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STRATEGIC ADVICE ON COMMERCIALIZATION OF FUEL CELL BUSES: POTENTIAL ROLES FOR THE GEF

(Prepared by the Scientific and Technical Advisory Panel)

Strategic Advice on Commercialization of Fuel Cell Buses: Potential Roles for the GEF

Prepared by
The Scientific and Technical Advisory Panel (STAP)
of the Global Environment Facility (GEF)

STAP Secretariat
United Nations Environment Programme

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Preface

It gives me great pleasure to submit the report entitled "*Strategic Advice on the Commercialization of Fuel Cell Buses: Potential Roles for the GEF*" prepared by the STAP Ad-hoc Working Group on Climate Change. This report is in response to a request from UNDP to provide comments on the commercialization of Fuel Cell Buses.

Given the importance of this issue and the potential commitment of GEF resources to Fuel Cell Buses, STAP has provided its advice on this issue for your consideration.

Madhav Gadgil
STAP Chairman

1.0 Introduction

STAP was requested by UNDP to provide comments on the Commercialization of Fuel Cell Buses following a report on a UNDP/GEF sponsored Workshop on April 27-28, 2000 and proposals for a series of GEF-supported projects in five developing countries.

2.0 Background

Ever since the inception of the pilot phase of the GEF, fuel cells have been seen as a 'transforming' technology, offering an exciting option for addressing the long-term problems posed by climate change. They offer the prospects of significant improvements in energy efficiency for both mobile and stationary applications; of solving the energy storage problem faced by solar and wind energy; and of bringing about a long-term transition to the 'hydrogen economy', in which there would be no emissions of greenhouse gases or local forms of pollution. They are also a well-proven technology.

The rationale for supporting their demonstration and use in developing regions has been set out in previous STAP working papers for the GEF, and in working papers published by the GEF itself. Two Operational Programmes (OP#7 and OP#11) have also stated that the fuel cells are eligible for support by the GEF in two areas:

- Stationary applications—primarily for electricity generation. They are not only high efficiency devices, but when used for decentralized forms of generation, avoid the electrical losses encountered in electricity transmission and distribution. In colder climates, the waste heat may also be used for domestic and commercial heating (combined heat and power). Also important, as with solar and wind energy, no water supplies are needed.
- Transport. The reasons and rationale for this were again stated in the UNDP-GEF paper on the Workshop proceedings of April 27-28.

Because of environmental regulations and the technology development policies pursued by the OECD countries, especially in the 1990s, it turns out that proposals for applications in transport have emerged first, though the GEF is also sponsoring workshops on the use of fuel cells for electricity generation.

3.0 Comments and Recommendations.

The following issues were raised by STAP in a discussion on the proposed pipeline of fuel-cell related projects and the UNDP/GEF workshop on fuel cell buses:

(i) **Objectives**: It is of common understanding that, the interest of such projects cannot be estimated through their direct impact on carbon emissions, but rather in the dynamic created through GEF funding in the development, the maturation and the integration of a new technological package in a long term perspective.

(ii) **Approach**: Fuel cell buses combine three elements that are at different stages of development and that should be considered separately, namely:

(a) **The hydrogen economy**. The use of hydrogen as a fuel for transportation is the subject of a debate that has evolved around the high costs of production and the time horizon for a transition to an integrated hydrogen economy. Such a transition will only occur in the

context of major technological changes in the transport sector, and in power generation. The high cost of using hydrogen, as compared to hydrocarbon fuels, poses an enormous barrier to its commercialization, which would also require the build-up of a hydrogen production and distribution infrastructure. The uncertain cost-reduction potential of hydrogen is an important issue determining its future adoption on a commercial scale.

(b) **The fuel cell technology**. Fuel cell technology is an uncontroversial technology which is at a pre-commercial stage, meaning it will be commercial in the next decade. Fuel cells can be used with hydrogen or hydrocarbon fuels. Costs are expected to decline significantly, though the extent of this is uncertain, and there will be much 'learning-by-doing' as experience is gained. We are a long-way from standardization and replication. Any intervention of GEF in this area should be phased, such that each project can learn from its predecessors, and take advantage of ongoing developments in the technology.

The initial issue here is the ownership of the technology: the developers and owners of the technology are a few firms in the North that are going through a learning experience, a process the developing countries are not benefiting from. Should the GEF provide the capital cost of the pre-commercialization of a technology developed and manufactured by an industry in the North? The developing countries cannot be passive recipients of the technologies, and financial support from GEF can be legitimate if the firms benefiting from the "learning by doing" process in manufacturing the cells can be identified in the client countries of the GEF. STAP is unanimous that local ownership would be central to the success of GEF projects in developing countries, and to the purposes and ideals of GEF; everything should be done to ensure that local ownership takes place.

(c) **The electric vehicle.** The potential environmental benefits of electric vehicles are considerable. They are defined as an attractive transport option in cities. Interesting developments in design are taking place, such as the 'in-wheel' motor integrating the motor, brake and hub into one unit, and eliminating the need for a gear-box and transmission-shaft system, thus increasing performance. Vehicle assembly is also simplified, and less 'high tech' than with the internal combustion engine vehicles. This echoes the comments of industry that appreciable sources of cost advantage ultimately lie 'under the hood'. The electric vehicle may open new opportunities in manufacturing and vehicle assembly in the industrializing of the developing countries. Electric vehicles however do not have to be powered with fuel cells, but can use batteries instead, a technology where experience is being gained on a larger scale, or even hybrid technologies.

(iii) **The transport portfolio**. STAP is concerned that the OP#11 portfolio might become unbalanced by the proposed fuel cell programme, which would absorb a large amount of available funds. STAP 's view is that other types of projects should be considered and developed simultaneously.

(iv) **Targeted research.** Both fuel cells are a rapidly developing technology, though costs are still high, there has been good engineering research on the cost-curves of fuel cells. The infrastructure requirements and costs of producing and delivering hydrogen to the users however, need further analysis. In the short term, existing sources of hydrogen—mainly supplies from refineries—will suffice. But in the long term it will be necessary to derive hydrogen from higher cost sources, either from renewable energy, or from fossil fuels, with

the carbon from the latter being sequestered. The costs and technical challenges of introducing hydrogen in the energy system in the long term will be appreciable, and greater than those for fuel cells. Targeted research into hydrogen and hydrogen infrastructure in relation the kinds of technologies supported by GEF programmes would be merited.

Conclusion

The present STAP sees no reason to reverse the recommendations of the previous STAP, nor to reverse the positions of OP7 and OP11, that fuel cells for both stationary and mobile applications are and should be eligible for GEF support.

However, any GEF strategy to develop Fuel Cell Buses for Developing Countries should be cognizant of the following issues:

- ***Local manufacture of the fuel cell***: The extent to which GEF support for Fuel Cell Buses (FCB) would assist the active involvement of its client countries in the manufacture of the fuel cell. Clarification would need to be provided on how the GEF would approach the complex patent and licensing procedures that local manufacture would require.

- ***Hydrogen*****:** The success of FCB technology is in the long-term reliant on the transition to a hydrogen-based fuel system. An explanation would be necessary on how such a transition would unfold and the potential role of GEF in facilitating a rapid transition.

- ***Portfolio balance***: At the moment, the OP#11 portfolio is dominated by the FCB projects with limited coverage of other important transport options such as non-motorized transport (bicycles); two and three-wheelers electric/hybrid vehicles; and, transport/land-use planning. Care needs to be taken to ensure that the OP#11 is not effectively transformed into an OP on Fuel Cell Buses.