PROJECT IDENTIFICATION FORM (PIF)

PROJECT TYPE: Full-sized Project
THE GEF TRUST FUND

Re-submission Date: 30 September 2009

PART I: PROJECT IDENTIFICATION

GEF PROJECT ID: **PROJECT DURATION:** 24 mo.
GEF AGENCY PROJECT ID:
COUNTRY(IES): Republic of Turkey, Cook Islands
PROJECT TITLE: Realizing Hydrogen Energy Installations on Small Islands through Technology Co-operation
GEF AGENCY(IES): UNIDO
OTHER EXECUTING PARTNER(S): UNIDO-ICHET (International Centre for Hydrogen Technologies), Ministry of Energy and Natural Resources (Turkey), Ministry of Energy (Cook Islands)
GEF FOCAL AREA(S): Climate Change
GEF-4 STRATEGIC PROGRAM(s): CC-SP3-RE
NAME OF PARENT PROGRAM/UMBRELLA PROJECT: TT-Pilot (GEF-4)

INDICATIVE CALENDAR	
Milestones	**Expected Dates**
Work Program (for FSP)	September 2009
CEO Endorsement/Approval	April 2010
GEF Agency Approval	May 2010
Implementation Start	June 2010
Mid-term Evaluation	June 2011
Project Closing Date	June 2012

A. PROJECT FRAMEWORK

Project Objective:	**Increased penetration of renewable energies on small islands through the transfer and use of hydrogen technologies**

Project Components	Type	Expected Outcomes	Expected Outputs	Indicative GEF Financing		Indicative Co-Financing		Total ($) C =a + b
				($) a	%	($) b	%	
1. Bozcaada installation (Turkey)	TA (Deployment of technologies)	Increased penetration of renewable energies by 10% (see note below)	Demonstrated RE-to-H_2 technology solutions to provide guarantied power and 63 tons of CO_2 avoided per annum.	0	0	1,500,000	100	1,500,000
2. Aitutaki installation (Cook Islands)	TA (Deployment of technologies)	Increased penetration of renewable energies by 10% (see note below)	Demonstrated RE-to-H_2 technology solutions to provide guarantied power and 495 tons of CO_2 avoided per annum.	1,880,000	56	1,500,000	44	3,380,000
3. Transfer of Technologies	TA (Sharing and adaptation of expertise)	Needs assessment for RE-to-H2 technology transfer	Developed local capacities through the accumulated experience of similar projects.	500,000	100	0	0	500,000

Project Components	Type	Expected Outcomes	Expected Outputs	Indicative GEF Financing		Indicative Co-Financing		Total ($) C =a + b
				($) a	%	($) b	%	
4. Diffusion of Technologies	TA (Networking, training and disseminatio n)	Created market conditions for renewable-based hydrogen energy applications in small islands	Trained local experts, established technology focal points, global forum activities	297,273	100	0	0	297,273
5. Project management				0	0	500,000	100	500,000
Total project costs				2,677,273	46	3,500,000	54	6,177,273

Note: The 10% increase in the share of RES is the result of some assumptions: (i) 30% of the production from the wind and PV installations cannot be fed to the electricity grid due to saturation of the local grid or grid instability issues; (ii) this electric energy is directed to the electrolyzer and is converted / stored in the form of hydrogen. When there is demand but no RE generation, this hydrogen is converted back to electricity through the fuel cells. For this process the assumed round-trip efficiency is 30%, so the increase in RE share is basically 0.3x0.3=0.09 or 9%, rounded to 10%. Besides this an important "value" of the system is its ability to provide prime back-up power or uninterrupted power at times when there is no RE production.

