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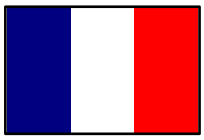


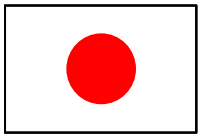
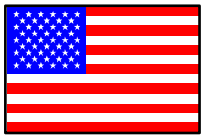


CHILOE Project

PRE-FEASIBILITY REPORT

Prepared by e7 Fund in Partnership with CNE and UNDP

December 2004

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Abbreviations

AEP	**American Electric Power, USA**
CDM	**Clean Development Mechanism**
CNE	**National Energy Commission (of Chile)**
E7 Fund	**e7 Fund for Sustainable Development**
EDF	**Electricity De France**
GEF	**Global Environmental Facility**
GTD	**GTD Ingeniería Ltda. of Santiago, Chile**
HQ	**Hydro Quebec, Canada**
KW-hr	**Kilowatt-hour**
MOU	**Memorandum of Understanding**
NREL	**Nation Renewable Energy Laboratory (of US Department of Energy)**
Region X	**Region de los Lagos (Region X) of Chile**
REP	**Rural Electrification Program**
UNDP	**United Nations Development Program**
$	**All monetary values given in US dollars**

1.0 EXECUTIVE SUMMARY

1.1 PROJECT DEFINITION:

Preliminary Activities for the Powering of the 36 Islands of the Chiloe Archipelago with Renewable and / or Hybrid Energy Systems within the Chilean Government's Rural Electrification Programme.

This study investigated in detail the installation of wind-diesel hybrid generation systems coupled to local distribution grids for 32 Islands, involving approximately 3,700 customers.

1.2 INTRODUCTION

1) E7 Role in the Project - At the invitation of UNDP, the e7 Fund agreed to participate in the Chiloe Project with CNE to explore the electrification of the islands of the Chiloe Archipelago. The e7 Fund formalized its involvement in the Chiloe project by signing an MOU with CNE and UNDP on September 9, 2003. In the MOU, the signature parties agreed to undertake a Pre-Feasibility Study of the project and pledged to work toward its development, construction, and operation. Participating parties from the e7 Fund in the Pre-Feasibility phase of the project were AEP, EDF, and HQ. AEP acted as Team Leader on behalf of the e7 Fund.

2) Chilean Rural Electrification Program - The Chilean Government has an ambitious Rural Electrification Programme (REP) that was initiated in 1994 and is administered by CNE. The existence of the REP allowed rural electrification coverage to increase from a 56.8 % in 1994 to a 76% in 1999. The Government has set the goal of achieving 90% rural household electrification coverage by the year 2005, at a national, as well as a regional level.

3) REP Subsidy Levels - The Chilean REP subsidy program is focused on capital subsidy and not operating subsidy. Rural electrification projects are co-financed by Government contributions (maximum 70% of total project cost), private investor company (minimum 20%), and by the beneficiaries (10%). The beneficiaries are assumed to cover the costs of interconnection, metering, and household wiring.

4) Project Study Team included:

a) CNE
b) UNDP
c) E7 Fund
d) SAESA, the local distribution company
e) GTD Ingeniería Ltda, in–country Consultant

1.3 APPROACH

1) The multi-member project team conducted a Pre-Feasibility Study and prepared the following assessments/studies:

a) Wind Resource Assessment
b) Social Economic Assessment
c) Preliminary Environmental Screening Assessment
d) Grid Design / Cost Study
e) Hybrid System Design Study
f) System Conceptual Design Study
g) Capital and Operating & Maintenance (O&M) Cost Study
h) Financial Assessment

1.4 RESULTS

1) A global wind map of the Archipelago prepared by EDF showed that the wind speed is medium to good in the region with a wind speed between 6.0 and 7.0 m/s at 30 meters above sea level. Twenty-four (24) islands have one or more sites with wind speeds above 7.0 m/s at 30 meters height (11 islands having wind speeds above 7.5 m/s).

2) The results of the assessments and studies conducted during the Pre-Feasibility phase of the project indicated that the project does appear to be feasible and financially viable, given the capital subsidy provided under the Chilean REP. The potential capital subsidy under the REP can represent 70% of the capital cost, including VAT tax.

3) The project team prepared detailed capital and O&M cost studies for each island, using an in-country consultant, giving close attention to the logistical challenges of the remote island based project. SEASA designed preliminary distribution grids for each island using field GPS data for locations of homes and roads, overlaid on topographic maps, and provided corresponding installed cost estimates. For the purposes of this Pre-Feasibility Study, the project team has performed their work with the expectation that the cost estimates will be accurate within +/-25%.

4) Under the structure of the Chilean REP, the preliminary Financial Evaluation performed for the study indicated that with an e7 Fund Investment of $1,548,336, wind-diesel hybrid generations systems and associated distribution systems can be installed in three (3) Municipalities, bringing electricity to 2,378 customers (65% of the customers) on the 32 islands studied in detail. An e7 Fund Investment of $2,416,781 wind-diesel hybrid generations systems and associated distribution systems can be installed in all eight (8) Municipalities, bringing electricity to 3,676 customers (100% of the customers).

