GEF

Global Environment Facility

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October 28, 2005

Dear Council Member:

I am writing to notify you that World Bank, the Implementing Agency for the project entitled, ***Global (Brazil, Chile, Mexico, Trinidad and Tobago, Philippines, India, Bangladesh, Egypt, South Africa): Fuel Cells Financing Initiative for Distributed Generation Applications***, has submitted the proposed project document for CEO endorsement prior to final approval of the project in accordance with World Bank procedures.

Over the next four weeks, the Secretariat will be reviewing the project document to ascertain that it is consistent with the proposal included in the work program approved by the Council in November 2003, and with GEF policies and procedures. The Secretariat will also ascertain whether the proposed level of GEF financing is appropriate in light of the project's objectives.

If by November 25, 2005, I have not received requests from at least four Council Members to have the proposed project reviewed at a Council meeting because in the Member's view the project is not consistent with the Instrument or GEF policies and procedures, I will complete the Secretariat's assessment with a view to endorsing the proposed project document.

We have today posted the proposed project document on the GEF website at www.theGEF.org. If you do not have access to the Web, you may request the local field office of UNDP or the World Bank to download the document for you. Alternatively, you may request a copy of the document from the Secretariat. If you make such a request, please confirm for us your current mailing address.

Sincerely,

for

Leonard Good
Chief Executive Officer and Chairman

cc: Alternates, Implementing Agencies, STAP

THE WORLD BANK/IFC/M.I.G.A.

OFFICE MEMORANDUM

DATE: October 17, 2005

TO: Mr. Leonard Good, CEO/Chairman, GEF

FROM: Steve Gorman, GEF Executive Coordinator, The World Bank

EXTENSION: 35865

SUBJECT: **Fuel Cell Financing Initiative for Distributed Generation Applications Submission for Final CEO Endorsement for Project 1: South Africa**

1. Please find attached the electronic file of the GEF Project Document for the above-referenced project for your final review and endorsement. Stage 1 of the Fuel Cell Financing Initiative was approved in the GEF Council Work Program in November 2003. We would appreciate receiving your response by October 31, 2005.

2. Following work program inclusion, the IFC released the second Requests for Proposal (RFP) under Stage 1 of the FCFI Program. These RFPs have generated a substantial amount of interest from the Fuel Cell industry. As a result of the two RFPs issued to date, FCFI has received sixteen (16) individual proposals, in eight (8) distinct countries, and four (4) distinct regions. After careful review of the proposal and initial technical due diligence, the IFC has cleared the first project under Stage 1 for a grant award.

3. The GEF Project Document is fully consistent with the objectives, scope and overall cost of the Fuel Cell Financing Initiative (FCFI) approved by the GEF Council in November 2003. No significant adjustments have been made during the preparation of this Project Document concerning the design, financing plan and operational modalities of the project. Comments from Council Members on the FCFI initiative as a whole were addressed through at the time of Council approval; many of the comments have subsequently been addressed in a specific manner by the project proposals. The comments from Council Members are addressed below.

A. Comments from Council Members:

(i) Comments from the Council Members (Switzerland):

The Swiss member of the Global Environment Facility had several comments to the Fuel Cells Financing Initiative for Distributed Generation Applications proposal in front of the GEF Council. These are listed below:

(a) Institutional set-up / role of partners unclear: The project brief is rather vague concerning the institutional set-up of the project, in particular the role of the private sector. Involvement of private sector stakeholders in such an initiative right from the start would be essential to ensure sustainability. It seems rather uncertain whether small, remote power applications can attract the interest of the private sector players with commercially not yet viable technologies. The fuel cell technology would compete with off grid application of renewable power applications such as Solar PV, micro hydro and biomass. Issues such as business models and local ownership, though very crucial in the context of such a project, are not outlined satisfactorily.

Response: At the time of Council approval, the IFC had not identified the sub-projects that would be awarded under Stage 1 of this initiative. The submission of the first sub-project is very specific about the institutional set of the project, and in particular the private sector stakeholders. IST and Plug Power have teamed up to provide a significant number of fuel cell units to private sector customers in the telecommunications industry in South Africa. There seems to be a significant market pull for the technology and application in South Africa itself, as the joint sponsors have already received purchase commitments. The IFC technical review team feels that the applications presented for the telecommunications back up power sector are perhaps one of the only viable applications currently with near term commercial potential and long-term sustainability in the small (<5kW) fuel cell market.

(b) Total supply orientation: The project concept appears to be completely supply driven. It is assumed that - once major fuel cell developers will have entered the market - the market will grow. What about the development of the demand? As long as the cost of fuel cell technology based power systems are higher - why should consumers switch off conventional systems?

Response: This proposal is for installing 400 individual fuel cell units in South Africa. The IFC team has been satisfied through its due diligence that there is sufficient market pull to commence this project.

(c) The justification for promoting this specific technology is not straightforward: reasons to support distributed power generation applications are the potential of such projects to reduce CO2-emissions and to give access to electricity as a key component of rural income generation opportunities. The project brief does not present convincing sets of arguments why in particular fuel cell technologies should be promoted, which will only be clean on the basis of non-fossil fuel technologies in the long run. The use of true renewable energy sources such as small hydropower, wind, PV and biomass are promoted with better prospects to become commercially viable earlier on the timeline and equally or better suited to meet the project development goals. They do not require the additional logistic system that needs to be built up in

order provide an assured supply of (compressed natural?) gas (or, in the long term, hydrogen), at the consumers' location.

Response: The Fuel Cell Financing Initiative for Distributed Generation Applications was approved by the GEF Council in November 2003, and is the result of the UNEP MSP, as well as extensive GEF and STAP consultations on fuel cells markets and their potential for stationary power applications in developing countries. Through their previous endorsements, the GEF has shown its willingness to promote fuel cell technologies under OP7 as an application with low greenhouse gas emissions. The project development goals under this program are to facilitate this technology deployment, which provides GHG benefits through displacement of other polluting technologies, in developing countries. While all issues with respect to providing fuel for fuel cell technologies have not been solved, we are operating on a timeline that goes to 2008 to 2010. In that timescale, we believe that some of those issues will be solved, and these technologies can provide a bridge to the hydrogen economy of the future. Specifically, this sub-project intends to partner with Afrox for the delivery of fuel to the fuel cells, and they hope to gain economies in the cost of the fuel as a result of the large number of installations that will require delivered fuel.

(d) Cost reduction of fuel cell systems through promotion of its application in developing countries is a myth: the conceptual idea is understood. The real world experience with PV - where this strategy to reduce costs basically through the effect of economies of scale and learning curves - has however shown that, over the last two decades, the impacts on cost reduction achieved have been far below expectations. Import based fuel cell technology still has a long way to go before becoming cost competitive in particular if also operation and maintenance costs are taken into consideration.

Response: It is important to note that most PV initiatives at GEF are supported under OP 6, not OP7. Hence the focus there is not on cost reductions, but rather on removal of market barriers. Secondly, as previously noted, the capital costs of most fuel cell technologies are already lower than the per kW SHS costs, and hence the reductions required to make the technology competitive are lower. One of the points that this program has made to all bidders is that the IFC does not subscribe to the "Volume cures all" myth. On the contrary, fuel cell cost reductions will occur through innovation via the approximately US$1.5 billion global fuel cell R&D program in OECD countries, reductions in balance of systems, liberalization of emerging markets, higher fuel efficiency, lower O&M costs, longer life and avoidance of environmental and disposal costs associated with recycling or disposal of back up batteries. Both the proposed grantee and the IFC are sensitive to all of these avenues to life cycle cost reductions, including O&M, and these issues will be closely monitored in this project.

(ii) Comments from the Council Members (Germany):

a. Stage 1 of the proposal should take place in a city with good infrastructure – but not in rural or remote areas. The involved fuel cell developers/firms should provide technical specialists est. on the spot. In our opinion it would make more sense to stat with such a large program in an industrialized country, but however, if the program developer is aware of problems mentioned above, it can be possible to be successful in large cities in developing countries.

Response: The IST/Plug Power proposal includes installations in remote telecommunications facilities in South Africa. IST/Plug Power recognize the importance of a well established infrastructure of technical specialists who can provide servicing to these units, and they intend to have routine scheduled maintenance. The sponsors have already started training technicians, and intend to launch a large scale training initiative in conjunction with the launch of this program.

b. Since PEM cells are ecologically not very beneficial (compared to conventional power generation), the project should fins applications for SOFC, MCFC or, at least, PAFC cells.

Response: It is not clear to us why PEM fuel cells are deemed less ecologically beneficial than the other fuel cell technologies named above. However, we are assuming that two potential reasons for objections to PEM fuel cells may be 1) the use of high value catalysts such as platinum that can then be wasted (alongside other component parts) when the proton exchange membrane is exhausted, and 2) the use of liquid fossil based fuels with some PEM fuel cells, which may not be very environmentally beneficial. It is therefore important to note that for our initiative, and specifically for the IST/Plug Power proposal, (1) Plug Power will be using either hydrogen as fuel (in its GenCore application), and LPG in the GenSys applications. Hence no liquid fossil fuels are to be used for our initiative, and (2) we are satisfied that Plug Power has an extensive recycling program which aims to reuse all the component parts of the fuel cell at the end of the life of the membrane. In addition, specifically because of the high value platinum catalyst, the recycling of these materials is a core part of the financial viability of the fuel cell, and hence material recycling is a key part of Plug Power's business plan and strategy.

c. We would like to see clear benchmarks for government commitments to provide an enabling environment for these fuel cell projects. In addition, the project should describe how the environment looks at the moment and what commitments the government will take on over time to enhance the enabling environment further. There are many options like the introductions of quotas for cogeneration, standards for supply efficiency or emissions, or even a special South African subsidy program for fuel cells.

Response: All proposals and projects under Stage 1 are required to have strong country support for the project, including local GEF focal point endorsement. We look to the host country government's to have a realistic minimum participation in this program. However, we feel that fuel cell technology is widely supported as an emerging application in many of the countries that the program targets, and we feel it is unnecessary at this time to implement a requirement of quotas and/or subsidy programs at the host country government level. While in many countries these already exist for fuel cells, we do not necessarily feel this is the best indicator to predict sustainability of this technology in the long term.

> *d. Further specification of the co-financing (classification and type) should be available. The ratio of GEF Funding vs. capital costs (stage 1: 50% and stage 2: 35%) seems to be appropriate only to prove technical feasibility and to implement some demonstration projects. The request for these amounts of GEF support shows that this technology is still far from being competitive. Further explanation of the assumed learning curves (from 50% support to competitiveness) within the project time frame should be given. Furthermore, in order to attain the goal of market development and replicability the co-financing targets should come down to 25% (stage 1) and 15% (stage 2).*

Response: Our current application to GEF Council is the result of the UNEP MSP, as well as extensive GEF and STAP consultations on fuel cells markets and their potential for stationary power applications in developing countries. However, some of the metrics used in that study, specifically the assumed learning curve, apply to fuel cells in transport applications, not in stationary applications. The goal under this program, as outlined in OP7, is to reduce the long term costs of this technology in developing countries. However, this does not necessarily mean that this program is looking to achieve "least cost" in every environment where the technology is placed. Cost can be seen as a function of alternative technologies available, reliability of existing infrastructure, the willingness to pay on the part of the customer, and the differentiated tariff structures existing within any given market (i.e.: some customers such as industrial customers, will pay a different tariff than others

> *e. There should be an independent evaluation of stage 1 before bringing stage 2 to the Council for approval.*

Response: We agree. We intend to perform a mid-term evaluation and a final evaluation during of this program.

(iii) Comments from the Council Members (France):

> ***a. Comment: The project is presented in a very vague term. None knows exactly what would be the primary source of energy which will be used to produce hydrogen (coal, natural gaz, LPG). Neither knows how the Escos will work. The role and the contribution of IFC is not very clear. In addition to that, IFC is not exposed at all on the financial aspect and is not providing any funds.***

Response: At the time of Council approval, the IFC had not identified the sub-projects that would be awarded under Stage 1 of this initiative. We believe these concerns have been specifically addressed by the proposal from IST and Plug Power. The IFC will play the role of executing agency for the GEF funds allocated to this project. At this point, the IFC will have no additional financing commitment to this project.