B. INDICATIVE CO-FINANCING FOR THE PROJECT BY SOURCE AND BY NAME (in parenthesis) if available, ($)

Sources of Co-financing	Type of Co-financing	Aitutaki Project	Bozcaada Project
Project Government Contribution	In-kind	500,000	
GEF Agency (UNIDO)	Cash for equipment Project management	0 300,000	1,500,000 200,000
Bilateral Aid Agency(ies)	In-kind	950,000	
Multilateral Agency(ies)			
Private Sector	In-kind	50,000	
NGO			
Others			
Total Co-financing		1,800,000	1,700,000

C. INDICATIVE FINANCING PLAN SUMMARY FOR THE PROJECT ($)

	Previous Project Preparation Amount (a)	Project (b)	Total c = a + b	Agency Fee
GEF financing	0	2,677,273	2,677,273	267,727
Co-financing	0	3,500,000	3,500,000	0
Total	0	6,177,273	6,177,273	267,727

D. GEF RESOURCES REQUESTED BY AGENCY (IES), FOCAL AREA(S) AND COUNTRY(IES)[1]

GEF Agency	Focal Area	Country Name/Global	(in $)		
			Project (a)	Agency Fee (b)	Total c=a+b
Total GEF Resources					

[1] No need to provide information for this table if it is a single focal area, single country and single GEF Agency project.

PART II: PROJECT JUSTIFICATION

A. STATE THE ISSUE, HOW THE PROJECT SEEKS TO ADDRESS IT, AND THE EXPECTED GLOBAL ENVIRONMENTAL BENEFITS TO BE DELIVERED:

The issue:

Renewable energy (RE) technologies face two major challenges in terms of their ability to replace fossil fuels in power generation and mitigate climate change: Firstly, they are stochastic and non-dispatchable, meaning that maximum production does not always occur at times of maximum demand. Secondly, production is intermittent, varying according to the instantaneous resource and thus RE penetration cannot normally exceed 30% in order not to affect the stability of the electricity grid (technical limit set by electricity companies). This is particularly so on small islands and autonomous grids in general.

Hydrogen energy technologies can be used to address the above issues by storing excess energy from renewables in the form of compressed hydrogen. This can later be used in fuel cells in stationary applications, thus increasing the penetration of renewables to the electricity grid, but also in vehicles where hydrogen can be used as an alternative fuel. Small islands, due to their small size and often remote locations, and high visibility and energy costs, are ideal demonstration sites for "renewables-to-hydrogen" energy systems. Developing countries in general and Small Island Developing States (SIDS) in particular offer the greatest opportunity since their energy infrastructures are not yet fully developed. They can "leap-frog" to the cleanest technologies, namely renewable energy sources in combination with hydrogen.

There are however several hurdles, both technical and economic that are pronounced in the case of the developing countries and small islands in particular. Without external investment and technical support, they lack the critical mass to effectively participate and contribute to this transition. Furthermore, the relative isolation of small island communities limits their ability to network to achieve this critical mass, to consider such technological options in their strategic energy planning, and to attract suitable projects. Lastly, there is limited expertise in the developed countries to transfer experience from established installations to interested and potential sites in the developing countries.

The project:

Deployment of Technologies Component (Budget: US$1.5 M for Bozcaada and US$3.38 M for Aitutaki)

The erection and operation of two highly visible renewables-to-hydrogen energy installations is a corner stone of the technology transfer objectives of the proposed project. The installations will be erected on two islands, Bozcaada island in Turkey and Aitutaki island in the Cook Islands.

The Bozcaada installation will be located on the Governor's plot of land and will involve the erection and operation of a 20kW PV system and a 30 kW wind turbine. When power from these sources is produced, a 25 kW electrolyzer will produce hydrogen that will be compressed and stored in cylinder tanks. The stored hydrogen will be used to fuel a 15 kW fuel cell and a 25 kW hydrogen gen-set (H_2-fueled internal-combustion engine and generator) that will be placed at the governor's building. They will generate electricity at times of peak demand and also as emergency back-up units in the event of power shortages. This installation places emphasis on stationary applications of hydrogen energy technologies. Transport applications (included in the schematic below) will be included as much as time and resources of the project permit. Details of the equipment of this installation are given below.