Table 1.4.1 – Implementation Scenarios – Capital Cost and Percent Population

Municipalities	Total Number of Customers (Note 1)	Percent of Population (Note 1)	Assumed e7 Investment, $ (Note 2)	Total Investment Required, $
Castro	435	12	284,715	2,290,001
Castro + Quemchi	1,063	29	723,107	5,816,049
Castro + Quemchi + Quinchao	2,378	65	1,548,336	12,453,477
Castro + Quemchi + Quinchao + Calbuco	3,144	86	1,919,191	15,436,318
Castro + Quemchi + Quinchao + Calbuco + Quellón	3,455	94	2,145,104	17,253,367
Total 8 Municipalities	3,676	100	2,416,781	19,438,504

Note 1 – Based on 32 islands, not 36 islands.

Note 2 – Assumes REP 70% Capital Subsidy. Includes Investment and working capital requirements.

5) It should be noted that all forms of energy on the Chile Archipelago are currently "expensive" to the residents given the remote nature of the islands and modest economic conditions that exit on the islands.

6) The financial evaluation estimated average monthly bills for low, middle, and high-income users for each of the islands. Further analysis indicated expected range of tariffs across Municipalities for "levelized" tariffs (as subsidy program is usually applied on a Municipality basis).

7) A formal "Ability to Pay" and "Willingness to Pay" assessment has not been performed this time. Preliminary indication from the government was that the estimated tariffs reported in this study for many islands appeared comparable to other isolated rural systems, and the electricity appeared affordable for many islands.

8) On some smaller islands with fewer residents, due to lack of economy of scale, the required tariff would be quite high

and likely beyond the residents' ability to pay. CNE and Region X officials have indicated that the project will be implemented at least on a Municipality level or perhaps even as a single project for the Archipelago with single tariff. It is expected that this cross-subsidy will result in a '"levelized" tariff that is generally affordable to the vast majority of customers. This issue will require further study as the implementation strategy for the project is finalized during the Feasibility Study phase.

9) The Pre-feasibility Study indicated that in general the wind-diesel hybrid solution provided a better lifecycle cost with lower tariff rate than a solely diesel generation based system. This was primarily due to the high cost of diesel fuel and fuel transport to these remote islands. The wind-diesel hybrid solution did require a higher capital investment.

1.5 GENERAL FINDINGS

1) The e7 project team conducted an in-depth Pre-Feasibility Study. The following general findings can be stated:

a) The Chilean REP program provides strong institutional and financial support for the Project.

b) CNE, Region X, and UNDP staffs provide strong technical support to the Project and will take an active role in the Project Implementation under the REP subsidy program.

c) The Chilean government has dedicated approximately $8 million to the Chiloe Project with emphasis on including renewable energy systems in the Project.

d) The Technical studies have indicated that installation of wind-diesel hybrid systems is viable, sustainable, and a cost-effective solution.

e) No "red flags" or project stoppers have been identified.

f) Studies have shown that the region has a good wind resource.

g) E7 funding for the Project could be highly leveraged in that 70% of the capital could be from the Chilean REP subsidy, 10% of the funding will come from the Municipality, at least 20% of the capital funding will come from the project Owner/Operator.

h) CNE advised that the Project Owner/Operator role will be open to a competitive bid process due to the IDB funding requirements.

i) E7 should <u>not</u> consider a formal Joint Venture partnership for the Project as there will be a competitive bid process and that certain tax treatments involved in the project could substantially improve project economics, but these could only be fully realized by an Owner with Chilean tax liabilities.

j) At least some percentage of the islands could likely receive wind-diesel hybrid systems. The question is how much renewable (wind) penetration into the 32 islands can be achieved and how quickly.

k) In sharing its preliminary draft of the Pre-feasibility Study with CNE and UNDP, the e7 Fund had proposed a future role in the project involving continued pro bono technical expertise, development, and funding for renewable energy based systems.

1.6 RISK ASSESSMENT

1) No significant risk areas have been identified. Low and moderate level risks are discussed within this report with appropriate mitigation measures.

1.7 NEXT STEPS

1) After the conclusion of the Pre-Feasibility Phase, CNE advised that it was initiating further studies for electrification of the Chiloe Islands.

2) CNE indicated that it was undertaking the following next steps with respect to electrification of the Chiloe Islands.

a) A preliminary analysis of the alternative of supplying electricity via underwater cable to the islands was conducted by CNE in 2004. From the standpoint of the level of investment, CNE stated that an underwater cable connection to the Central Interconnected System (SIC) is a viable economic alternative for approximately twenty-one (21) of the Chiloe Islands. A Feasibility Study for supplying Guar Island with submarine cable was on-going in December 2004. Similar Feasibility Studies were proposed for supplying the remaining twenty (20) islands via submarine cable from the SIC.

b) Two (2) islands included in the study were being analyzed for aerial connectors. It was anticipated that these

projects would be executed in the short term (2005/2006).

c) For the remaining twelve (12) Chiloe islands, CNE advised the best alternative is to generate electricity within the islands (not connected via cable). Based on this, CNE was planning to initiate the corresponding detailed engineering studies early next year, with the exception of one island, that is scheduled for this year. These studies were to be financed by the GEF project.

d) One (1) island is proposed with a micro-hydro solution, to be a separate project implemented by CNE

3) CNE has restated that it is important to consider that in Chile, funding for rural electrification projects with self generating systems (isolated systems) is only possible after a detailed engineering study is done. This is a pre-condition for fund allocation. Moreover, the project must have a positive social evaluation, using the Ministry of Planning ad-hoc methodology. Further studies need to be undertaken before project execution is possible.