(iv) Comments from the Council Members (United States):

(a) Outputs for each program components identify indicators but assign no value for the percentage increase or decrease. Does baseline information exist? In general, it seems like the project is not prepared fully. The project would benefit from greater discussion of the costs structures, a justification of the timeliness of the intervention, and clarification on the selection criteria, particularly the country enabling environment, for the first and subsequent projects.

Response: At the time of Council approval, the IFC had not identified the sub-projects that would be awarded under Stage 1 of this initiative. We believe these concerns have been specifically addressed by the proposal from IST and Plug Power. A discussion of cost structures, timeliness of the intervention, a discussion of country enabling environment and a review of the proposal's conformity with the Fuel Cell Financing Imitative selection criteria can be found in the project document.

4. Attached with this cover memo are the Project Document, the GEF Focal Point Endorsement and the proposal submitted to the IFC in response to the RFP under the Fuel Cell Financing Initiative. Please feel free to contact us if you have any additional questions or need any clarifications. We look forward to receiving your endorsement of the project for IFC Management approval

Attachment:

Project Document, GEF Focal Point Endorsement: South Africa, Letter of Support from the Department of Science and Technology : South Africa, IST/Plug Power Submission Document

Distribution:

DOCUMENT OF

THE INTERNATIONAL FINANCE CORPORATION

FUEL CELLS FINANCING INITIATIVE FOR DISTRIBUTED GENERATION APPLICATIONS

Sub-Project
IST Group/Plug Power

GEF Project Document

October 2005

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EXECUTIVE SUMMARY

IST/Plug Power have been chosen by the IFC to be a recipient of funding under Stage 1 of Fuel Cell Financing Initiative for Distributed Generation Applications (FCFI). The overall objective of FCFI is to help in the reduction of GHG emissions in GEF eligible countries, by supporting the creation of sustainable markets for fuel cells in suitable stationary power applications. Under Stage 1 of the FCFI, IFC is able to make three grant awards of up to US$3 million each. After careful review of sixteen proposals from eight distinct countries, the IFC is prepared to submit the following proposal to the GEF CEO for endorsement and further funding under this initiative.

The IST Group in South Africa has made a joint proposal with Plug Power, a US manufacturer of PEM fuel cells. IST/Plug Power have proposed to install 400 x 5kW units for a total of 2.0 MW of fuel cell capacity in South Africa. The sponsors will deploy two separate fuel cell products: the GenCore 5kW unit for back-up power applications, and the GenSys 5kW unit for baseload power applications. IST/Plug Power are targeting the telecommunications market in South Africa, specifically focusing on the industry's requirements for reliable back-up power solutions for the telecommunications infrastructure in remote locations. IST/Plug Power have significant interest from several telecommunications operators in South Africa, and have begun on the ground installations with some carriers. In addition, IST/Plug Power have established a relationship with Afrox, a key fuel supplier and distributor in South Africa. Afrox will provide the fuel and the delivery infrastructure to support this project and is seen as a pivotal partner in the project.

Since the units to be installed in this phase are still relatively expensive due to low volumes of production, IST/Plug Power will use the grant provided under Stage 1 of the FCFI program to offset a part of the capital costs of the fuel cell units they install in South Africa. The grant funding available under Stage 1 of the FCFI program will contribute roughly 25% of the total cost of each unit. IST/Plug Power's cost reduction plans include and increase in volume sales, and potentially relocating a portion of fuel cell manufacturing and assembly facilities to South Africa in the future. IST/Plug Power estimate that these activities will enable it to sell a product that will no longer require capital subsidies in the near term, and potentially in the same timeframe as Stage 2 of the FCFI initiative.

After initial review by the FCFI RFP Review Committee and technical due diligence team, IFC believes that IST/Plug Power's plans for installing 2.0MW of fuel cell capacity in South Africa fully support the overall objectives of the initiative. We believe that this project represents a unique application for fuel cells and will expand the breadth of applications considered under Stage 1 of the FCFI. IST/Plug Power are installing large number (400) individual PEM fuel cell units. The IFC believes that successful implementation of this project will help accelerate the process of fuel cell commercialization in South Africa, particularly in the distributed generation and back-up power markets.

We believe that the current proposal by IST/Plug Power is a good fit for this initiative, since it will provide us with valuable transactional experience with PEM applications, and also inform us about the demand for power in the distributed, back-up power markets in South Africa. In our view this proposal is ready to proceed to the next stage of implementation, for the following key reasons:

- **Strong Sponsors with Significant Commitment to the Market:** Both IST and Plug Power are leaders in their respective industries and markets. IST Group, one of South Africa's premier electrical and technology companies, was founded in 1980 and was listed on the Johannesburg Stock Exchange in 1998. Plug Power is one of the leading manufacturers of PEM fuel cells in the United States, and is a leader in the deployment of commercial fuel cells globally

- **Extensive Testing and Technology Demonstration To Date:** Plug Power has one of the largest demonstration platforms for PEM fuel cells systems with over 550 fuel cell systems delivered to customers worldwide in commercial, public sector, telecommunications, utility and uninterruptible power supply markets. The IFC technical team feels that in addition to its own due diligence, there is a significant foundation of independently analyzed data in the public domain to fully support this technology in Stage 1 of the FCFI initiative.

- **Significant Number of Units to the Field:** IST/Plug Power have proposed to install 400 individual fuel cells under this initiative. The IFC feels this is significant and should result in more than simply a demonstration of the technology, but is the first step to truly commercializing the product. Successful completion of this project under the FCFI initiative could lead to a greater probability of sustainability if the result of pushing so many units into the field results in a faster adoption rate of the technology.

- **Strong Local Partners:** IST/Plug Power have pulled together an impressive list of stakeholders and partners in South Africa. Afrox, the largest supplier of gas in South Africa, has officially endorsed this project and will be supplying the Sponsors with hydrogen and liquefied petroleum gas (LPG) to the fuel cell sites at a market discount. The IFC believes that this partnership, and others like it, will be critical to the initial success of the project. In addition, IST/Plug Power recognize the need to establish well qualified technical specialists to service these units, and they have detailed plans to implement training and set up technical service infrastructure to support the product in the local market.

- **Demonstration Scheduled in 2007-08 Timeframe:** IST/Plug Power intend to deploy all 400 units under Stage 1 of the FCFI by 2008, but have projections to install well over 1,000 units in the field by 2012. This represents a significant deployment of this technology in a fairly short period of time. IST/Plug Power feel strongly that the grant funds provided under this program will lead to larger orders from customers and increased market penetration and will ultimately accelerate commercial sustainability of this product.

For the reasons outlined above, the IFC is ready to present this project for consideration and endorsement to the GEF CEO.

Sincerely,

Sandeep Kohli
Program Manager
Fuel Cell Financing Initiative

IST GROUP/PLUG POWER

Introduction

The IST group of companies was founded in 1980 and listed in the electronic and electrical equipment sector of the Johannesburg Stock Exchange (JSE) in 1998. The group provides high technology solutions in areas of integrated electro-mechanical and engineering software solutions, telecommunications technology and energy management systems and services. IST telecom will be the local sponsor of this project.

Plug Power Inc. is a US based company that specializes in designing and manufacturing proton exchange membrane ("PEM") fuel cells for distributed energy solutions. Plug Power's headquarters are in Latham, NY, and has offices in Washington, DC, and the Netherlands. Plug Power has gained extensive experience in the design and operation of PEM fuel cell systems since 1997. The Company's focus on natural gas-powered fuel cell systems has resulted in the successful demonstration of over 500 fuel cell systems with increasing functionality and reliability and decreasing cost, and has led to the development of GenCore and GenSys fuel cell system product lines and GenSite on–site hydrogen generation systems.

Plug Power and IST have teamed up in a joint proposal to the IFC under the Fuel Cell Financing Initiative to install 2.0MW of fuel cell capacity in various locations in South Africa. The joint sponsors will install 400 x 5kW units in telecommunications facilities to provide reliable back-up power generation. A copy of the proposal submitted to the IFC in response to the RFP issued in April 2004 can be found in Annex 1 of this document.

Market

The IFC has identified South Africa as a favorable environment for the adoption of distributed generation and remote power opportunities, given market conditions and the emerging regulatory and policies frameworks. IST/Plug Power confirms that there is a sizeable and practical opportunity in the deployment of fuel cell technology in remote power applications in the telecommunications sector in South Africa, as well as other markets in Africa.

The sponsors believe that the South African context provides considerable opportunities in the telecommunications sector for the cost-effective deployment of flexible and responsive back-up power generation based on fuel cell technology. The proposed customers for these products have operations throughout South Africa, including in the cities, in rural locations and in very remote locations, and IST/Plug Power aim to capture a significant part of this market by 2012.

Under Stage 1 of the FCFI, IST/Plug Power plan to install 400 x 5kW units in several locations in South Africa, for a total of over 2.0MW of fuel cell capacity[1]. IST/Plug Power is targeting the back-up power market for remote telecommunications stations in South Africa. IST/Plug Power estimate that the total market size for this application consists of roughly 17,000 sites today, and the number of these sites is growing. Stage 1 funding for this project will support fuel cells for roughly 2% of the total market today.

The back-up power market in South Africa is significant in size, in part due to issues with reliability of existing grid infrastructure as well as the lack of infrastructure in many places. IST/Plug Power have chosen to pursue a sub-sector of this market, specifically targeting the power requirements for the telecommunications industry in South Africa. IST/Plug Power list the following as justifications for choosing this market segment for their 5kW product:

- Grid reliability issues create need for reliable back-up generation;
- Many areas do not have access to grid power and depend on distributed generation solutions (mostly DG sets);
- Aged utility infrastructure requires significant upgrade;
- Significant build-out of telecommunications infrastructure requires reliable power solutions, in both grid connected and non-grid areas.

In order to successfully target this market, IST/Plug Power have pulled together an impressive list of stakeholders and partners in South Africa. Afrox, the largest supplier of industrial gases in South Africa, has officially endorsed this project, and will be supplying IST/Plug Power with hydrogen and liquefied petroleum gas (LPG) to the fuel cell sites at a market discount. Afrox also operates a large carrier fleet, which consists of over 500 vehicles, and operates from 96 South African branches. Afrox has over 2,000 distributors and 2.6 million cylinders in circulation. This partnership will be critical in maintaining a consistent fuel supply for the fuel cells, especially in remote locations. Some of the other potential stakeholders and partners that IST/Plug Power have identified to participate in Stage 1 of the FCFI Program are:

- **Telecom SA**: Telecom SA is the largest communications service provider on the African continent based on operating revenue and assets. They offer business, residential and payphone customers a wide range of services and products, including fixed line voice services, fixed line data services and mobile communications services.

- **Eskom**: Eskom is a vertically integrated operation that generates, transmits and distributes electricity. Eskom generates 95% of the electricity used in South Africa alone, and the company operates all over the African continent. Eskom has expressed interest in deploying fuel cells throughout its network to replace back-up battery and diesel generators.

[1] While the Plug Power PEM units are sized at 5kW maximum capacity, not every unit will operate at this capacity. IST/Plug Power estimate that the total average load will be 1.715MW after installing 400 units.

- **<u>Vodacom</u>**: Vodacom is a pan-African cellular communications company providing a world class GSM service to millions of customers in South Africa, and other African countries. Vodacom is the market leader in South Africa with more than 95% of South Africans now within the coverage area of its 5,000 plus base station cellular network.

The IFC believes that any of the above mentioned entities would be a strong partner for IST/Plug Power to support its plans for promoting PEM fuel cells in South Africa.

IST/Plug Power feel that the initial 400 units to be supported under the FCFI program will generate and support additional, larger orders by many companies in the back-up power telecommunications sector. IST/Plug Power have estimated the installation of over 1,000 units by 2012, well into Stage 2 of the FCFI program.

Country "Drivenness"

South Africa's regulatory reforms strongly favor renewable energy solutions, distributed generation, energy efficiency and clean energy. IST/Plug Power believe that South Africa's regulatory environment and policies towards renewable energy and fuel cells are very favorable for the types of projects envisioned by the FCFI Program. Over the last couple of years, South Africa has been quite active in supporting and passing legislation targeting the renewable energy sector. In late 2003, South African government endorsed a white paper on renewable energy which suggested that South Africa receive more than 15% of its energy from renewable sources by 2012. In 2005 alone, the South Africa government has passed new legislation supporting several environmental initiatives. For example, in February 2005, the South African government passed the Air Quality Act of 2004, which established standards and set targets for air quality in South Africa. In March of 2005, the Energy Efficiency Strategy of South Africa was adopted. This was the first government effort to develop energy efficiency practices in South Africa. This legislation sets national targets for energy efficiency improvements of 12% by 2014, and it sets targets to reduce the load growth by over 4,000MW by 2025.

