme, 2009-I J. no.64009-0016*
*Participants:* IRD, Smart Fuel Cell (SFC), BAXI & American Power Conversion (APC)
*Project period:* 2009-2011

**PEM Low Cost Endplates**
*National Danish EUDP programme, 2009-II J.no.64009-0217*
*Participants:* Danish Technological Institute & IRD
*Project period:* 2009-2011

**Energirigtig minerydning**
*Erhvers- og Byggestyrelsen; Sag 09/01052*
*Participants:* Det Syddanske Bruxelles kontor (coordinator), in total eight Danish partners including IRD
*Project period:* 2009-2011

Networking: Would you be willing to share results with the projects identified above? 
*Indicate willingness to networking and also potential conditions*

Yes, networking is established

Knowledge sharing: Would the abovementioned Networking necessitate a formal knowledge sharing agreement? To your view would this be the preferred route?

An agreement is the preferred route

Future steps: Are there any follow-up activities considered after the completion of your project? Is there a need to scale up activities in this topic at European level?

*Depending on the project outcome, new project may be applied based on the obtained results. Large projects on the European level may be attractive in this respect.*

---

**B. RESOURCES AND INVESTMENTS**
RESOURCES AND INVESTMENTS

Describe in short any RD&D infrastructures that your project relies on. Are these available or do they need to be developed?

The required analysis, process and test equipment are available.

If these are to be developed, what is the corresponding investment required? What is the allocated budget (€) for this investment in your project?

N/A

OTHER INFORMATION

Date: 16.03.2011

Information provider: X

Please send the completed form to JeanLuc.Delplancke@fch.europa.eu set-plan-secretariat@ec.europa.eu preferably by MARCH 15.

Thank you for your cooperation!