1.8 RECOMMENDATIONS

1) The e7 Fund undertook the Pre-Feasibility Study to develop a "roadmap" for providing rural electrification to the Chiloe islands with renewable systems. The findings of the Pre-Feasibility Study have indicated that installation of wind-diesel hybrid systems is viable, sustainable, and a cost-effective solution.

2) CNE and Region X Representatives are working to determine the implementation strategies and technologies to be used based on the follow-on studies, constraints of the IDB financing, and requirements of the Chilean Rural Electrification Program. At this time, the e7 will await the results of follow-on studies and proposals from CNE before considering a future e7 role in the Chiloe Project related to renewable energy systems.

3) The e7 Fund Chiloe Project MOU signed with CNE and UNDP expired in September 2004. The Pre-Feasibility Study discussed in the MOU has been completed and results shared with CNE and UNDP. It is recommended that the MOU not be extended in its current form. If e7 has a future role in the project, a new MOU will be needed focused more on implementation strategy.

2.0 INTRODUCTION

2.1 BACKGROUND

1) At the invitation of UNDP, the e7 Fund agreed to participate in the Chiloe Project with CNE to explore the electrification of the islands of the Chiloe Archipelago. Preliminary studies had been performed by CNE and NREL within the frame of cooperative agreements, endorsed by UNDP, with a financial contribution from GEF, for the electrification of the islands of the Chiloe Archipelago (Appendices 2.1.1 and 2.1.2). The focal point of interest in this region, for the use of these energy alternatives are the islands of the Archipelago of Chiloé, since it is geographically, technically and socially difficult to provide them by extending the distribution system. Economically challenged inhabitants populate the islands. Most of them belong to the Huilliche ethnic group, and are mostly dedicated to low-scale fishing, cattle-raising and survival agriculture. Generally, each island has a school, a Rural Accident and Emergency Center, one or more churches, and a Resident's Association. They have no access to electricity.

2) The Tac Island Wind Diesel Rural Electrification Project was constructed in 2000. The Tac Island demonstration project was collaboration between Region X, CNE, SAESA, Wireless Energy, and NREL. A detailed description of the Tac Island Project and Lessons Learned after one year of operation were included in a report prepared by Wireless Energy (Appendix 2.1.3). The Tac Island Project was intended as a demonstration project to promote further introduction of wind based renewable energy into the Chiloe Archipelago.

3) The Chiloe Project is intended to support CNE's and the Region X Government's mutual goals of rural electrification, increased introduction of renewable wind energy, and reduction of greenhouse gases.

4) To support the implementation of the Chiloe Island project, CNE in cooperation with UNDP and GEF has undertaken a monitoring program of the wind resources of the Chiloe Archipelago. Specifics on this wind-monitoring program will be discussed in Section 4.

5) As the e7 Fund began its involvement with the project, a brief description of e7 Fund's understanding of the project and its goals were identified and presented to CNE and UNDP in 2Q 2002. (Appendix 2.1.4).

6) The e7 Fund formalized its involvement in the Chiloe project by signing an MOU with CNE and UNDP on September 9, 2003 (Appendix 2.1.5). In the MOU, the signature parties agreed to undertake a Pre-Feasibility Study of the project and pledged to work toward its development, construction, and operation. Participating parties from the e7 Fund in the Pre-Feasibility phase of the project were AEP, EDF, and HQ. AEP acted as Team Leader on behalf of the e7 Fund.

2.2 COMMITMENTS AND PROJECT BENEFITS

1) The General Commitments of the parties as expressed in the MOU between the e7 Fund, CNE, and UNDP were as follows:

a) Work together in a timely manner to support the receipt of the necessary permits and approvals upon a presentation of appropriate documentation, according to the national policies and regulations, for the development, construction, operation, distribution, and sale of electricity produced by the Project;

b) Ensure the completion of the Pre-feasibility Phase following the task list, responsibilities, and schedule in Annex 1 to this MOU and all following phases of the Project; including if needed, the assistance to facilitate the compliance of all applicable legal and regulatory requirements, to determine appropriate financial policies as appropriate for its development and operation, as well as to share mutual experiences;

c) Cooperate to prepare the necessary documentation for the project registration in order to apply for greenhouse gas emission reduction or mitigation programs, especially within the CDM of the Kyoto Protocol;

d) Co-ordinate the necessary public consultation with all stakeholders directly concerned by the Project.

2) The expected Benefits to be realized by the project, as expressed in the MOU, are as follows:

a) Will make the Chiloe Archipelago less dependent on diesel generation and reduce expenses associated there;

b) Will reduce the risk of oil spills associated with the transportation and delivery of fuel;

c) Will reduce the atmospheric emissions of fossil-fuel emissions and greenhouse gases on a local and global scale;

d) Will be an example of multilateral collaboration for the mitigation of Climate Change under the aegis of the United Nations Framework Convention on Climate Change (UNFCC);

e) Will provide valuable experience for the global promotion of small-scale, power generation and distribution systems with renewable energies;

f) Increase the access of the local population to renewable energy and contribute to the local economic development;

g) Develop public awareness of effective demand side management and energy conservation practices.