The Department of Science and Technology (DST) in South Africa has written a strong letter of support for this project. In particular, DST sees this initiative as "important in speeding up the process of increasing the exposure of South Africa to fuel cell technologies." The DST feels that supporting this technology provides a strategic advantage for South Africa, and could support the country's Advanced Manufacturing Technology Strategy if this project leads to the migration of manufacturing facilities to South Africa.

In addition to a favorable regulatory environment, South Africa's demand for power solutions continues to grow as demand quickly outpaces supply. It is estimated that demand for power will overtake generating capacity in 2007, and this estimate only takes into account the demand from those connected to the grid, and does not consider the demand from those who have no current access to power. Fuel cells, particularly in a distributed generation model, can play an important role in filling this growing demand, as well as demand from those not connected to the grid.

IST/Plug Power believe that their project under Stage 1 of the FCFI program will begin to address some of the requirements for distributed power needs in the South African context, and they believe that the regulatory environment is very favorable for this kind of project.

Sponsor Commitment

IST/Plug Power have already begun operations on the ground in South Africa. IST has dedicated personnel working on the deployment of Plug Power's PEM fuel cells, and Plug Power intends to relocate employees to South Africa in the future as product demand increases. The joint sponsors began working together in early 2003**,** and have pursued the market for PEM fuel cells rather aggressively over the last few years. In March 2004, IST/Plug Power sponsored a "complimentary" fuel cell conference which was attended by over 100 representatives of industry in South Africa. Feedback from attendees was highly favorable and showed support for this technology. Following the conference, IST/Plug Power installed several fuel cell units at customer sites in South Africa. IST/Plug Power have represented that they intend to install over 4,000 x 5kW units by 2012, a ten-fold increase from the units covered under the Stage 1 grant. The first market that IST/Plug Power intend to pursue is the telecommunications back-up power market, and the IFC believes that IST/Plug Power have already made significant investments towards this plan. The IFC believes that the IST/Plug Power joint sponsorship is a good candidate to support with funding in Stage 1 of the FCFI Program.

In addition to IFC's recommendation for grant support under the FCFI program, IST/Plug Power have received GEF Focal Point endorsement from the South African GEF Focal Point, a copy of which can be found in Annex 2.

Technology

Plug Power has proposed two configurations of their PEM fuel cell technology; 114 GenSysII and 286 GenCore units. Both units are rated at peak output of 5 kW but have significantly different fuel types, loads and operating cycles. The GenCore is Plug Power's commercial offering for back-up applications for Information Technology and Telecommunication systems in the event of grid loss. It is a 5-kW power plant, hydrogen-fueled, and is available with 24, 48, and 120 volt DC output. It has been commercially available since December 2004 and is regarded by the due diligence examiners as an essential stepping stone for growth and sustainability to the GenSysII intermediate and baseload system[2]. The GenSysII is a multi-fueled (natural gas, LPG), 5 kW, base and intermediate load system that is capable of Combined Heat & Power (CHP) or strictly the production of electricity. The GenSysII exists as a full-scale prototype scheduled to undergo over 40 laboratory- and field-based tests as a LPG-fueled, 48-

[2] Here the terms "commercially available" and "commercial" refer to the fact that this product is no longer in the research and development prototype stage. Plug Power's GenCore fuel cell is a product that the company is actively marketing. In this regard, the design is stable with design focus being on cost reduction and reliability verses new product functionality. Plug Power is promoting the product line aggressively in many markets including: Telecom, Electric Utility, and Industrial UPS. However, it is still not cost competitive in most applications. Plug Power intends to use the basic GenCore fuel cell stack technology in other products, including the GenSys. It does not anticipate phasing this product out of its offering.

volt DC output system. Plans call for the introduction of a natural gas-fueled option in the 2nd quarter of 2006 with the eventual specification of an inverter to provide AC power output capability. Plug Power has represented that 4.1 tons of C02 will be avoided over a ten year life from the 114 GenSysII units proposed in Phase I. Plug Power's design and environmental goal is 100% recycling of their product and currently achieve 90% recycling which is a significant advantage over competing diesel generator and battery systems.

The proposal was reviewed, a site visit was made, representations by Plug Power were examined, numerous technical interrogatories were satisfactorily made and public documentation was utilized. The due diligence examination that follows is segmented by the product line of GenCore and GenSysII with the advisory that the GenCore is an essential building block to sustain commercialization of the GenSysII which is the product of highest relevance to the goals and objectives of the GEF.

5 kW GenCore Telecommunications Back Up Application

The 5 kW GenCore, hydrogen fueled system is equipped with a battery-based Electrical Energy Storage Module which provides seamless transfer of power to the load upon grid loss while the fuel cell is reaching its designed output (maximum 30 seconds). The average system efficiency of Plug Power's twenty-one unit Reliability Fleet is exceptionally high at 46.9% (LHV). This is partially attributed to the design being DC output only and operating on hydrogen fuel which does not require a fuel reformer. The grid loss, back up application requires that it be designed for 50 start/stop cycles per year over a 10-year life (500 total). Independently verified field experience has demonstrated performances that exceed this design value by almost an order of magnitude. It is anticipated that the GenCore's annual back up duty cycle in the applications in South Africa will only be a maximum of 150 hours/year.

The 5 kW GenCore product has a smaller data base of demonstration record at 107 units shipped when compared to 550 GenSys systems. The Plug Power Reliability Fleet had twenty-one (21) units with 91,500 commissioned hours and total runs of 26,700 hours while the longest single commercial unit has had 9,192 commission hours with 2,742 run hours. Individual stack performance data was provided for all Plug Power fielded units to date, as the technology has matured throughout SU prototypes. The data demonstrate a consistent improvement in stack life with time and experience. Stack voltage degradation rate over time is a generic metric of system life and performance, and the GenCore's is specified as 6.67%/1000 hours. This translates to over 14 years run time at 5 kW peak output, and to over 28 years run time at the anticipated average 2.5 kW output. This degradation rate is regarded as favorable and acceptable by the due diligence examiners. Unscheduled maintenance for commercial installations has improved from 6.8/yr down to 2.01/year, and the mean time between failure (MTBF) for the Reliability fleet is now 537 runs hours. Forecasted operating life is based on analytical, third party equipment and PRISM software.

The GenCore system operates on 99.95% pure hydrogen from compressed gas cylinders. The 30 second response time from dormant to load pick up has made the unit an attractive backup power system in the remote telecommunication market in developing and developed countries. The price elasticity of demand and criticality of sustained back up power for telecommunications and essential services has recently been witnessed beyond normal grid outages during the recent natural disaster of Hurricane Katrina. The US Federal Aviation Administration (FAA) in 2004 publicly stated that fuel cells in back-up power roles for airport runway facilities are economically viable even at today's prices for back-up capability requirements greater than 4 hours. The remote telecommunications market for GenCore is unique due to the premium price that customers are prepared to place on reliability, minimal environmental impact for the extremely expensive alternatives needed for remotely located units. Plug Power estimates an approximately 55% life cycle cost advantage over battery back up systems, particularly in the South African context where the life of batteries is greatly reduced as a result of the challenging environment. Plug Power is gaining market penetration into the remote telecommunication market as witnessed by the recently announced awards for up to 300 units from Tyco and state agencies, and this volume approximates the units proposed to GEF. Additional market penetration is expected due to the recently enacted US Energy Legislation that provides a 30 percent tax credit up to $1,000 per kilowatt on the purchase of fuel cells used in residential or commercial applications as well as applications for telecommunications carriers. GenCore has been tested and certified to Level III of NEBS testing, which indicate that it is suitable for applications which demand minimal service interruptions over the equipment's life.

The GenCore product for UPS applications utilizes substantially the same fuel cells stack components as the GenSysII product for intermediate and base load applications. Although the GenCore has a lower duty cycle in a given year, its contributions to reducing the manufacturing costs via higher production levels are virtually equal to that of a GenSysII. The current GenCore orders in OECD markets can best be described as generating from environmentally conscious, early adopters that are placing orders to thoroughly demonstrate the suitability of GenCore to their application's specification. The current GenCore orders should not be characterized as "commercial" in the strictest definition of the term, although they are primarily sold to OECD private sector telecom and IT clients at a non-competitive price, they do have warranties approaching that of a commercial sale. The Plug Power/IST proposal represents some of the first GenCore orders from a non-OECD country that will more significantly expand the manufacturing volume of Plug Power's fuel cell stack components. These orders are creating market pull which can result in driving down the manufacturing volume-cost relationship. The IST/Plug Power proposal does not indicate that they will be phasing out the GenCore, but rather that they will be shifting the grant funding under this program to the more highly inelastic GenSysII which competes with the environmentally inferior, lower capital cost, reciprocating and diesel engines operating in a distributed generation mode. Thus, the short term support of GenCore leverages GEF funds by significantly increasing manufacturing volume that will cascade into a lower manufactured cost of the GEF focused GenSysII system in a sustainable fashion for the long term. Plug Power has sufficiently demonstrated during the due diligence process that the GenCore product's near term, commercial niche market appeal is on the technology's critical path to expanding the manufacturing resources for later remote base load and intermediate load applications. It is important to point out that the low 150 hrs/year duty cycle of the GenCore in this backup power application, represents a smaller portion of the estimated potential for CO2 avoidance under this program. However, it is recommended that the GenCore product and application be regarded as an essential technical and commercial stepping stone for greater and earlier market penetration of the GenSys product.

The 5 KW GenSysII System for Intermediate and Baseload Applications

The grid independent, DC output, propane fueled GenSysII has a 5 Kw_p capacity rating and is intended to be Plug Power's commercial offering for intermediate and base load applications in South Africa. For the IST South Africa applications of 1 – 5 kW, the GenSysII will load-follow whatever the application requires as it will be a grid-independent. While this system has benefited from previous experience with the GenSysI family of products, it features a new cell stack (95 cells versus 88) and a new reformer.

At over 400 of the precursor GenSysI delivered to customers worldwide in commercial, public sector, telecommunications, utility and uninterruptible power supply markets, Plug Power has one of the largest demonstration platforms for PEM fuel cells systems. ***Plug Power's GenSys technology represents the most extensively and independently tested PEM fuel cell systems in the world***; and thus, there is a significant foundation of independently analyzed data in the public domain for this technical due diligence. The 5 kW GenSys I were designed to operate on propane and natural gas, and over 500 systems have logged more than 2.0 million operating hours and 5.3 GWh of electric power on natural gas. On average, the GenSys I operated at 2.74 kWh which includes the time operating at the 2.5, 4.0 and 5.0 kW set points. Review of the GenSysI units operating data over the past eighteen months indicated a stack DC voltage degradation rate for the fleet at 1.43-1.79%/1000 hours. The GenSys I Reliability Fleet of twenty-one (21) units has electrical efficiency of 27% (LHV), and the GenSys II is expected to achieve 30% with LPG. GenSys I systems have a failure rate of 1.62/year or one per 5,407 hours. The foremost source of independent data has been the US Department of Defense's Residential PEM Demonstration Project which has experience from numerous vendors over 362,998 of total operating hours, 927,773 of total kWh produced with a fleet average electrical efficiency of 24.0% and availability of 89%. Plug Power with 52 units represents the majority of DOD's PEM residential program.[3]

Fuel processors have long been a dilemma for PEM fuel cells developers, and Plug Power has been extremely responsive to the due diligence examiner with respect to their demonstrated capabilities. Based upon eight (8) units of the early versions of the product installed at Saratoga NSU and operating a total of 37,935 hours, a mean time between failure for the fuel processor was calculated at 6,021 hours. The catalyst life of the autothermal reformer fuel processor for the GenSys II is estimated by Plug Power to be respectable 100,000 hours. The GenSys I fuel processor was designed for 33 start/stop cycles per year while the GenSys II was designed for 10/year. The fuel processor requires the majority of the 180 minute cold start to full load. Transient response of the combined reformer/stack allows transition from 12% to 100% of rated power in less than 10 minutes. The GenSysII reformer is designed to be modular, such that many of the individual components can be serviced in less than 30 minutes. In summary, based upon Plug Power's fuel cell processing expertise, design specifications and demonstrated performance of current systems, fuel processing for their systems does not at this time represent a technical concern to the due diligence examiners.