BOZCAADA INSTALLATION

	Equipment	Cost, US$
1	30 kW wind generator+mast+cabling	70,000
2	30 kW ac to dc converter (wind generator to electrolyzer interface)	10,000
3	20 kW PV solar panels +assembly+cabling	70,000
4	20 kW dc to dc converter (PV panels to electrolyzer interface)	5,000
5	20 kW dc to ac inverter/battery charger	8,000
6	Battery backup 48V/5000 Ah	5,000
7	Electrolyzer, 10 Nm3/hr, 30 bar	350,000
8	Single stage compressor from 10 to 220 bar	80,000
9	H2 storage either at 15 bar or at 220 bar (500 Nm3 of H2 at 150 Euro / Nm3)	75,000
10	Hydrogen buffer tank and hydrogen cylinders for storing 120 Nm3 of H2	20,000
11	Fuel cell, 15 kW	75,000
12	Internal combustion H2 engine + ac generator set, 25 kW	65,000
13	Central control system and data logging	60,000
14	Cabling	10,000
15	Hydrogen piping	15,000
16	Peripherals (water chiller, air compressor, water and air piping, safety, etc.)	60,000
17	Consultancies/ contracts for data collation, feasibility studies and system design	100,000
18	Earthworks, foundations	80,000
19	Labour costs design and construction of pos. 1-16	120,000
20	Building 1 (earthworks, concrete base, fence, isoboxes, protecting covers, etc.)	22,000
21	Building 2 (40 m2 internet room, 30 m2 reading room, 30 m2 common area)	200,000
	TOTAL	1,500,000

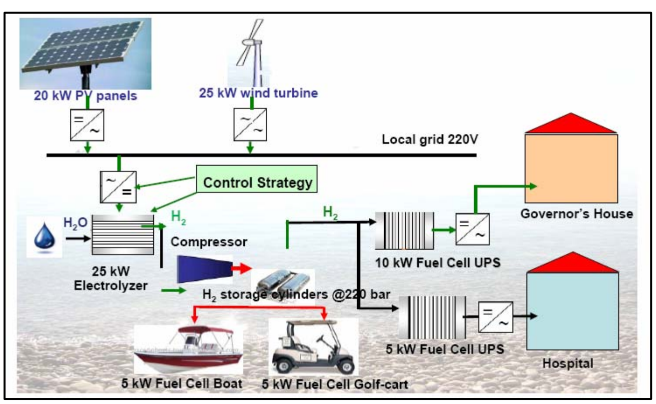
The Aitutaki installation, also a pilot project, will involve the erection and operation of a RE-to-hydrogen system at a disused, but highly visible, airstrip at the island's Airport . This location will involve a 72 kW PV array producing a nominal 161,000 kWh/year and 12 wind turbines of 15 kW each, producing a nominal 349,000 kWh/year. The units will be connected to an electrolyzer capable of generating around 2 kg/hr of H_2. The H_2 will be compressed and stored in cylinders. The H_2 will supply two stationary and two mobile applications. The stationary applications will involve three 5 kW fuel cells at the airport and at the island's hospital. The mobile applications will involve a minibus with an internal combustion engine modified to operate on H_2 and a passenger boat retrofitted with a 30 kW fuel cell and electric motor to take tourists on the lagoon. H_2 will be carried in high-pressure cylinders to the stationary applications and the boat, while the minibus would be refueled at the RE/H_2 generation site. A vehicle refueling facility may be included in a future phase of the project to fuel additional minibuses and other vehicles such as cars and two- or three-wheelers associated with tourism and the resorts. Detailed investment requirements of this component of the project are given in the table on the next page.

At the hospital, the fuel cell may be configured to function as a nighttime constant power supply and as a daytime emergency backup system. At the airport, the fuel cell may be configured to function as a daytime constant power supply while planes arrive and depart five or six times a day. While the airport currently does not operate at night, the fuel cell would provide power to the terminal and runway in a nighttime emergency or when the airport opens to regular night flights. The fuel cell installations at the airport and the hospital can be viewed as grid support in as much as they will substitute for the island's grid power. Renewable energy produced surplus to the H_2 demand of the electrolyzer, may be fed directly to the grid under an energy management control system. It follows that the pilot project would take a balanced and integrated approach to transferring and demonstrating stationary and mobile technology applications.