2.3 SCOPE AND PROJECT ORGANIZATION

1) The general scope and project organization were identified in Annex 1 to the MOU, referred to by the project team as the Task List (Appendix 2.3.1 herein). The Task List divided the work for the Pre-Feasibility Study into defined tasks, assigned responsibility, and set target schedule dates. The project tasks in general are typical of many other projects that the participants had worked on, but the project scope was complex in that the team was studying thirty-six (36) islands concurrently and treating each island individually to obtain accurate results.

2) The project was broken down to fourteen (14) specific tasks. Lead organizations were assigned and supporting organizations identified for each Task. A dedicated project website was established to facilitate the exchange and sharing of project files among the study participants.

3) Study participants included CNE, UNDP, SAESA (the local electrical distribution company in Chiloe and operator of the Tac Island Project), the e7 Fund, and GTD (as an in-country consultant to the e7 Fund).

4) CNE social-economic field studies identified that thirty-six (36) islands were to be studied in the Chiloe Project. A list of the islands is included in Appendix 2.3.2. Early studies for the rural electrification of the Chiloe islands identified approximately 3,500 households would benefit from the project. The detailed (door-to-door) social-economic studies conducted under this study showed that approximately 4,100 households are located on the islands identified.

5) The project team undertook to identify specific rural electric solutions for each of the thirty-six (36) islands identified in the study and identify these solutions in the Pre-Feasibility Study. It was accepted by UNDP and Chilean Officials (from CNE and Region X) that the e7 Fund's interest in the project mainly focused on renewable energy related solutions.

3.0 CHILEAN RURAL ELECTRIFICATION PROGRAM

3.1 CURRENT LEGAL FRAMEWORK

1) The Chilean Government has an aggressive and admirable Rural Electrification Programme (REP) that was initiated in 1994 and is administered by CNE. The existence of the REP allowed rural electrification coverage to increase from 56.8 % in 1994 to 76% in 1999. The Government has set the goal of achieving 90% rural household electrification coverage by the year 2005, at a national, as well as a regional level. That translates in the electrification of 100,000 households, with an approximate investment of 150 million dollars. The above figures were taken from Appendix 3.1.1. Due to the success of the program, Chile holds the third place in Latin America (in relation to rural electrification coverage), preceded only by Costa Rica and Mexico.

2) The REP subsidy program is focused on capital subsidy and not operating subsidy. Rural electrification projects are co-financed by Government contributions (maximum 70% of total project cost), private investor company (minimum 20%), and by the beneficiaries (10%). The beneficiaries are assumed to cover the costs of interconnection, metering, and household wiring.

3) The Regional Planning Secretariat is responsible for reviewing the private and social evaluation of projects, determining contributions from companies, and corresponding subsidy amount to projects. Subsidy is defined in a way that the project's internal private return rate (private TIR) is a 10%, subsidizing only the projects whose internal social return rate (social TIR) is higher or equal to a 12%. (Refer to Section 3.3 below for more details on the subsidy process).

3.2 FUNDING MECHANISM

1) CNE indicated that the Chilean Government has funding in place for the REP. The Inter-American Development Bank (IDB) has provided a loan of US$ 40 MM toward the overall funds of US$ 70 MM committed to the Programme. Of that funding, US$ 8 MM has been designated specifically for the Chiloe Project as a means to support renewable

energy development. Refer to Appendix 3.2.1 for March 2004 press release on loan IDB signing.

2) The e7 fund requested documentation relating to the specific project requirements of the IDB Financing, such as requirements for competitive bidding, reporting, due diligence, etc. Near the completion of the Study, CNE advised that a condition of the IDB financing, the subsidy process related to selection of the Owner/Operator of rural, isolated electrical systems must be determined through a competitive bid process. This key point will influence how project implementation will be undertaken and the role the e7 Fund could play on the project.

3.3 SUBSIDY PROCESS

1) Appendix 3.3.1 was developed by MIDEPLAN – CNE in 2002 as a guide to development and evaluation of rural electrification projects.

2) During e7 Fund Missions to Chile, CNE presented an overview of the rural electrification subsidy program. An important aspect of the financial assessment is that while subsidy levels up to 70% are possible for project capital costs, each project must be evaluated for Social and Private Net Present Value (NPV). Each project is eligible for subsidy levels up to the point where Private [Financial] NPV becomes positive or where Social [Economic] NPV becomes negative.

a) The following general observations were stated by CNE regarding the subsidy program:

- Each region administers its own subsidy program.
- The National Government can make recommendations, but all decisions are made at the regional level.
- The applicant (Municipality or Company) applies to the Regional Government for subsidy. The application is assigned to SERPLAC (Planning Office – National and Regional in nature) for review.
- SERPLAC reviews the application for the appropriate subsidy level and performs due diligence on project technical and environmental aspects.
- If SERPLAC determines the project is acceptable, it is added to a list of recommended projects annually.
- The Regional Governor decides what acceptable projects from the list get presented to the Regional Committee for implementation.
- In general, April is the deadline for submission to SERPLAC; however, CNE notes that "special projects" can be presented at any time.