[3] http://www.dodfuelcell.com/

The cumulative confidence in GenSysII is based upon the GenSysI demonstrated performance and the current field test by the US Air Force. To date, five (5) of the thirty-five (35) GenSysII units scheduled for field test have been installed at Robins AFB, Georgia USA, but these units have not been in operation for a sufficient amount of time to provide any meaningful data.[4] The US DoD announced on July 10, 2005 an award to Plug Power for ten (10) next-generation continuous-run fuel cell 5 kW systems to be operated on LPG (liquefied petroleum gas) fueled systems to confirm system reliability and suitability for forward deployment efforts on military bases. Thus, the GEF and the IFC have a validation from a universally recognized third party of the demonstration program to date, a contractual willingness to expand and extend the relationship with Plug Power, and a developmental support for LPG which has a significant implication to utilizing the existing LPG supply infrastructure in the World Bank's client countries.

Plug Power has represented that their commercial product rollout is dependent on field test results that average 95% availability, no more than 2 unscheduled service visits/year, and a 10,000 hour demonstrated cell stack life. GenSysII systems are designed to experience 10 start/stop cycles per year, and laboratory units have already demonstrated more than 100 start/stop cycles. GenSysII fuel cell stack degradation rate is 6 micro V/cell-hr which corresponds to a degradation rate of 0.9%/1000 hours.

Batteries included as part of the GenSysII system are either charged or discharged during transients to accommodate the difference between electric power generation by the reformer/stack combination and the fluctuating load demand placed on the system. Laboratory units have demonstrated efficiencies in excess of 30% on LPG fuel, with cell stack degradation rates of less than 1%/1000 hours. The system is designed to be water-neutral, and to not require purge nitrogen for startup/shutdown.

In summary, the GenSysII represents the next generation of intermediate and baseload PEM fuel cells from the world's largest supplier of independently demonstrated units in the 5 kW capacity range. The combined market pull of the GenCore units for the price insensitive back up telecommunication applications, including IST's in South Africa, and the price sensitive GenSysII intermediate and baseload applications represents one of the strongest possible proposals from the global fuel cell industry at this time.

Sustainability

IST and Plug Power have identified the telecommunications back-up market in South Africa as an early adopter of fuel cells to displace diesel generators and batteries currently being used in a distributed generation application. Furthermore, while the sponsors have identified 400 sites for the units under this program, this number correlates with less than 2% of the total market that they are pursuing. The sponsors hope to gain enough traction with their current marketing efforts and through this program to obtain a much higher share of the back-up power telecommunications market. This will require the sponsors to invest in ancillary infrastructure

[4] The first five Robbins AFB units have been installed in the grid-connect mode using various inverter suppliers that Plug Power will eventually specify for the GenSysII product to be offered for AC power.

required to support such a business, such as the establishment and training of technicians in South Africa. The transfer of this technology by Plug Power to South Africa will also lead to knowledge transfer in the field of fuel cells. IST/Plug Power have represented that the grant funding under the FCFI will accelerate the process of commercial sustainability for both the GenCore and the GenSys product. Finally, promoting this technology, the FCFI is promoting clean distributed generation alternatives, which could have the potential to offset or completely displace more polluting technologies, such as diesel generators. The IFC review team feels that all of these activities contribute to the increased probability of future sustainability of fuel cells in South Africa.

Replicability

The FCFI program is designed in two stages, and Stage 2 of the FCFI initiative will not commence until costs of fuel cells have dropped to certain levels. IST and Plug Power have represented that they anticipate a 5% annual reduction in capital costs of their product over the next five years. If true, the IFC expects that the replication potential for future fuel cell projects in South Africa, and elsewhere will be very high.

In addition, the IST/Plug Power project has received strong support from the Department of Science and Technology of South Africa, and indicates that this project is in line with its overall renewable energy strategies and the development of the fuel cell market in South Africa. This supports the IFC's claim that there is a high replication potential for this project and others like it, and indicates that there is support from the government for sustainable development of the fuel cell market.

Funding Allocation

Stage 1 of the Fuel Cell Financing Initiative for Distributed Generation Applications provides for a total funding allocation of $9.825 million in GEF funding. This sub-project will be eligible for up to US$ 3 million in grant funding. The funding allocated for this project is as follows:

FCFI Stage 1 Grant Funding	US$ 3.000 million
FCFI Stage 1 M&E Allocation	US$ 0.175 million
Total funding from GEF for FCFI Stage 1	**US$ 3.175 million**

There are additional technical assistance funds in the amount of US$ 100,000 that can be made available for activities related to this project, or which support and promote the use of fuel cells in South Africa. In addition, the Department of Science and Technology (DST) in South Africa has fully supported this project, and has expressed an interest in assisting in capacity building and barrier removal for the adoption of these products in South Africa. This could indicate support which could leverage any technical assistance funds provided under this program.

Monitoring and Evaluation

The IFC committed to the GEF that it would establish a monitoring and evaluation ("M&E") plan for each sub-project awarded grant funding under Stage 1 of the FCFI. The IFC, with support from the World Bank and from the external STAP evaluator, feels that these activities will be crucial to the success of Stage 1, and for the formation and development of the next stage of the program. The IST/Plug Power project is expected to contribute to the overall objectives of Stage 1 of the FCFI by installing over 2.0MW of fuel cell capacity and by deploying at least US$ 6 million in co-financing. Below is a description of the Monitoring and Evaluation plan envisioned for this project under Stage 1 of the FCFI. The Logframe for the IST/Plug Power project in South Africa can be found in Annex 3 of this document.

The M&E program for the IST/Plug Power project, which is to be managed by the IFC, will monitor the project's *physical outputs.* Data from the IST/Plug Power project under Stage 1 will be collected on (i) number of kW installed, or number of units installed and (ii) sustainability of the fuel cells projects including: business profitability, capital cost declines, scalability and reformer issues, institutional and financial viability of fuel cells. This data will be used to evaluate the project, and to gain operational and transactional experience about the project to improve the implementation of Stage 2 of the initiative. Specifically, data on the following will be collected:

- Number of kW installed, or number of units installed;
- Generation: cumulative MWh installed
- Avoided CO2 emissions
- Co-financing deployed under this project;
- Percent reduction of fuel cell component costs, including:
  - Fuel cell stack
  - Balance of Plant
  - Reformer technology, if applicable
  - Cumulative cost reductions over project life
- Percent of project capital costs that are eligible for subsidies;
- analysis mitigation mechanisms, including insurance policies, service agreements, warranties and O&M agreements;
- Replicable management tools, including corporate governance rules, reporting mechanisms and MIS systems to track progress.

IST/Plug Power will be required to report relevant data to the IFC on a quarterly basis. Regular monitoring of the project will occur through this reporting mechanism as well as through site visits as required.

Reviews would be conducted by an independent evaluator with the project developers which would establish rigorous monitoring and evaluation protocols as required but not less frequently than twice in the six year period under Stage 1 of the FCFI, with one of these evaluations being the final evaluation. Participatory M&E will also be adopted to ensure that the views of stakeholders are taken into account in assessing the project's results. An evaluation at the end of the project's life will be conducted by an independent consultant, and will look to evaluate the project's success based on the stated objectives and key performance indicators for the project.

At the final review, it is also possible that surveys would be contracted out to relevant research institutes and consulting companies in order to evaluate market and environmental impact of the project. The information provided by through these surveys would be particularly useful for project management, dissemination of lessons learned, and specifically would be useful for the larger Stage 2 of the initiative. In addition, the independent evaluator will look at the transactional structures and evaluate the effectiveness of the risk mitigation mechanisms contained within each one.

CO2/GHG Emissions Reductions Potential

Over the course of Stage 1 of the FCFI program, IST/Plug Power intend to deploy a significant number of PEM fuel cells in South Africa. The introduction of fuel cells into South Africa begins the process to leverage fuel cell technology to reduce emission levels when compared to incumbent power generation technologies. Both the IFC and IST/Plug Power understand that this activity will not be a single event displacing incumbent high greenhouse gas emissions (GHG) generating technology. Rather this will occur over time as the technology matures and technology transfer costs are reduced and the necessary infrastructure, labor force, and public acceptance are increased. The transition that is envisioned by IST/Plug Power is as follows:

1. Prove that systems are commercial – create awareness
2. Displace incumbent technologies where best advantaged
3. Lower cost and build margin
4. Optimize total system: emissions, wellhead to in-use reductions, sustainability practices, design for cradle to cradle operations.

Plug Power fuel cell systems leverage fuel cell technology and the advantages of the distributed power generation model to experience reduced emissions levels when compared to incumbent power generation technologies. The electro-chemical process within a fuel cell combines hydrogen and oxygen to form water. The transfer of electrons during this reaction is harnessed for electricity. The exothermic nature of the reaction generated waste heat that can be reclaimed by the end-user. Placing this type of power generation device at the point of use eliminates the line-loss and inefficiency experience with the centralized generation model and results in an overall more efficient system. The CO2 levels of fuel cells are comparable with the other technologies where carbon into the system equals the carbon leaving the system. Reductions in emission rates can only be achieved through efficiency increases; either with the technology or the overall transmission and delivery system. The distributed generation model advances this fundamental principle and reduces transmission and delivery losses dramatically.

The baseline or “business as usual” (BAU) case for measuring the potential CO2/GHG emissions reduction is the alternative technology that would be displaced by the fuel cell installations. In the case of IST/Plug Power, where there are two different PEM products, the BAU case is slightly different for each. In the case of the GenCore 5kW product, the fuel cell units will most likely displace hybrid systems comprising batteries plus diesel generators as backup power solutions. In the case of the GenSysII 5kW product, the fuel cell units will most likely displace diesel generators as primary power applications.

IST/Plug Power have performed an analysis on the amount of emissions reduced by deploying both their 5kW GenCore and GenSys fuel cell systems. This analysis calculates the amount of emission avoided assuming that the displaced power source is either a) a hybrid system comprising of a battery and a diesel generator (for the GenCore unit), or b) a diesel generator (for GynSys unit). The analysis below assumes that roughly 90% of the reductions are resulting from the GenSys installations, while only 10% result from the GenCore installation. The estimates of the CO2 emissions avoided assume a run time of approximately 150 hours annually. However, it is important to note that this is just an estimate of the number of hours of back-up generation required on average. It is possible, although unlikely, that a unit may have no operating hours in a year if there is no need for back-up generation.

The emissions reduction planned for the IST/Plug Power project is summarized in the following tables. Following the growth of the technology, the reduction of greenhouse gases is anticipated to significantly increase during the transition from backup to prime power applications.

Plug Power fuel cell systems leverage fuel cell technology and the advantages of the distributed power generation model to experience reduced emissions levels when compared to incumbent power generation technologies. The electro-chemical process within a fuel cell combines hydrogen and oxygen to form water. The transfer of electrons during this reaction is harnessed for electricity. The exothermic nature of the reaction generates waste heat that can be reclaimed by the end-user. The following shows the amount of CO, SOX, NMHC and particulate matter avoidance anticipated in Stage 1 and Stage 2 of the FCFI initiative

Table 1 - Comparison of GenCore & GenSys II Systems against Incumbent Technologies

Emissions Comparison

GenCore 5T and GenSys 5T48 vs. Diesel Genset

1/24/2005

Summary

This analysis calculates the amount of emissions avoided by using a Plug Power 5kW GenCore 5T or a GenSys 5T48 fuel cell system to displace a diesel generator in prime and backup applications. The comparison is based on the US EPA nonroad diesel combustion engine standards.

US EPA Diesel Emissions Standards for Nonroad Engines Tier 1-4 Standards

Tier 1 standards were phased-in from 1996 to 2000.