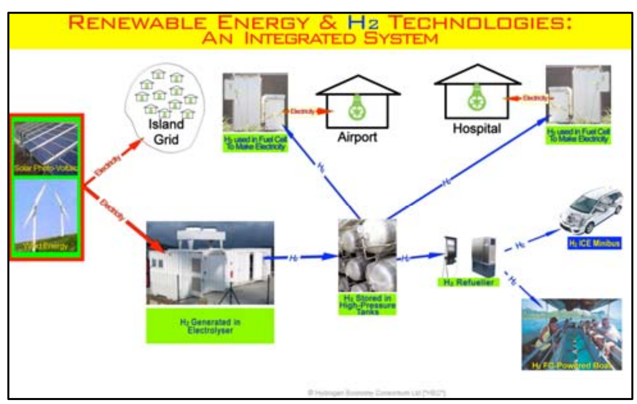
AITUTAKI INSTALLATION

						Estimated Cost [US$]	
	Equipment	Spec	Unit	Quantity	Units	Unit Rate	Total
1	Building 1 [9 m^2 open 'island'-type - information point at Airport]	1	room	10	m^2	1,600	16,000
2	Building 2 [20 m^2 Control House]	2	room	16	m^2	1,650	26,400
3	Cabling	440	V	1,200	m	40	48,000
4	Civil Engineering Works			1	LS	150,000	150,000
5	Compressor - Single stage	700	Bar	1	Nos	200,000	200,000
6	Control system: Central control system			1	Nos	100,000	100,000
7	Fuel Cells: Fuel Cell Boat Retrofit to FC-power	30	kW	1	Nos	50,000	50,000
8	Fuel cells: Stationary	5	kW	3	Nos	35,000	105,000
9	ICE: Internal combustion engine conversions	20 to 80	kW	1	Nos	30,000	30,000
10	KOH electrolyzer @ ≥20 bar, 2kg/hr production	≈30	kW	1	Nos	600,000	600,000
11	Labour costs, Design and construction, & Shipping			1	LS	400,000	400,000
12	Peripherals [H_2O chiller/piping, Air compressor/piping, safety, etc.]			1	LS	40,000	40,000
13	PV Panels solar panels + assembly + cabling	72	kW	340	Nos	1,200	408,000
14	Step-up transformer from turbine output	11	kV	1	Nos	15,000	15,000
15	Tanks - High Pressure	700	Bar	15	Nos	1,200	18,000
16	Tanks - Medium Pressure	350	Bar	5	Nos	800	4,000
17	Information campaigns + dissemination			1	LS	60,000	60,000
18	Water Catchment & Storage [30 days]	3,200	l	1	Nos	10,000	10,000
19	Water Purification Equipment [for electrolyser's H_2O]			1	Nos	150,000	150,000
20	Wind Turbine + mast + cabling + Inverters	15	kW	12	Nos	70,800	849,600
						Sub-Total	3,280,000
21	Contingency: Physical						50,000
22	Contingency: Price						50,000
						TOTAL	3,380,000

The following schematics present the concepts to be applied to the two deployment sites (Bozcaada island on the left, Aitutaki island on the right):



Bozcaada site



Aitutaki site

Transfer of Technologies Component (Budget: US$0.5 M)

The experience from existing hydrogen installations is planned to be exploited for the optimal design and realization of the two proposed sites. Experts involved in the erection of two such installations will be invited to advice on the design and preparation of the proposed project. The two existing installations are:

1. the Nordic climate island of Utsira, Norway wind-hydrogen installation realized by Statoil Hydro in the context of privately funded research.
2. the Mediterranean climate Keratea wind park, Attica, Greece wind-hydrogen installation realized by CRES in the context of the RES2H2 EC funded project.

International Experts in the hydrogen energy technologies will also be involved in the project, focusing on the Aitutaki installation. They will be the link with the local authorities, private companies, local technicians, etc. on Aitutaki for the design and realization of the project.