3) CNE also explained the general process for the subsidy process is as follows: If the Municipality presents the project to the Regional Government, there is a competitive bid process for the electrical supplier. If a Company presents the project to the Regional Government, there is no competitive bid process. The law establishes that the subsidy can be given to the Municipality or directly to the Company. This is a free decision by the Regional Government. More recently, CNE has advised that since the project will consist of isolated rural systems, a condition of the IDB financing is that the project Owner/Operator must be selected by competitive bid.

4) CNE provided Appendix 3.3.2 containing associated NPV calculations. CNE offered their technical support for determining the Social NPV and Financial NPV numbers. There appears to be some confusion in that many subsidy cases use assumed factors based on grid extension projects. CNE indicated that very few, if any, applications were previously submitted for remote island projects using wind-hybrid like those proposed for Chiloe. The e7 Fund team members recommended that CNE take the lead on evaluations of Social and Financial NPV factors as the project moves into the Feasibility Study phase. (The e7 Fund offered that we could add CNE developed "functions" to the financial model at a later date if that would help expedite and assess social NPV criteria)

5) In performing the Financial Assessment for the Pre-Feasibility Study, given the large number of islands to be analyzed and having questions on the specific social NPV methodology, the project team ran financial models at two different subsidy levels, assuming 35% and 70%.

6) CNE provided Appendix 3.3.3 as indicator of the documentation that will be required to support the subsidy submission for the project. During the Feasibility Study Phase, it appears that we may need to discuss and resolve what level of engineering detail will be needed in the drawing submissions for the subsidy application as it is unlikely that detail

design drawings will have been developed by the Owner/Operator bidder for all 32 islands in advance of determination of subsidy amount and assurance that a subsidy will be provided.

4.0 RENEWABLE ENERGY POTENTIAL ASSESSMENT (TASK 1)

4.1 GENERAL

1) In consideration of the REP, CNE has investigated renewable energy resources in much depth across Chile. In general, Chile is blessed with abundant resources of wind, solar, hydro, and biomass energy. The availability of these resources depends on the specific region of the country. A general assessment of Chile's energy resources is presented in Appendix 4.1.1.

2) The primary renewable resources in the Chiloe Archipelago are wind, biomass, and hydro. Solar radiation resources in the northern regions of Chile are reported to be among the highest levels in the world; however, the solar radiation resources are low in the project area. (Ocean tidal, current, and wave resources were not investigated under this study considering that this technology is still in the early stages of commercial development).

3) The e7 project team did not study the option of submarine cables as CNE had indicated in September 2003 that submarine cable should not be considered a viable alternative given expected cost, depth of water in the region, numerous aquaculture operations, and potential difficulties in licensing the submarine cable.

4.2 WIND

1) The Chiloe Archipelago has significant wind energy resources. The Pre-feasibility Study focused on the use of wind energy as the primary renewable resource. Wind energy assessment is discussed in detail in Section 5 herein.

4.3 MICRO HYDRO

1) A preliminary screening of islands with micro-hydro potential was conducted by e7 Fund and CNE project team members. The island of Llancahue was visited and several potential micro-hydro sites were observed, including a small privately owned micro-hydro system serving a small inn. CNE has undertaken and completed the hydro resource assessments for Llancahue Island and reported that the results are encouraging. CNE has prepared a tender document for a consultant to perform a micro-hydro Feasibility Study. CNE has advised that it prefers to address the implementation of the Llancahue micro-hydro sites as a separate project aside from the other islands of the Chiloe Archipelago.

4.4 SOLAR

1) The solar radiation resources of the Chiloe Archipelago are relatively low (Appendix 4.1.1). CNE and e7 Fund have focused attention primarily on the abundant wind energy resource.

4.5 BIOMASS

1) The Island of Butachauques was reported to have significant forested areas. The island also has a biomass fueled electrical power generator system that is currently non-operational. The e7 Fund and CNE project team did not investigate the biomass potential of Butachauques in great depth. Instead the team considered use of the abundant wind resource on Butachauques since the wind energy equipment would require less operator interface, and could allow lower operating costs and would have commonality with other island systems.

4.6 DISTRIBUTION GRID EXTENSION

1) As part of the study SAESA reviewed islands that had the potential to be connected to existing electrical systems economically to provide rural electrification. SAESA confirmed two islands for possible grid extension; Caucahue and Tranqui. These islands will be assumed to receive electrification by grid extension and will not have independent generating systems.

2) Early in the Pre-Feasibility Study, the island of Coldita was identified as a candidate for grid extension due to its close proximity to the main island of Chiloe. SAESA later advised that Coldita is not a feasible candidate for electrification

by grid extension as there is no distribution system in the area on the adjacent main island (nearest service is 20 km away). Due to early consideration for grid extension to supply Coldita, the island did not have a specific wind map developed nor was it analyzed for a wind-diesel hybrid system using the HOMER modeling software. Coldita contains a large Indigenous Community and the social-economic assessment indicates the island residents (and adjacent island residents of Laitec and Cailin) have a low ability to pay. Coldita Island represents a challenging set of circumstances; this island needs to be studied in more detail during the Feasibility Study phase and a unique solution may be required. Refer to Section 6 herein for more discussion of the Indigenous Community.