Tier 2 standards take effect from 2001 to 2006. (Current standards)

Assumptions

EPA Tier 1-3 Nonroad Diesel Engine Emission Standards, g/kWh

Engine Power	Tier	Year	CO	NOx+NMHC	PM
Engines less than 8kW	Tier 1	2000	8.0	10.5	1.0
	Tier 2	**2005**	**8.0**	**7.5**	**0.8**

GenCore 5T Emissions Profile, g/kWh

Engine Power			CO	NOx+NMHC	PM
5kW			0.0	0.0	0.0

GenSys 5T48 Emissions Profile, g/kWh

Engine Power			CO	NOx+NMHC	PM
5kW			0.045	0.041	0.0

Table 2 - GenCore and GenSys Emissions Reductions

GenCore - Emissions Mitigated Relative to Tier 1 Standard Diesel Generator

Year ended December 31	kW of sites	Existing sites	2005	2006	2007	2008	2009	2010	2011	2012	Total
Maximum number of projects that could be completed (with GenCore 5kW H2)	5	16,400	23	53	87	123	185	250	338	455	1,514
Total number of units running for a year period in each year		Units	0	23	76	163	286	471	721	1059	
Running time ("up-time") 150 running hours per System per year at 2.5kW average load		hours		3,450	11,400	24,450	42,900	70,650	108,150	158,850	419,850
Power Output (running time x average load)		kW-hrs	0	8,625	28,500	61,125	107,250	176,625	270,375	397,125	1,049,625
Emissions Mitigated (based on Tier 1 standards)											-
CO		lbs	0	152	503	1,078	1,892	3,115	4,769	7,004	18,512
NOx + NMHC		lbs	0	200	660	1,415	2,483	4,089	6,259	9,193	24,297
Particulate Matter		lbs	0	19	63	135	236	389	596	876	2,314

GenSys II - Emissions Mitigated Relative to Tier 1 Standard Diesel Generator

Year ended December 31	kW of sites	Existing sites	2005	2006	2007	2008	2009	2010	2011	2012	Total
Maximum aggregate capacity that could be installed (kW)	5		20	100	150	300	1050	2500	4125	7500	15,745
Total number of units running for a year period in each year		Units	0	4	24	54	114	324	824	1649	3,149
Running time ("up-time") 24x365 running hours per System per year at 2.5kW ave load		hours		35,040	210,240	473,040	998,640	2,838,240	7,218,240	14,445,240	26,218,680
Power Output (running time x average load)		kW-hrs	0	87,600	525,600	1,182,600	2,496,600	7,095,600	18,045,600	36,113,100	65,546,700
Emissions Mitigated (based on Tier 1 standards)											-
CO		lbs	0	1,536	9,218	20,740	43,785	124,441	316,480	633,343	1,149,543
NOx + NMHC		lbs	0	2,020	12,119	27,269	57,567	163,611	416,098	832,701	1,511,386
Particulate Matter		lbs	0	193	1,159	2,607	5,504	15,643	39,784	79,616	144,506

Total Emissions Avoidance Phase 1 of Program (Through 2008 – 286 GenCore / 114 GenSys):

CO Avoidance = 33,227 lbs 10 Year Life CO Avoidance = 456,744 lbs
Sox + NMHC Avoidance = 43,683 lbs 10 Year Life Sox + NMHC Avoidance = 600,491 lbs
Particulate Matter Avoidance = 4,176 lbs 10 year Life Particulate Matter Avoidance = 55,039 lbs

Total Emissions Avoidance Phase 1&2 of Program (Through 2012 – 1,514 GenCore / 3,149 GenSys):

CO Avoidance = 1,168,055 lbs 10 Year Life CO Avoidance = 12,194,439 lbs
Sox + NMHC Avoidance = 1,535,683 lbs 10 Year Life Sox + NMHC Avoidance = 16,032,920 lbs
Particulate Matter Avoidance = 146,820 lbs 10 year Life Particulate Matter Avoidance = 1,532,857 lbs

If the electrical efficiencies of stationary electricity generation possibilities are compared (see below), fuel cells show higher efficiencies than to day generation production in their size range. Although it looks like central power production has a lower emission profile, two items need to be taken into account. First the power has to be transported with additional losses and thus the CO2 emissions will rise. Secondly, the heat usage of the systems is not taken into account. The distributed use of small scale fuel cells allows high usage of the produced heat of the systems. When the unit is used for such combined heat and power solutions, the CO2 emissions are less then central power production. It is currently calculated to achieve approximately 9% reduction over conventional power generation alternatives; however with improved efficiencies expected in the future it is to be expected that this reduction increases up to 31%. The following is a calculation of the CO2 avoidance anticipated through Stage 1 and Stage 2 of the FCFI initiative.

Assumptions:

- Diesel GenSet creates 1.96 lbs / kWh
- GenCore creates 0.0 lbs / kWh
- GenSys creates 1.63 lbs / kWh

CO2 Avoidance Phase 1 of Program (Through 2008 – 286 GenCore / 114 GenSys):

GenCore CO2 Avoidance = 192,570 lbs 10 Year Life GenCore CO2 Avoidance = 2,102,100 lbs
GenSys CO2 Avoidance = 592,614 lbs 10 Year Life GenSys CO2 Avoidance = 8,238,780 lbs
Total CO2 Avoidance = 785,184 lbs Total 10 Year Life CO2 Avoidance = 10,340,880 lbs

CO2 Avoidance Phase 1&2 of Program (Through 2012 – 1,514 GenCore / 3,149 GenSys):

GenCore CO2 Avoidance = 2,057,265 lbs 10 Year Life GenCore CO2 Avoidance = 11,127,900 lbs
GenSys CO2 Avoidance = 21,630,411 lbs 10 Year Life GenSys CO2 Avoidance = 227,578,230 lbs
Total CO2 Avoidance = 23,687,676 lbs Total 10 Year Life CO2 Avoidance = 238,706,130 lbs

As mentioned above, IST/Plug Power intend to use the GEF funding under the FCFI Program to install the initial 400 units of the 5kw GenCore and GenSys PEM fuel cells in South Africa. The grant funding under Stage 1 of the FCFI will contribute roughly 25% of the total cost of the unit for each of the 400 x 5kW units deployed under Stage 1 of the FCFI program. The total funding required by IST/Plug Power for Stage 1 of the FCFI is $3 million, and the total project costs for the first 400 units are estimated to be about 13.6 million, including fuel costs and O&M costs.

Criteria for Selection

The table below assesses this project alongside the criteria outlined in the Project Document submitted to the GEF Council in November 2003. The project scores well in several categories.

The IFC believes that IST/Plug Power have a well thought through business model for deploying PEM fuel cells into the South African distributed generation market, specifically the back-up power market for the telecommunications sector, during the Stage 1 period. IST/Plug Power have also developed strong partnerships with some of the leading parties in South Africa's telecommunications, power and gas markets. The IFC believes that these things provide a solid foundation for the project, and that there is a relatively good probability of success and sustainability of the business model.

Criteria Used to Select Projects and Develop the Baseline for Projects	How Project May Meet Criteria	IST/Plug Power
Potential value of the transactional experience obtained through the project's implementation	*To gain experience through Stage 1 ("learning by doing") it is imperative that:* • Sponsor involvement demonstrates a commitment to the project's overall success and demonstrates a long-term commitment to the market • Countries selected possess market conditions or reform potential that will facilitate the introduction of fuel cells in stationary applications and distributed generation.	• IST and Plug Power are installing a large number of 5kW units, and as such the project represents a unique transaction model (ie: white goods), and will provide valuable transactional experience. • South Africa's regulatory reforms strongly favor renewable energy solutions, distributed generation and clean energy projects. • Plug Power anticipates moving part or all of its manufacturing and assembly capabilities in country at a point in time when the market is sufficient to sustain such activities. IFC feels that this demonstrates a strong commitment to the South African fuel cell market for stationary power.
Incremental costs on a narrowing trajectory (sustainability)	• Future incremental costs are shown to narrow over time. • Developer's forecasted reductions in capital costs and improvements in efficiencies are reasonably projected and imply future commercial sustainability. • Capital costs of fuel cell	• Plug Power anticipates an annual reduction in price of 5%, which will contribute to the overall commercial sustainability of the product in the market.

	will be on a downward trajectory such that projections of costs in the Stage 2 timeframe (5-8 years) will result in no more than 35% incremental cost margin (the cap for Stage 2 GEF grant component)	
Quality of lead sponsor and partners	• History of transactional and development experience • Strong partnerships with local industry and/or local support • Technical capacity of fuel cell as measured by various testing/R&D metrics • Corporate governance rules in place and willingness to comply with IFC/GEF reporting requirements.	• Plug Power has more commercial units in the field than any other fuel cell company, and as such has a significant amount of transactional experience. • IST and Plug Power have gathered an impressive set of partners to roll out this initiative. • Plug Power has significant testing history for both units under the proposal. • Plug Power has extensive quality management systems in place. • Both Plug Power and IST are ISO 9001 compliant
Financing details and risk sharing	• Ensure that capital structure (Debt/Equity) is beneficial and provides greatest leverage. • Project developers, manufacturer's guarantees and power purchase agreements provide sufficient creditworthiness, or credit risks are mitigated through contractual structures. • Technology risks are adequately assumed by manufacturers or ESCOs rather than end-users. • Warranties and/or service agreements provide sufficient coverage of technology risks.	• IST/Plug Power are providing a standard warranty for their units. • IST/Plug Power are also developing local training for technicians to be able to support the systems in the field. Several training sessions have already taken place. IFC sees this as a key risk mitigator, as technical support will be critical to market acceptance and penetration. • All risk sharing mechanisms and structures to be finalized during the grant negotiations.

Potential widespread penetration of the market, replicability and sustainability	• Due diligence affirms there is substantial regional and global "market pull" for similar sized fuel cell units with comparable capital cost, efficiency, performance and fuel usage. • Choice of applications provided the greatest potential for replicability and sustainability in the market • The business plan adequately addresses the strategy for expansion into the regional and global market.	• IST/Plug Power have chosen the back-up power market for the telecommunications sector in South Africa. IST/Plug Power have presented conservative estimates of market penetration, and feel that it is likely that they will be able to replicate the model and gain further market penetration once the program is underway. • South Africa's government policies strongly favor fuel cells as a renewable energy source, and distributed generation solutions in general.
Timetable envisaged for project preparation and completion	• The proposal establishes a realistic timetable for project development and financing based upon a set of minimum requirements for field testing, in-country capacity building, and establishing manufacturing capabilities. • The proposal establishes a minimum performance specification for duration.	• IST/Plug Power have presented a conservative timetable, which the IFC feels is achievable.
Overall potential for CO2 emissions reductions with widespread penetration of the market	• The choice of applications will be such that future penetration of the technologies will ensure significant reductions in CO_2 reductions over the "business as usual" (BAU) case	• IST/Plug Power have projected the impact on CO2 reductions as a result of their project, as measured by avoided emissions. Emissions reductions projections are presented in this document.

Risks

In the Project Document submitted to the GEF Council in November 2003, the IFC identified four main risks for fuel cell projects under this program. These risks are:

1. Technology Risk
2. Affordability Risk
3. Commercial and Market Risks
4. Policy and Regulation Risks

Proper risk allocation among stakeholders in a project in order to optimize cost/benefits can be one of the more challenging parts of project development. One of the objectives of Stage 1 of this initiative is to develop an understanding of how best to mitigate project risks for different transaction structures relevant to the development of fuel cell projects. In the case of IST/Plug Power, the joint sponsors are acting as both a technology provider for their customers and have created a strong partnership with a critical entity that will eventually service and maintain their products. The most important risks in this case are the affordability risks and commercial/market risks, specifically those related to servicing and maintaining the systems. The IFC feels that IST/Plug Power have a well thought through business proposition that will attempt to mitigate as many of these risks as possible at this stage. The table below is an explanation of how IST/Plug Power will attempt to address all four main risk areas in their fuel cell project in South Africa.