UNIDO-ICHET will also be providing its expertise on various technical and economic aspects of the two installations. Furthermore, since the two installations will be realized with one year phase difference (the Bozcaada project is already in its implementation phase), the Aitutaki project will take advantage of the data and the on field experience acquired in the Bozcaada program.

The implementation of the proposed project will secure technology transfer of new technologies and will not be limited to the simple application of environmentally friendly ones (e.g. PV and wind energy). In fact through their integration for hydrogen production, this RE+hydrogen application will imply also innovation and the development of expertise at local level that can take advantage of foreign support (from engineers, experts, technicians). Especially in a location like the Cook Islands, namely a remote and isolated community, this can represent a significant improvement towards the leapfrogging of conventional and polluting energy technologies in favor of state of the art technology (hydrogen systems), that can be considered as innovative also in the most advanced countries of the world. It has then to be underlined that in remote islands the local grid is mostly fed by Diesel generators, so the shifting to clean technologies is significantly remarkable. The integration of RES and hydrogen can be considered as one of main challenge for the market penetration of hydrogen energy technologies in general. The related acquisition of local expertise will give as a result the training of local personnel that will be in charge for the plant maintenance and operation, the creation of new job places that can bring to the development of a local expertise potentially applicable to all the islands territory: local expertise regarding the most clean and innovative energy vector (hydrogen indeed), low emissions and potentially zero emission technologies.

Diffusion of Technologies Component (Budget: US$0.3 M)

The diffusion of the project experiences will be ensured through a number of actions involving:

- Organizing site visits to existing sites or the sites to be realized within the project
- Training of personnel from other potential sites with interest in realizing similar installations including Fiji and other Cook islands, Cape Verde and others
- Establishing tools on the internet for wider diffusion (blog space for Hydrogen islands)
- Leading an Annex at the International Energy Agency's Hydrogen Implementing Agreement focusing on Hydrogen islands
- Promoting experiences in international events and other global forum activities
- Linking with existing institutions focusing on energy and environmental issues on islands in general and Small Island Developing States (SIDS) in particular. For example: the Pacific Islands Applied Geoscience Commission (SOPAC), Alliance of Small Island States (AOSIS), the Asia Pacific Network on Climate Change (AP-Net), Network of European Island Authorities (ISLENET), etc.

The global environmental benefits

Hydrogen is not a primary energy source but an energy carrier. The GHG emitted in producing hydrogen depends on how the hydrogen is produced; renewable energy technologies have zero emissions. A well-to-wheel study performed by CONCAWE, the JRC and EUCAR (http://ies.jrc.ec.europa.eu/WTW.html) has concluded that the renewables-to-hydrogen route ensures the lowest GHG emissions. Similarly, hydrogen can be used for storing excess renewable energy and providing it at times of low production and/or peak demand.

The total environmental benefits accruing from the Bozcaada project amount to around 63 tons of CO_2 avoided per annum. In the evaluation it has been considered that the 30% of the electricity produced from RE will not be taken up by the grid. This amount will be turned into hydrogen with a round trip efficiency of 25% for the hydrogen system (electrolyzer+fuel cell and auxiliaries). A 35% capacity factor for the wind turbine has been assumed and 1,300 operating equivalent hours per annum for the PV system. The same estimation as for the wind turbine have been applied for the Aitutaki Island, while for the PV system 1,700 operating hours have been taken into account. Thus in this case of Aitutaki installation, electricity production is expected to be 510,000 kWh annually from sun and wind. The total benefit amounts to 495 tons of CO_2 avoided per annum. Calculation details of both cases are shown in the tables below.