4.7 CONCLUSIONS

1) For the thirty-six (36) islands included in the original study (Appendix 2.3.2), the following solutions have been proposed in this study.

a) One (1) island for micro-hydro solution (Llancahue). To be a separate project implemented by CNE.

b) Two (2) islands for grid extension (Caucahue and Tranqui). Assumed to receive rural electrification by SAESA outside of this project.

c) One (1) island requires more study (Coldita) as it cannot be electrified by grid extension as originally considered. (Refer to Section 6 herein for special considerations involving Indigenous Communities adjacent to Coldita that are also without electrical service).

d) Remaining thirty-two (32) islands to be presented in this Pre-Feasibility Study with hybrid wind-diesel generating systems. These 32 islands represent approximately 3700 households of the overall estimated 4100 households in the 36 islands identified.

5.0 WIND RESOURCE ASSESSMENT (TASK 2)

5.1 DATA

1) E7 Fund Team Member EDF conducted a thorough wind resource assessment considering wind data provided by CNE.

2) CNE, in coordination with UNDP / GEF, has conducted an extensive wind monitoring program for the islands of the Chiloe Archipelago specifically to support the development of wind-based rural electrification projects.

3) Wind data from the following sources has been considered:

a) Data from Puerto Montt Meteorological Station

b) Data from installed wind turbine and 24-meter wind mast at Tac Island

c) Data from wind monitoring towers installed at the following islands:

- Quenu
- Llanchid
- Quehui
- Laitec
- Chaiten

4) An overview of the wind monitoring program was presented by CNE in coordination with UNDP / GEF in April 2003 and is included herein Appendix 5.1.1. The locations of the wind monitoring towers are shown.

5.2 METHODOLOGY

1) EDF reported preliminary results of the wind resource assessment in June 2003 (Appendix 5.2.1) with the complete evaluation completed in April 2004 (Appendix 5.2.2).

2) A global wind map of the Archipelago and zoomed wind maps for each of the 32 islands were developed considering topographical details for each island. The global wind map shows a global tendency of the wind speed for the region, and detailed wind maps of the 32 islands allow indicate the best sites in each island for the installation of a wind turbine.

5.3 RESULTS

1) As presented in Appendix 5.2.2, the EDF prepared "Wind Evaluation of the Chiloe Archipelago", the global study of Chiloe Archipelago shows that the wind resource is good in a major part of this Archipelago. The wind is primarily from the North.

2) The Wind Evaluation draws attention on the different uncertainties having a significant effect on the results of this study. The wind regime varies between the different places in the Archipelago and the six (6) reference measurement points are quite scattered versus the large size of the studied region. Thus, real wind speeds in some islands may be different than calculated wind speeds. Other uncertainties concern relief information. Relief curves have been provided every 25 meters and relief information every 10 meters would have brought more accuracy. Nevertheless, at this preliminary stage this study shows a good approximation of the wind speed in the Archipelago.

3) The global wind map (Appendix 5.3.1 – distributed on CD by EDF) shows that the wind speed is medium to good in the region with a wind speed between 6.0 and 7.0 m/s at 30 meters above sea level. When a favorable relief exists on some islands, the wind speed increases strongly to reach 7.5 m/s or more. At the opposite, when the relief is not favorable (plateau) and when the vegetation is dense (forest), the wind speed quickly decreases to 5.5 m/s or less. Many islands have some favorable relief with a good exposure to prevailing winds, i.e. relief located on the North or Northwest coasts. Thus, even in less windy parts of the Archipelago, it is possible to find good sites in most of the islands.

4) Wind maps for the 32 islands (Appendix 5.3.2 – distributed on CD by EDF) show that 24 islands have one or more sites with wind speeds above 7.0 m/s at 30 meters height (11 islands having wind speeds above 7.5 m/s). Four other islands have wind speeds comprise between 6.5 and 7.0 m/s (same level of wind speeds than for Tac existing wind turbines). Four other islands have wind speed ranges between 6.0 and 6.5 m/s. Most of the islands will have several sites of the same level of wind speed allowing a choice of site with the easiest access and connection to the local grid.

5) The Wind Evaluation goes on to recommend that to confirm the good levels of wind speed calculated all over the Archipelago, existing wind masts installed should be moved to some other places of the area to reduce the uncertainties and to confirm the calculated wind speeds.

5.4 NEXT STEPS FOR WIND MONITORING

1) Wind monitoring efforts are on-going. Appendix 5.4.1 shows the locations of new wind monitoring towers and where some of the existing towers are currently being relocated. The wind-measuring tower on Quehui will remain in place to provide a consistent reference point. New towers are proposed for Tauculon and Chaulinec Islands. Existing towers will be relocated to Llingua, Cailin, and Caguache.

2) As part of the Feasibility Study to more directly support the implementation strategy, it is anticipated that a program of micro-siting so that wind resources will be validated by measurements on each island and / or validation of the EDF wind models will occur before system final design and construction will begin. Use of simple, inexpensive single channel wind monitors at a significant amount of islands should be considered to expedite the final wind evaluations and implementation process. Wherever possible, wind measurements should be taken at the actual proposed wind turbine location.