Identified Risk	Recommended Mitigations / Indicators	IST – Plug Power Proposal Status / Mitigation Plans
Technology Risks	• Number of System Installs	• Plug Power has sold and installed at customer sites over **500 Fuel Cell Systems** worldwide since 2001. • Believed to be more customer site installations then the rest of the Fuel Cell Industry combined
	• kW-hrs of Power Generated	• Plug Power Fuel Cell Systems at customer sites have produced approximately **5.3MGWh** of electricity
	• Hours of Operation	• Plug Power Fuel Cell Systems have accumulated more than **2M operating hours (up-time)** at customer sites
	• System Reliability	• **Significant field experience and learning** - Plug Power Fuel Cell Systems have grown reliability from > than 30 service calls per year in 2001 to < than **2 service calls/yr on our GenSys I Systems and less than 1 call/year on our GenCore Systems** – using third party and customer service organizations
	• Support Infrastructure	• IST is an established power equipment installer and service provider in South Africa. • Plug Power has a fully implemented 24hr second level support hotline and infrastructure in place that has supported over 500 worldwide installations • Plug Power second level technical support resides in both the US and Apeldorn Netherlands.
	• O&M Strategy	• Plug Power will put technical support on the ground in South Africa as required.

Identified Risk	Recommended Mitigations / Indicators	IST – Plug Power Proposal Status / Mitigation Plans
Technology Risks cont.	• Warranty • Qualified Technician Availability • Fuel Cell Stack Technology • Fuel Reformer Technology	• IST and/or the end customers will provide all first level service support. • IST and Plug Power will provide second level support • Spare parts inventory will be maintained on ground in South Africa. • Plug Power has a train the trainer and a technician training class that has been. delivered successfully to several hundred field service reps. • GenCore Systems have a 2 year or 1500 hour full parts warranty. Plug Power can provide an extended warranty beyond year two through year five. • GenSysII has a 2 year full parts warranty and a 5 year full part warranty on the fuel cell stack • 24 hour swap out will be offered from IST location as and if required • IST has trainers and technicians trained on GenCore Systems • Plug Power has a full 3 day technician training course and a 5 day train the trainer course for GenCore. • Train the Trainer and Technician training will also be available for GenSysII • When the program is approved IST/Plug would like to start training technicians and service personnel in South Africa o Train the Trainer classes on the ground in South Africa for each of the major customers on GenCore o Technician Training on the ground in South Africa for incremental IST Service Representatives and Initial Service Reps for each major customer on GenCore o Process would be repeated for GenSysII introduction • Plug Power has over 2M operating hours at customer field installations on stack technology • Plug Power has improved stack life from 100's of hours in 2001 to > 10,000 hours through system control and design improvements. • Projections for GenSys II stack life are > than 20,000 hours • Plug Power has over 2M operating hours at customer field installations on reformer technology. • Very low failure rate on GenSys I installations • Field Test data from over 500 fielded systems, benchmark micro-flow reactor capabilities and dynamic modeling capabilities drive high confidence in our Fuel Processor design • Significant learning from field installations and system autopsies have driven significant improvements into GenSys II Fuel Processor Design.

Identified Risk	Recommended Mitigations / Indicators	IST – Plug Power Proposal Status / Mitigation Plans
Affordability Risk / Financial	• Cost Reduction Capabilities	• GenCore and GenSys Products have reduced cost >> 20% per year on average since 2001 for technology and design reductions – Volume reductions have not been considered • IFC/GEF Fuel Cell Financing Initiative Program proposal from IST/Plug Power calls for year over year price reductions of 5 to 12% which is well within Plug Powers demonstrated cost reduction capabilities and will allow margin growth making fuel cell business for IST and Plug Power sustainable.
	• First Cost Price Point against competitive technologies	• End customer first cost price points with IFC/GEF capital credits are very competitive with incumbent battery and generator pricing in South Africa and the African continent. • Plug Power research has shown that customers are willing to pay a slight first cost premium for Fuel Cells because of reduced operating costs, reduced maintenance requirements, reduced noise, and reduced emissions compared to batteries and generator sets.
	• Cost of Ownership Comparisons	• Cost of ownership for GenCore Systems is less than batteries because of increased life and less than generators because of reduced maintenance compared to generator sets.
	• Project Costs Underestimated	• IST has completed several installs to date and has a good understanding of costs. • Plug Power has over 500 worldwide fuel cell installations and over 100 GenCore installations worldwide giving us a very informed ability to estimate project costs. • Fuel Pricing commitments are in place and reflected in project proposal
Affordability Risk / Financial cont.	• Financial Strength of Sponsors	• IST Group o Well established power industry supplier and service provider o Greater than R323 million revenue in 2004 o Greater than R39 million profit in 2004 • Plug Power Inc. o Public Company listed on NASDAQ exchange o Strong and lean balance sheet with 110M in cash & equivalents o Viewed as leader in Fuel Cell Industry enabling: • Access to Capital through public markets • Have raised $448M life to date through public security offerings
Project Structural Organization Risks	• Program Sponsors	• IST and Plug Power have been working together since 2003 with the mutual goal of opening the South African and African continent power markets to fuel cells
	• Contractual	• IST is a contracted Distributor and Service Provider for Plug

Identified Risk	Recommended Mitigations / Indicators	IST – Plug Power Proposal Status / Mitigation Plans
	obligations among sponsors • Key Program Partners • Customer Relationships	Power Fuel Cells including all business terms. • Eskom is the 6th largest utility in the world and has strong interests in replacing their battery and generator infrastructure with GenCore fuel cells. • Eskom has been running a GenCore system in technology demonstration for nearly a year and is in the process of installing two more systems in substation installations. • Eskom prepared an installation forecast for our proposal that shows a 300% increase in installed volumes with the IFC/GEF Capital Credit • Vodacom is South Africa's largest wireless telecom provider with over 10M subscribers. • Vodacom has strong interest in both GenCore for back-up power and GenSys for remote base station installations. • MNT is South Africa's second largest wireless telecom provider with over 6.8M subscribers and MNT has over 6,500 cell sites in Africa. • MNT has strong interest in both GenCore for back-up power and GenSys for remote base station installations. • Telkom SA is South Africas's only fixed line telecom provider with over 2000 sites in South Africa. • Telkom SA has strong interest in GenCore for back-up power. • IST has strong business relationships with Eskom and Telkom SA. • IST has been providing power and telecom equipment and service support to Eskom and Telkom SA for more than 7 years.

Commercial and Market Risks
 	
Commercial and Market Risks cont.
	• Technology Adoption Rate of Target Industries
	• Customer Interests in Technology
		• Mitigating Factors that make South Africa a great market:
		  o Key target customers Eskom, Vodacom, and MNT are very interested in moving to fuel cells.
		  o South Africa environment (temperature and dust) is very brutal on batteries and generators leading to short lives and significant maintenance costs.
		  o South African infrastructure is old and needing repair and upgrade.
		  o Wireless Telecom expansion is being limited by grid infrastructure and MNT and Vodacom want a clean remote continuous power source (GenSysII)
		  o South African Government is pushing for cleaner power technologies and the removal of noisy, dirty diesel generator sets.
		• Plug Power/IST will prepare a separate proposal on how to accelerate adoption through Technician, Technician Trainer, Engineering, and Sales Training on the ground in South Africa for IST and Key Customers at the time of program approval. It will also propose incremental Plug Power

Identified Risk	Recommended Mitigations / Indicators	IST – Plug Power Proposal Status / Mitigation Plans

	• Availability and Cost of fuel supply
	
	• Competitive responses
		resource on the ground in the initial phase of roll-out. Proposal will use a percentage of TA program funding to execute this accelerated training.
		
		• AFROX a member of the worldwide BOC gas organization (South Africa's biggest Hydrogen and LPG source) has agreed to preferential Hydrogen and LPG pricing for the program phase 1 duration.
		• The AFROX Quotation for Hydrogen and LPG cost infrastructure is built right into the program proposal and the customer cost of ownership economic models.
		
		• Batteries
		  o Battery market has become a commodity market with very small or negative margins.
		  o Lead prices which contribute over a third of production cost for Stationary Lead Acid Batteries have doubled in the last 2 years
		  o Above factors make it very unlikely that Battery manufacturers will respond with a significant cost reduction.
		  o Batteries are a mature technology with very slow innovation. It is very unlikely that they will come up with a solution for the environmental extremes that reduce battery life significantly.
		• Generator Set Companies
		  o Emission regulations are going to make it very difficult for generator set manufactures to hold current prices, more likely is price increases for the extra equipment required to reduce emissions.
		  o Additional equipment for emission management will only increase the disadvantages generator sets have compared to fuel cells around maintenance costs.
		  o Noise is becoming a greater and greater issue for generator sets as population expands – Noise reduction packages have similar cost and maintenance cost implications for generator sets.
		• Fuel Cell Companies
		  o The opening of the South African and African Continent power markets to fuel cells will likely bring in more fuel cell companies, more competition, and a greater likelihood of building a sustainable fuel cell industry in RSA and the African Continent forming.

Policy and Regulatory Risks	• Environmental Regulations • DG supportive policies • Host country support	• Environmental Emission regulations will be very positive for fuel cell adoption and will increase price pressure on incumbents. • Recent public releases and meetings with high level Republic of South Africa Government officials have been very supportive of DG, Fuel Cells, and Hydrogen Economy.

Identified Risk	Recommended Mitigations / Indicators	IST – Plug Power Proposal Status / Mitigation Plans
Policy and Regulatory Risks cont.	• Grid Interconnect Standards	• Support has been represented from the Dept of Science and Technology, Resources and Minerals, and Environmental Affairs and Tourism. • Endorsement letter from Republic of South Africa GEF Operational Representative who is also RSA Director General of Environmental Affairs and tourism is forthcoming • .GenCore and majority of GenSysII installations are Grid Independent (off-grid remote) allowing time to develop grid interconnect standards in parallel as fuel cell technology is accepted.

ANNEX 1: IST GROUP/PLUG POWER PROJECT DOCUMENT

ANNEX 2: GEF FOCAL POINT ENDORSEMENT FOR SOUTH AFRICA PROJECT

ANNEX 3: LOGICAL FRAMEWORK: IST/PLUG POWER PROJECT: SOUTH AFRICA

	Narrative Summary	Objectively Verifiable Indicators	Means to Verify	Assumptions
Goal	To support the creation of sustainable markets for stationary fuel cells which will enable the reduction of GHG emissions	GHG emissions reductions associated with this project, and fuel cell costs as tracked and measured over time	Information from the sponsor, independent M&E review of FCFI Stage 1, and all sub-projects	1. Assumes fuel cell costs decline over time 2. Assumes that supporting this project will lead to a sustainable market for fuel cells in South Africa. 3. Assumes that fuel cells will offset GHG emissions
Objective	Promote the use of fuel cells in South Africa through the installation of over 1MW of fuel cell capacity	Project is fully implemented and disbursed; TA funds are utilized to assist in creating market for the product.	Independent M&E review of the project	1. Assumes that money disbursed will result in the installation of over 1MW of fuel cell capacity.
Activities	1. Implement grant agreement which outlines performance requirements and milestones for kWh installed or number of systems installed 2. Implement TA and M&E related activities for the project, including reporting requirements; 3. Monitor the reduction of capital costs of	1. Fully executed grant agreement 2. Disbursement of at least 70% of total grant award against achieved milestones 3. TA program implemented based on demonstrated demand for TA funds	Task manager reports and independent M&E verification of project activities.	1. Assumes that the sponsor will be able to deliver on the project and install 2 MW of fuel cell capacity 2. Assumes that TA funds are used to facilitate market penetration (i.e.: for training technicians)

	fuel cell components.			
Output	1. Install 400 systems 2. Reduction of technology costs during Stage 1. 3. achieve at least 2.0 MW installed capacity 4. At least 785,000 lbs of CO2 avoidance	1. kWh installed 2. cumulative MWh installed (generation 3. # of systems installed 4. cumulative CO2 emissions avoided 5. % of fuel cell component cost reductions, or reduction of $/kW per FC system of at least 10% over the life of the project in Stage 1. 6. cumulative CO2 avoided as a result of installations	Quarterly reporting indicators and independent M&E review to track progress against baseline.	1. Assumes that the sponsors have the capacity to deploy at least 400 system in the field 2. Assumes that installing 400 systems in the field will result in cost reductions

DOCUMENT OF

THE INTERNATIONAL FINANCE CORPORATION

FUEL CELLS FINANCING INITIATIVE FOR DISTRIBUTED GENERATION APPLICATIONS

GEF Project Document

October 2005

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PROGRAM BACKGROUND AND OBJECTIVE (FCFI)

The Fuel Cells Financing Initiative for Distributed Generation Applications (FCFI) is designed to accelerate the market for fuel cell technologies in distributed, stationary power applications, as outlined in the strategy document titled, “Market Prospects and Intervention Strategies to Accelerate the Deployment of Fuel Cells in Distributed Power Generation in Developing Countries”. This document was presented to the GEF Council at its December 2001 meeting. The concept note titled, “Fuel Cell Financing Initiative for Distributed Generation Applications” was submitted to the GEF Council in April 2002. IFC obtained and received concept approval in June 2003 from the GEF for a US$ 54 million of GEF funding after responding to the Council’s questions and clarifications. This initiative is to be funded in two stages. Stage 1 of the FCFI Program was approved by the GEF Council in November 2003, and has a total funding allocation of US$ 9.825 million for project grants, technical assistance and M&E activities. Stage 1 allows for up to three separate grants, each of which require separate CEO endorsement. Stage 1 is anticipated to span a six year period.