Bozcaada emission reduction

YEARLY ENERGY PRODUCTION	kWh
PV panels (total 20 kW, approximate solaration for Bozcaada)	19,838
Wind turbines (total 30kW, approximate wind conditions for Bozcaada)	70,181
Total electricity production	90,019

CO_2 emissions from the Turkish grid 0.7 kg/kWh

AVOIDED CO_2 EMISSIONS:	kg
Avoided CO_2 emissions by PV electricity	13,887
Avoided CO_2 emissions by wind electricity	49,127
Total avoided CO_2 emissions	63,013

Aitutaki emission reduction

YEARLY ENERGY PRODUCTION	kWh
PV panels (total 72 kW, approximate solaration for Cook Islands)	161,000
Wind turbines (total 180 kW, approximate wind conditions for CI)	349,000
Total electricity production	510,000

Assuming that 1kWh of electricity production from fossil fuels emits 0.97 kg of CO_2:

AVOIDED CO_2 EMISSIONS:	kg
Avoided CO_2 emissions by PV electricity	156,170
Avoided CO_2 emissions by wind electricity	338,530
Total avoided CO_2 emissions	494,700

B. DESCRIBE THE CONSISTENCY OF THE PROJECT WITH NATIONAL/REGIONAL PRIORITIES/PLANS:

Turkey priority/plans

In 2005 Turkey instituted Law No.: 5346, "Law on Utilization of Renewable Energy Sources for the Purpose of Generating Electrical Energy". The first article states the main purpose of this law is as follows: "Article 1 − The purpose of this law is to expand the utilization of renewable energy sources for generating electric energy, to benefit from these resources in a secure, economic and qualified manner, to increase the diversification of energy resources, to reduce greenhouse gas emissions, to assess waste products, to protect the environment and to develop the related manufacturing industries for realizing these objectives." The project proposal is thus in line with the principles of Law No. 5346 and more in general with the aim of Turkey of reducing its dependency on fossil fuels for electricity generation as it proposes a sustainable energy system to produce electricity from diversified renewable energy sources.

Almost 15% of the Turkish population of over 70 million lives in remote settlements / communities on land-locked mountainous locations or islands. UNIDO-ICHET is promoting the use of hydrogen energy technologies in such communities where they can be used to increase the penetration of renewables in the case of weak electricity grids and more importantly can be used as emergency back-up systems. The successful demonstration of the present project will allow the replication by promoting for appropriate legislation and suitable tariffs that would make such hybrid renewable-hydrogen systems financially viable. With respect to the developing world, ICHET will seek to replicate such systems on islands (like islands on SIDS Network) exploiting national or international funds. Particular interest has been expressed by Cape Verde where ICHET is supporting a pre-feasibility study on this topic and from Mauritius. Similarly the Secretary General of the Indian Ocean Commission (which includes Comoros, Madagascar, Mauritius, Seychelles and Réunion Island (part of France)) has expressed interest on renewable energy exploitation.

Cook Islands priorities/plans

As confirmed in the endorsement letters enclosed with the PIF submission from the Minister of Energy, the Government of the Cook Islands is committed to the reduction of green house gases by reducing the use of imported fossil fuels. Therefore, the utilization of hydrogen energy technologies envisaged under the project is consistent with commitments by the Government of the Cook Islands under the relevant global environmental conventions to maximize the deployment of RE sources through their storage in the form of hydrogen. The technologies will be exploited to cover both stationary and transport energy needs of the island communities. The commitment of the Government to replicate the project in other islands is expressed in the letter from the Office of the Deputy Prime Minister.

C. DESCRIBE THE CONSISTENCY OF THE PROJECT WITH GEF STRATEGIES AND STRATEGIC PROGRAMS:

The proposed project is consistent with GEF strategic objectives in the climate change focal area and in particular with strategic objectives:

- n. 4, "To promote on-grid renewable energy";
- n. 7, "To facilitate market transformation for sustainable mobility in urban areas leading to reduced GHG emissions";
- having also benefits within objective n. 5, "To promote the use of renewable energy for the provision of rural energy services (off-grid)".

Concerning the objective n. 4, the envisaged renewables-to-hydrogen system to be installed in the Cook Islands and subject of the parallel project in the Turkish island of Bozcaada foresees grid-connected energy systems which exchange electricity with the grid as a function of the renewable energy produced. The installations, due to the size of the wind and solar systems installed, will not affect the grid stability and efficiency and will contribute to increasing the renewable energy production share of the local grids.