6.0 ENVIRONMENTAL ASSESSMENT & INDIGENOUS COMMUNITIES (TASK 3)

6.1 LEGISLATIVE REQUIREMENTS

1) During the September 2003 Mission, e7 Fund and CNE team members met briefly with Mr. Felipe Artancibia from the Regional Commission for Environmental Affairs (COREMA). Mr. Artancibia is in charge of coordination of the Environmental Impact Evaluation System at the Regional level. As previously reported by CNE, Mr. Artancibia confirmed the project will not be required to perform an Environmental Impact Assessment (EIA) since it is expected the island systems will be under the 3 MW threshold.

2) The CDM process, as well as e7 policy, requires an environmental screening. The Representative from the

Environmental Ministry was somewhat familiar with the desire for environmental screening, and many projects have been seeking "voluntary EIA's." No potential "red flags" were immediately identifiable for the project, however, areas that were suggested as requiring the e7's attention included:

- SENATUR– National Tourism Office – Concern with visual impact
- CONAF - Forestry Department
- Land use Planning
- CANIDE – National Bureau for Indigenous People

The Environmental Ministry official suggested an official request for information be submitted on behalf of the project by CNE at the Feasibility Study phase of the project when more specific details of the project have been identified.

6.2 ENVIRONMENTAL FINDINGS

1) An Environmental Screening Study was performed by UNDP on behalf of the project (Appendix 6.2.1). No immediate issues of concern or "red flags" were identified.

6.3 ENVIRONMENTAL AREAS OF CONCERN FOR FURTHER STUDY

1) The e7 Fund project team has not identified any specific environmental areas of concern requiring further study. The team proposes to meet with Environmental Ministry officials for further discussion during the Feasibility Study phase when specific island system configurations (which islands will receive wind turbines) has been identified.

2) It will be proposed that Environmental Management Plans be developed for the construction and operation periods of the project.

6.4 INDEGINOUS COMMUNITIES

1) The social-economic field assessments have identified four (4) islands with significant Indigenous People populations:

a) Alao
b) Coldita
c) Laitec
d) Cailin

2) Project team members visited the Ministry of Heritage in Puerto Montt during the Sept 2003 Mission. The group discussed land use issues for the indigenous peoples and the possibility of archeological sites or other possible sensitive areas. The Mission Team was informed that an archeological survey of all the islands was planned for 2004. This issue should be investigated during the Feasibility Study phase to determine latest status and issues of potential concern.

3) CNE reported recent studies performed in Chile demonstrated the positive impact of rural electrification on the Indigenous Peoples, however, the e7 has not obtained a copy of this reference report at this time.

4) As noted earlier in this report, a specific technical solution has not been proposed for Coldita Island. This island was originally conceived to receive electrification via grid extension, until the project team learned that the grid terminated 20 km away. On the man island of Chiloe, immediately adjacent to Coldita Island, there is a large Indigenous Community called Piedra Blanca (Refer to map in Appendix 6.2.2). The Pierda Blanca community is also without electrical service. The project team would recommend that during the Feasibility Study phase, the concept of main grid extension or isolated grid with self-generation be considered for both the Pierda Blanca community and Coldita to provide economy of scale and a more economically viable solution for the limited finances of the people.

7.0 SOCIO-ECONOMIC ASSESSMENT (TASK 4)

7.1 METHODOLGY

1) A rigorous and detailed social economic assessment was carried out by CNE for each of the thirty-six (36) islands identified for the project. CNE had two (2) field teams visit every home, public and commercial enterprise on the islands. Detailed social economic data was obtained by the field surveys, as well as photo-documentation and GPS

coordinates of the structures and roads. An interim presentation on the type of data being collected was provided in September 2003 and is contained herein as Appendix 7.1.1.

7.2 RESULTS

1) E7 Fund Team member Hydro Quebec presented topics that should be considered in the social-economic analysis (Appendix 7.2.1) to be performed by CNE.

2) The results of the field social-economic assessment by CNE are presented in Appendix 7.2.2. (The voluminous raw data for all the 36 islands was provided to the e7 team members on several CD's).

3) A summary description of the key findings has been prepared for each island and is included in Appendix 7.2.3 herein.

7.3 ABILITY TO PAY AND WILLINGNESS TO PAY

1) As reported in Section 14 herein, detailed financial models were developed for each of the 32 islands assuming 35% and 70% capital subsidy levels by the REP. Financial model results provided average monthly electric bills indicated for low, middle, and high-income provided for each island. Summaries of levelized bills across Municipalities were also developed.

2) CNE and Region X officials indicated that many of the proposed island tariffs identified in the financial models (Section 14) appeared reasonable in comparison to other rural electrification projects in Region X such as Tac Island.

3) It should be noted that all forms of energy on the Chile Archipelago are currently "expensive" to the residents given the remote nature of the islands and modest economic conditions that exits on the islands.

4) SAESA indicated in conversation that on rural electrification projects, they do not generally have significant problems with people paying their bills.