The overall objective of this initiative is to facilitate reduction of the long-term costs of fuel cell technologies and to promote their use in GEF-eligible countries. The long term objective of the initiative is to catalyze the creation of sustainable markets for fuel cells in suitable stationary power applications in GEF eligible countries. The IFC/GEF initiative is designed to support market conditioning, regulatory reform, sustainable commercialization and long-term financial viability of fuel cell technologies, in a variety of applications in GEF eligible countries.

In Stage 1, the objective is to prove the environmental and economic benefits of fuel cell technologies through an initial series of stationary power applications. A key goal is to obtain operational experience and an understanding of transaction models and project risks necessary to introduce these technologies in developing countries. The results of Stage 1 are to be used to inform the design of the larger second stage of the initiative. Therefore, appropriate emphasis on progress monitoring and choice of M&E indicators at an individual project level is also a stated objective of this initiative. In addition, Stage 1 will also be used to impart appropriate technology training and information dissemination within host countries through targeted Technical Assistance. Once again, these technical assistance activities are likely to help in laying the ground for Stage 2.

As part of the objectives for Stage 1, the IFC works with the private sector to develop projects in GEF eligible countries. The role of the private sector in identifying opportunities and examining the possibilities and barriers to entering into such transactions is very important for the overall success of this Program. We believe private sector companies will be able to react more quickly to the changing nature of electricity markets and supply, and may be able to capture opportunities that arise as a result of deregulation. Specific project structures under the FCFI Program will be designed on a project by project basis to take into consideration all stakeholders involved, including both private sector and public sector entities. In addition, project structures will be designed to meet the objectives of the two stages of this initiative.

On the whole, the FCFI contributes to the key targets of the GEF Business Plan by a) supporting a technology that is more efficient because it produces more energy per unit of fuel used, b) significantly reduces the amount of carbon emissions due to the fuel cell process itself, and c) forming a bridge to the hydrogen economy, where there is expected to be significantly few carbon emissions. In these ways, the FCFI contributes to the key targets of the Business Plan by reducing greenhouse gas through emissions avoided as a result of implement fuel cell projects in developing countries.

FUNDING ALLOCATION

Stage 1 of the Fuel Cell Financing Initiative for Distributed Generation Applications provides for a total funding allocation of $9.825 million in GEF funding. These funds are allocated as follows:

FCFI Stage 1 Grant Funding	US$ 9.000 million
FCFI Stage 1 TA Allocation	US$ 0.300 million
FCFI Stage 1 M&E Allocation	US$ 0.525 million
Total funding from GEF for FCFI Stage 1	**US$ 9.825 million**

Grant funding under this inititative will be allocated to no more than three (3) separate sub-projects. Each sub-project will be eligible for a maximum grant of US$ 3 million. Techinical assistance funds in the amount of US$ 300,000 can be used for project-specific or non-project activities assocated with promoting fuel cells in the countries selected. A maximum of US$ 100,000 will be allocated for each project.

MONITORING AND EVALUATION

The IFC committed to the GEF that it would establish a monitoring and evaluation ("M&E") plan for Stage 1 of the FCFI, as well as each sub-project awarded grant funding under Stage 1 of the FCFI. The IFC, with support from the World Bank and from the external STAP evaluator, feels that these activities will be crucial to the success of Stage 1, and for the formation and development of the next stage of the program.

Stage 1 of the FCFI is anticipated to span no more than six (6) years. On a programmatic level, Stage 1 of the FCFI initiative will seek to install a combined capacity of at least 4MW of fuel cells in at least two countries. In addition, the FCFI will seek to secure co-financing of at least $US 14 million in three sub-projects. It is anticipated that overall capital costs of the fuel cell plant will decrease by at least 5% during the period of Stage 1, however this will be highly dependant on the type of fuel cell (eg: PEM, SOFC, MCFC). There will be one mid-term review in the third year of Stage 1, and a final review at the end of this part of the initiative, or at year six, whichever is earlier. The logframe for Stage 1 of the FCFI initiative can be found in Annex 1 of this document.

FCFI envisages detailed evaluation of impacts, both on a programmatic level and on a sub-project level, to establish its effectiveness in meeting its goals and objectives under this initiative. Objectives of each of the sub-projects will contribute to the overall objectives of Stage 1. The M&E program for Stage 1, which is to be managed by the executing agency (IFC), will consist of three parts: (i) monitoring of the program's *physical outputs* to assess the progress in reaching the renewable energy targets and in monitoring progress and lessons learned with regards to transaction structures, risk sharing, and project types; (ii) evaluation of the program's *impacts* to assess reduction of barriers, including cost barriers, of the fuel cell technology, especially in developing countries; and (iii) to evaluate the *lessons learned* from the development of each project in order to inform Stage 2 of the initiative.

Activities and Data Gathered Under M&E

Generally, data from each fuel cell project under Stage 1 will be collected on (i) number of kW installed, or number of units installed; (ii) sustainability of the fuel cells projects including: business profitability, capital cost declines, scalability and reformer issues, institutional and financial viability of fuel cells, etc; and (iii) environmental impact. This data will be used to evaluate each project, and to gain operational and transactional experience about the types of projects to improve the implementation of Stage 2 of the initiative (the "learning by doing" approach). Specifically, data from each project under FCFI would be collected on the following:

- GEF Climate Change indicators, as applicable to the specific project, including:
    - installed capacities;
    - generation: cumulative MWh installed
    - avoided CO2 emissions, cumulative
    - Reduction of technology costs;
    - Expansion of business and supporting services for the fuel cell projects;
    - Development of sector policies, laws and regulations that support project goals;
    - Improvement of awareness and understanding of technologies among producers and users;
    - Change in consumption, fuel-use pattern and impacts on end-users; and
    - Emissions avoided as a result of the fuel cell project.

In addition, data on the following will be collected for each project under FCFI:

- Number of kW installed, or number of units installed;
- Percent reduction of fuel cell component costs, including:
    - Fuel cell stack
    - Balance of Plant

    - Reformer technology
- Percent of project capital costs that are eligible for subsidies;
- Transaction models, including an analysis of replicable and successful risk mitigation mechanisms, including insurance policies, service agreements, warranties and O&M agreements;
- Replicable management tools, including corporate governance rules, reporting mechanisms and MIS systems to track progress.

Limited monitoring of this data will happen on a yearly basis at the sub-project level.

Mechanisms for Reporting

Project developers under Stage 1 will be required to report relevant data to the Task Leader at the IFC on a quarterly basis. Regular monitoring of the projects will occur through this reporting mechanism as well as through site visits as required. Disbursements of grant money will be dependent upon the project developers' ability to establish a well thought through reporting mechanism as well as other conditions precedent. These will be specific to each project's key performance indicators.

The MTR for Stage 1 could be conducted within IFC in accordance with GEF practices, but the final review of Stage 1 will be conducted by an independent evaluator. Participatory M&E will also be adopted to ensure that the views of stakeholders are taken into account in assessing the project's results. The results of evaluations also will be used to guide revisions of Project design, specifically Stage 2 of the FCFI. Additional surveys or market analyses may be needed throughout the Project period to assess specific areas of fuel cell development in these markets, such as assessment of fuel cell developers in the market, change in consumption or fuel use patterns of consumer, or a review of sector policies that impact the project. These will be conducted by an independent evaluator, under the guidance of the IFC.

Budget

M&E is expected to cost about US$525,000 for the three sub-projects under Stage 1, or approximately US$ 175,000 for each sub-project. It should be noted this figure is an estimate of the costs for M&E for the three sub-projects. It is anticipated that the review at year three will yield the information required to inform Stage 2 of the initiative.

PROGRAM & POLICY CONFORMITY

Activities under this initiative will support the strategic priority, "Reducing the Long Term Costs of Low Greenhouse Gas Emitting Energy Technologies" by providing support to project developers who actively pursue fuel cell project in GEF-eligible countries. The two-staged approach of this initiative is predicated on the fuel cell manufacturing industry achieving specific price points along a declining cost curve. Stage 1 of the initiative will provide mostly grant to developers to be used as a capital cost buy-down. The larger Stage 2 of the initiative will contribute a larger amount of funding, to be disbursed in a variety of financing mechanism, including loans, guarantees, and grants. This approach will contribute to the overall strategic priority of reducing the long term costs of this technology, while ensuring that the technology is deployed in GEF-eligible countries.

SUSTAINABILITY

The International Energy Agency (IEA) estimates that distributed power generation could reach about 5-7 GW by 2010. In practice small combustion generators are used extensively in developing countries where central electricity supply is constrained. Therefore, a market for smaller electricity generators already exists and we believe both replicability and sustainability risks will be lower when a superior technology enters these established markets at appropriate price levels.

The current initiative will also help reduce GHG emissions by promoting clean distributed generation alternatives in developing countries. This will attempt to offset future investments in the more polluting technologies, such as diesel gensets, that are currently in widespread use in locations with poor grid performance or non-existence of grid infrastructure. The reduction of GHG emissions can also be achieved by employing fuel cells in “premium power” applications. These are likely to grow in importance as high value added industrial and commercial ventures are established in the developing world.

REPLICABILITY

This project is designed with an embedded mechanism for assessing the performance of sub-projects at the initial demonstration stage and will incorporate experience and lessons learned before proceeding to the more expanded second stage. Furthermore, by initiating the second stage once research and development has succeeded in reducing prices to more competitive levels, it is expected that the replication potential for future fuel cell projects will be very high

FCFI ACTIVITIES SINCE PIPELINE ENTRY

Since the GEF funded study commissioned by IFC and administered by United Nations Environmental Program (UNEP) titled, “Market Prospects and Intervention Strategies to Accelerate the Deployment of Fuel Cells in Distributed Power Generation in Developing Countries,” was completed in October 2001, the fuel cell industry has continued to improve upon technology, engage in demonstration projects and pursue new markets for stationary fuel cells. However, the results of the report from the UNEP/GEF study predicted certain cost points and manufacturing thresholds by 2003 which have not yet come to pass. In addition, some technologies have not had significant demonstration testing to predict all potential risks with the technology[1]. Also, the industry is still working through issues with the reforming technology that would allow for greater flexibility in fuel use. The industry continues to improve upon these technological issues, but some uncertainties remain. Because of these and other issues, the IFC extended timeline for initiating projects for Stage 1 through 2006. As discussed in the Project Brief submitted to the GEF Council in November 2003, Stage 2 will commence no earlier than a point in time when the technology costs have reached a certain threshold, and not before the mid term review for each project in Stage 1 has been completed.

Stage 1 Project Selection Process

Stage 1 is not merely a technology demonstration. It is also meant to demonstrate commercial viability of the chosen fuel cell applications, and to test new models for deploying fuel cells in developing countries in a variety of applications. The IFC has reviewed all proposals considering a variety of criteria. Because of the diversity of proposals received in the RFP process, the strength of the proposals can be seen in some of the criteria, but perhaps not all the criteria.

One of the criteria for assessment is to insure that all risks are appropriately dealt with, in a manner as close to commercial as possible. An appropriate treatment of the technology element is a key part of the criteria. The emerging nature of the technologies and the desire to support technologies with a decreasing cost trajectory may mean, however, that equipment lifetimes, warranties and service agreements may not as yet be in line with those for conventional technologies. Our approach in project selection and ratification will be to minimize such risks through available service agreements and warranties, but also to concurrently recognize that there may be some residual technology risks during the Stage 1 demonstrations. Upon further review of short-listed projects, if we perceive the technical risks to be beyond acceptable levels, we will delay our presentation to GEF Secretariat until we have the necessary comfort that the technical risks are within acceptable levels. Furthermore, in keeping with the OP 7 mandate, IFC's appraisal process will focus on technologies that are likely to provide a schedule of capital cost reductions over time, and that will eventually lead to commercial viability.