Regarding the objective n. 7, the project, being focused on both stationary and transport applications, supports the introduction of sustainable mobility within the islands' territories. In this sense islands are ideal locations to demonstrate such clean energy concepts. Because of their geographical locations, islands are often disconnected from mainland electricity grids and their internal transport systems can be specifically designed to be sustainable and in the case of hydrogen with zero emissions. The introduction of boats or vehicles powered by hydrogen (or of pure electric powered vehicles by green electricity produced by renewables) will contribute significantly to proving the concept and acquiring the necessary experience with renewable energy transport needs in isolated communities.

Finally, the data acquired from the on-grid proposed systems will provide useful and decisive technical data regarding the feasibility of off-grid systems subject of the Objective n. 5, (e.g. its targeted size, energy flows exchanged, real load diagrams, etc.). This aspect, especially in small, remote islands with limited energy demand (like the Cooks' archipelago), and being powered mostly by Diesel generators, can represent a significant added-value in the transition towards energy independence and reductions of GHG emissions. This substitution of RES for conventional systems will lead to zero impact of energy production on the environment.

Moreover, the successful implementation of the project in the selected islands will contribute to proof of concept of renewable-to-hydrogen energy systems. The concept should have a strong replication potential for Small Island Developing States (SIDS) and their communities worldwide.

GEF's adaptation purpose, "to support pilot and demonstration projects for adaptation to climate change" will be materially advanced through the technology transfer and implementation of this pilot project. Its development objective will be to demonstrate the potential for increasing the penetration of indigenous RE in small island nations and reducing their dependence on imported fossil fuels (strengthening grid reliability). Complementary outcomes will be a reduction of the islands' carbon footprints and mitigation of their impacts on climate change.

D. JUSTIFY THE TYPE OF FINANCING SUPPORT PROVIDED WITH THE GEF RESOURCES:

Since the main objectives of the project lying in the abatement of GHG, technology transfer and demonstration of an innovative technology that has currently no market penetration, the financial instrument that best suits the implementation of this project is the grant, because it will enable the RE-to-H_2 system to take off, e.g. operate and demonstrate the concept thanks also to the foreseen co-funding. Different type of initiatives will not be as effective for the project. After its implementation further instruments for its continuous operations (like revolving fund) can be envisaged.

E. OUTLINE THE COORDINATION WITH OTHER RELATED INITIATIVES:

The GEF funding proposal as shown in the budget lines is interrelated with the parallel Bozcaada island project in Turkey funded by UNIDO through ICHET. This initiative is inserted in the Pilot Project funding scheme of ICHET, aiming at diffuse the hydrogen technologies exploitation. The development of the two projects will be jointly monitored and the results of the applications of the RES+hydrogen systems will be matched and compared so to understand similarities and differences between different types of island realities that will constitute a relevant on-field database to refer to, in light of the replication of the proposed concept in further islands. For the Bozcaada project no contribution from GEF will be requested. Instead the UNIDO-ICHET budget put into it (US$1.5 M) will represent part of the co-funding to the requested GEF funding.

F. DISCUSS THE VALUE-ADDED OF GEF INVOLVEMENT IN THE PROJECT DEMONSTRATED THROUGH INCREMENTAL REASONING:

As a background introduction it can be said that renewables and hydrogen technologies suffer by a general lack of on-field applications and the wake support of devoted policy measures. In this context the value-added by the

GEF involvement other than in the benefits provided by the GEB achievement (GHG emissions reduction) as described in section A stands in two more main domains:

- It will contribute in the RE-to-hydrogen concept penetration and technology transfer in the small island type of applications that are ideal to demonstrate its on-field feasibility. Especially in the present difficult worldwide economical situation the GEF funding can definitely contribute in keeping the general attention on innovative energy technologies high and avoid a lowering of interest and diffusion in favor of conventional and polluting solutions only because they need low investment costs.
- More in general the GEF involvement will contribute in the market penetration of RE-to-hydrogen technologies. By proving the technology deployment also policy makers can be attracted in supporting the diffusion of this new energy solution by introducing ad hoc policy measures that can, in their turn, encourage also private investors in diversifying their portfolio with non-conventional energy systems. Energy policy measures specifications have necessarily to be derived from real installations data acquisition to become really effective for the market penetration.