An important factor for the replication of fuel cell projects for stationary power will be the availability of an appropriate policy and regulatory framework for distributed generation. Policies that permit distributed power generation to compete directly with conventional generation will enable strong market growth for fuel cells in stationary power applications. Such policy measures may include the establishment of interconnection standards, net metering provisions and tariff guidelines that encourage cost-effective deployment of distributed generation resources. The policy perspective

[1] "Significant Demonstration Testing" is generally defined in the industry as hours of operation in a demonstration setting. Many manufacturers require a certain number of demonstration hours before they begin to entertain commercial applications of the fuel cells. This varies by manufacturer, but can be as little as six months to several years.

and host country government support to a distributed generation applications will be taken into consideration in the selection of projects for implementation.

Incremental costs will be reviewed on a case-by-case basis for each application, since such costs will depend on the energy systems where fuel cells will be operating and the actual fuel used for electricity generation. Estimates will be based on increased energy efficiency, fuel switching, avoided energy costs, and other cost features of particular projects, and the source of fuel supply for the individual projects will be appraised on a total fuel-cycle basis to ensure that actual fuel use will lead to reduced greenhouse gas emissions.

Evaluation criteria in Stage 1 for evaluating each project prior to GEF Secretariat approval will seek to encompass the critical elements required to achieve Stage 1 objectives. Much of this information will come from the project sponsor itself, but some may come from outside sources. All of this will be gathered prior to GEF Secretariat approval. Each of these evaluative criteria will support the overall objectives of OP7. Below is an example of the evaluation criteria used to select sub-projects and to develop baselines for those projects. It is important to note that no one project will satisfy <u>all</u> the criteria listed below. However, all projects will be screened against these criteria and the individual project will contribute to the portfolio of projects under Stage 1 of the Fuel Cell Financing Initiative, and as such each individual project will provide unique contribution to Stage 1. As a result, we intend for there to be several different transaction models and project structures proposed for endorsement under Stage 1 of the Program.

TABLE 3: EVALUATION CRITERIA USED TO SELECT PROJECTS AND DEVELOP BASELINES

Criteria Used to Select Projects and Develop the Baseline for Projects	How Project May Meet Criteria
Potential value of the transactional experience obtained through the project's implementation	*To gain experience through Stage 1 ("learning by doing") it is imperative that:* • Sponsor involvement demonstrates a commitment to the project's overall success and demonstrates a long-term commitment to the market • Countries selected possess market conditions or reform potential that will facilitate the introduction of fuel cells in stationary applications and distributed generation.
Incremental costs on a narrowing trajectory (sustainability)	• Future incremental costs are shown to narrow over time. • Developer's forecasted reductions in capital costs and improvements in efficiencies are reasonably

	projected and imply future commercial sustainability. • Capital costs of fuel cell will be on a downward trajectory such that projections of costs in the Stage 2 timeframe (5-8 years) will result in no more than 35% incremental cost margin (the cap for Stage 2 GEF grant component)
Quality of lead sponsor and partners	• History of transactional and development experience • Strong partnerships with local industry and/or local support • Technical capacity of fuel cell as measured by various testing/R&D metrics • Corporate governance rules in place and willingness to comply with IFC/GEF reporting requirements.
Financing details and risk sharing	• Ensure that capital structure (Debt/Equity) is beneficial and provides greatest leverage. • Project developers, manufacturer's guarantees and power purchase agreements provide sufficient creditworthiness, or credit risks are mitigated through contractual structures. • Technology risks are adequately assumed by manufacturers or ESCOs rather than end-users. • Warranties and/or service agreements provide sufficient coverage of technology risks.
Potential widespread penetration of the market, replicability and sustainability	• Due diligence affirms there is substantial regional and global "market pull" for similar sized fuel cell units with comparable capital cost, efficiency, performance and fuel usage. • Choice of applications provided the greatest potential for replicability and sustainability in the market • The business plan adequately addresses the strategy for expansion into the regional and global market.
Timetable envisaged for project preparation and completion	• The proposal establishes a realistic timetable for project development and financing based upon a set of minimum requirements for field testing, in-country capacity building, and establishing manufacturing capabilities. • The proposal establishes a minimum performance specification for duration.
Overall potential for CO2 emissions reductions with	• The choice of applications will be such that future penetration of the technologies will ensure

widespread penetration of the market	significant reductions in CO_2 reductions over the "business as usual" (BAU) case

Based on the criteria outlined above, we feel that we are now in a position to present one specific proposal from South Africa, which we believe is ready for endorsement by the GEF CEO. The project document for this project is being submitted along with this document. The proposal from IST/Plug Power which was submitted to the IFC as part of the RFP process can be found in Annex 1 of the project document. The GEF Focal Point endorsement for the project can be found in Annex 2 of the IST/Plug Power project document.

Post endorsement from the GEF CEO, our activities will involve further detailed due diligence and negotiations on the grant agreement for the project being presented. We also intend to submit an additional two projects under Stage 1 of the FCFI initiative.

Stage 1 RFP Process

Since formal approval of Stage 1 of the FCFI Program in early 2004, IFC has been actively engaging interested technology and project developers to gauge the status of stationary fuel cell technology, and to inform the implementation of the program. IFC staff have attended numerous industry conferences and technical meetings, and hosted meetings with industry representatives. From this experience, we have confirmed that the FCFI is the only program supporting fuel cells in commercial applications in developing countries. We have also confirmed that the subsidy level offered under this program is highly competitive relative to subsidy programs in OECD countries, and is very attractive to industry players interested in developing country markets.

The IFC has released two Requests for Proposals under Stage 1 of the FCFI Program. These RFPs have generated a substantial amount of interest from the Fuel Cell industry. As a result of the two RFPs issued to date, FCFI has received sixteen (16) individual proposals, in eight (8) distinct countries, and four (4) distinct regions. The countries represented in the RFP process to date are:

- Mexico
- Brazil
- Dominican Republic
- South Africa
- Philippines
- India
- Armenia, and
- Poland

In addition to country and regional diversity in the proposals received, there has been a wide variance in applications proposed under this Program. The IFC has received proposals for using fuel cells for rural use, residential/urban use, small industrial and large industrial use. The variety of proposals received by the IFC as a result of the RFPs shows us that the applicability for fuel cells in developing markets is quite large. As a result, we expect that the three demonstrations under Stage 1 of the program will provide different models for deploying fuel cells in developing countries.

Based on the approval by the GEF Secretariat of the concept note for the program, a Guidance Document was issued by the IFC on January 30, 2003 seeking requests for funding from eligible sponsors of fuel cell projects in developing countries. As a result of this first RFP, nine (9) proposals were received from potential sponsors. Countries represented in this first RFP included the following: Mexico, Philippines (2), Brazil (2), South Africa, Poland, Armenia and one unspecified location. A review committee consisting of six (6) members, including staff from the World Bank Environment Department and IFC Infrastructure Department, was formed in April 2003 to evaluate these responses. The evaluation was a two step process.

The first step was a pre-screening process where the Committee reviewed the submissions based on the criteria laid out in the document titled, "Fuel Cells Initiative Review Committee Meeting and Step 1 Evaluation Criteria." Based on the Committee's review of the criteria, the submissions were divided into three (3) categories, as follows:

(A) responses that were deemed to be ready for proceeding to the due diligence stage. In the Committee's view they had the greatest probability of resulting in sustainable and replicable projects. These respondents proceeded to Step 2 of the evaluation process.

(B) responses that had overall merit, but where several issues were outstanding, and these had to be satisfactorily answered before the projects were deemed ready for formal due diligence; and

(C) responses that the Committee did not feel would result in sustainable projects.

Of the nine proposals received, the Committee categorized two (2) as Category A, three (3) as Category B, and four (4) as Category C. Those proposals that were categorized as Category A and Category B proceeded to the second step of the review process. The second step ("Step 2") of the review process consisted of a due diligence process with short-listed parties from Step 1. Over the course of the next six months, IFC engaged the five respondents whose submissions were categorized as A or B in a technical due diligence process.

In early 2004, after solicitation of feedback from industry participants on the first RFP, IFC determined that the FCFI Program would benefit from a second round RFP and released a request in April 2004. The objective in issuing this RFP was to solicit new proposals from the market because at least two grants under Stage 1 of the Program are still available. The process for soliciting and reviewing proposals remained the same as with the first RFP.

The second RFP yielded seven (7) proposals from potential sponsors. Countries represented in this second RFP included: Mexico, Dominican Republic, South Africa, and India (4). A review committee consisting of six (6) members was formed in order to evaluate these responses. Three proposals received as a result of the second RFP proceeded to the technical due diligence phase. The first of these proposals is being presented to the GEF CEO for endorsement in the document titled “Fuel Cell Financing Initiative for Distributed Generation Applications – IST/Plug Power Project Document”.

ANNEX 1: LOGICAL FRAMEWORK: FCFI PROGRAM – STAGE 1

Hierarchy of Objectives	Key Performance Indicators	M&E / Data Collection Methodology	Critical Assumptions
GEF Operational Program: Operational Program #7: “Reducing the Long-Term Costs of Low Greenhouse Gas Emitting Technologies.”	Various indicators that GEF benefits were generated. Application of GEF Climate Change indicators will depend on specific projects under Stage 1.	Project sponsors/developers; Government regulatory bodies; Fuel cell manufacturers and independent research institutes	
Global Objective: To support the creation of sustainable markets for fuel cells (FCs) in suitable stationary power applications in GEF Eligible countries that enable the reduction of GHG emissions.	**Outcome/Impact Indicators:** 2.1 Major fuel cell developers and/or manufacturers enter the market/GEF countries in Stage 1. Cost of fuel cell stack, balance of plant, and reformer technology declines, making fuel cells more cost competitive with other technologies by the end of Stage 2. Successful and replicable “transaction models” are developed from Stage 1.	**Project Reports:** Baseline assessments of the projects, and midterm and final evaluations	**(from Objectives to Goal)** Assumes that if major fuel cells developers enter the market, the market will grow. Assumes that if key barriers are overcome (cost, fuel supply, regulations), the fuel cell market would grow in these countries.
Output from each Program component: 1. Number of MW of fuel cell capacity increases 2. More fuel cell market participants develop projects	**Output Indicators**: 1.1 Install at least 4MW of fuel cell capacity 1.2 deployment of at least $14 million additional co-financing	Reporting will be done on an ongoing basis for many indicators through project sponsor’s self reporting and through IFC monitoring.	**(from Outputs to Objectives:)** Assumes that financing component will be sufficient to encourage developers, etc. to develop fuel cell

Hierarchy of Objectives	**Key Performance Indicators**	**M&E / Data Collection Methodology**	**Critical Assumptions**
in GEF eligible countries 2. Fuel cell component costs reduces, or there are reductions in $/kWh (levelized cost) for fuel cell projects in the specific market 3. Gained operational and transactional experience about these types of projects to improve the implementation of Stage 2 of the initiative (the “learning by doing” approach) 3.1 Have designed effective contractual mechanisms that allocate acceptable levels of risk (technological, financial, etc) among project stakeholders 3.2 Have designed transactional models and management tools that are diverse and can be seen as replicable.	2.1 overall $/kW decreases 2.2 % reduction in fuel cell component costs of at least 5% over three projects 2.3 % reduction in levelized costs vs. conventional technology 2.3 % of project costs that must be subsidized decreases 3.1 Risk mitigation mechanisms (i.e.: insurance policies, service agreements, O&M agreements), that are sound and legally enforceable are developed	Other output and key performance indicators will be monitored on an annual basis through an independent evaluator. An independent evaluator will also perform a thorough mid-term review and a final review on all sub-projects in Stage 1 of this initiative. Some statistics could be gathered by government statistics, industry statistics or other sources than the sponsor itself. Also, M&E program manager will perform annual PSRs for each sub-project.	projects in GEF eligible countries Assumes cost trajectories continue to fall If replicable models are developed, sponsors would enter the market, to use these models to develop new projects