The involvement in the project of the Turkish Ministry of Energy and Natural Resources and the Ministry of Energy of the Government of Cook Islands insures that policy makers are well represented.

Furthermore the GEF funding, in combination with the UNIDO-ICHET funding for Bozacaada island, will also enable to compare two different typologies of island communities. One, Bozcaada, connected to main electricity grid and the other, Aitutaki, featuring a Diesel power generator. Therefore at the end of the project the whole energy picture concerning islands communities will be completed. Without the GEF involvement at the moment it is not foreseeable any different way to implement such a project other than business as usual scenario, which is characterized by fossil fuel based solutions or in the best case by isolated RE solutions, but that alone cannot significantly weigh on the general energy scheme and produce relevant technological innovation and transfer.

G. INDICATE RISKS, INCLUDING CLIMATE CHANGE RISKS, THAT MIGHT PREVENT THE PROJECT OBJECTIVE(S) FROM BEING ACHIEVED, AND IF POSSIBLE INCLUDING RISK MITIGATION MEASURES THAT WILL BE TAKEN:

The potential risks of the Renewables-to-H_2 system would be operating failures, especially of some hydrogen system components, in particular the electrolyzer, fuel cells, and their peripherals. Although the reliability of these systems has improved in terms of their lifetime working hours, it still has to be demonstrated in field applications that they are comparable to conventional systems. It follows that the project's basic development objective will be to prove the concept and its viability in real energy applications in developing countries, and to diffuse the results to other island states. The most proven reliable devices available will be selected, with particular emphasis on their warranty terms. If a hydrogen system were to fail, the system design would enable the plant to switch to produce green electricity from RES and feed it directly to the grid. Hence in a worst case scenario, there may be a failure of hydrogen production but in mitigation the renewable energy would continue to be produced and used. Wind and solar, as mature technologies, are highly reliable, requiring minimal programmatic maintenance in comparison with most conventional energy systems.

A detailed assessment of the various risks associated with the implementation of the project and the definition of mitigating measures will be an integral part of the project preparation phase.

H. DESCRIBE, IF POSSIBLE, THE EXPECTED COST-EFFECTIVENESS OF THE PROJECT:

The well-to-wheel study performed by CONCAWE, the JRC and EUCAR confirms that RES+hydrogen insure the cleanest energy system, able to achieve zero emissions. Because of the fact that an official market does not exist, the cost effectiveness of the project cannot be currently guaranteed. Cost effectiveness of such system can be only attained through the improvement of technology demonstration, which is the subject of the proposed project. Therefore cost effectiveness in itself can be considered as one the final purposes of the project.

I. JUSTIFY THE COMPARATIVE ADVANTAGE OF UNIDO:

UNIDO is within the comparative advantage matrix. UNIDO's competences together with the expertise of UNIDO-ICHET, being a UNIDO project specifically devoted to hydrogen energy technologies with particular emphasis on hydrogen from renewables, ensure the full technical and management coverage of all the project aspects.

PART III: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY(IES)

A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT(S) ON BEHALF OF THE GOVERNMENT(S):

NAME	POSITION	MINISTRY	DATE *(month, day, year)*
Hon. Tangata VAVIA	Minister	Ministry of Energy of Government of the Cook Islands	June 11, 2009
Mr. Vaitoti TUPA	Director, GEF Operational Focal Point	Environment Service of Government of the Cook Islands	June 15, 2009

B. GEF AGENCY(IES) CERTIFICATION:

This request has been prepared in accordance with GEF policies and procedures and meets the GEF criteria for project identification and preparation.	
GEF Agency Coordinator Dmitri PISKOUNOV Managing Director Programme Development and Technical Cooperation Division UNIDO	**Project Contact Person** Enver KHAN Project Manager Energy Efficiency Unit Energy and Climate Change Branch UNIDO
Signature:	Tel.: +43 1 26026 5119
Date:	E-mail: E.Khan@unido.org