5) On some smaller islands with fewer residents, due to lack of economy of scale, the required tariff would be quite high and likely beyond the resident's ability to pay. CNE and Region X officials have indicated that the project will be implemented at least on a Municipality level or perhaps even as a single project with single tariff. It is expected that this cross-subsidy will result in a tariff that is generally affordable to the vast majority of customers. This issue will require further study as the implementation strategy for the project is finalized during the Feasibility phase.

6) A detailed "Ability to Pay" and "Willingness to Pay" Assessment was not performed by the e7 Fund. It is recommended that the detailed assessment be performed in the Feasibility Study phase when the specific implementation strategy is identified (what islands, sequence, and cross-subsidy potential within Municipality or Region). During the Feasibility Study phase, more data should be obtained on other REP projects in Chile and compare methodology issues (such as using three standard classes for residential consumption identified in the REP or the merit of further breakdown to 6 or 8 categories). It should be considered also that the REP Subsidy process does take into account the ability to pay assessment in determining the "social net present value." The methodology and requirement for positive social NPV can be taken as an indicator that the consumers will be positively impacted (financially) by the introduction of electricity.

7.4 DETAILED SURVEY DATA ALLOWS POSSIBLE FOLLOW-ON STUDIES

1) As an interesting side note, the level of social-economic evaluation performed by CNE was extensive and in more detail than what the e7 Fund has encountered in other projects. Also, extensive photo-documentation was carried out by the field teams that were comprised of many young people with anthropology backgrounds.

2) It is the opinion of the e7 Fund team members that considering the extensive social economic studies acting as a "baseline", rural electrification of the Chile Archipelago offers the opportunity for later studies after project implementation to help quantify and better understand the benefit that access to electricity can provide to society and the direct quality of life improvements realized.

8.0 DEMAND ASSESSMENT (TASK 5)

8.1 METHODOLGY

1) Extensive data and accepted methodology exists for performing rural electrification demand assessments under the Chilean REP. For the Chiloe Project, the demand assessment was performed by Hydro Quebec based on the social-economic data collected by CNE, demand assessment characteristics provided by CNE, and Hydro Quebec's own experience.

2) CNE provided typical rural electrification demand curves (Appendix 8.1.1) with yearly growth rates for various economic classes that have been gathered through experience under Chile's REP. CNE also provided population growth change rates for the islands in Appendix 8.1.2.

3) SAESA provided typical seasonal demand curves and 24-hours curves, tariff data, and other demand data for other rural electrification projects they have operated (Tac Island wind-diesel-hybrid, diesel-only remote island, and grid extension) in Appendix 8.1.3.

4) HQ also received input from the Regional Government on planned municipal infrastructure projects, such as potable water systems and schools.

8.2 RESULTS

1) Hydro Quebec performed the Demand Assessment and distributed the results for each island to the team. The majority of Demand Assessment results were reported in March 2004; two islands (Quenac and Llingua) had their Demand Assessments updated in April 2004. The results of the Hydro Quebec Demand Assessment are included herein as Appendix 8.2.1.

2) Subsequent to the completion of the Hydro Quebec Demand Assessment, CNE reviewed the finalized social-economic evaluation data and proposed several changes to the Demand Assessment (Appendix 8.2.2). Most of these changes were not significant, except for changes (increases) suggested for islands "Chelin+Quehui", Caguache+Quenac", Meulin, and "Aulin+Butachauques". Since HOMER Hybrid Modeling studies were performed using the earlier HQ Demand Assessment and detailed capital cost and O&M studies were underway at the time, the decision was made to disregard the CNE suggested changes to the Demand Assessment during the Pre-Feasibility Study phase. These changes will be considered later during the Feasibility Study phase when system design is studied in more detail. The decision not to incorporate the changes to the Demand Assessment was also considered reasonable as all changes were related to increasing the peak load and this would only improve project economics. CNE accepted this decision in order to keep the Pre-Feasibility study moving forward. The CNE suggested revisions to the Demand Assessment are identified in Appendix 8.2.3.

8.3 SALMON PRODUCERS –POTENTIAL FOR INCREASED REVENUE

1) The Chiloe Archipelago has an extensive aquaculture industry including salmon farms and mussel harvesting operations. During the course of the Pre-Feasibility Study, the project team met with several aquaculture firms to determine their interest in receiving power from renewable energy sources (wind) on the islands.

2) It was determined that the Salmon industry has high electrical demands, with future demands likely to increase as automated feeding systems are introduced and increased use of scientific instrumentation is encountered to monitor the aqua-culture activities (underwater cameras, dissolved oxygen sensors, etc).

3) Salmon industry representatives were very interested in renewable power supplies as they sell their product into the North American and European markets where an increasing use of sustainable production methods is demanded. Salmon farmers expressed interest in the proposed renewable energy systems but also noted their strong concern that the cost of renewable generated electricity be competitive with their current diesel generation sources.

4) Locations on most of the major salmon operations were provided to CNE and e7 Fund by the Salmon Farmers association on a CD (retained by AEP). The project team was informed that concern over water pollution (fish feces) requires the farmers to provide fallow periods when the fish are not present. Some Salmon farmers operate their fish pens for 18 months and then they remain idle for 6 months. Other operations run their pens for 5 years then they

remain idle for 2 years. Some farms use nighttime lighted feeding systems; others do not believe in this technique.

5) Due to the varied operating modes of the Salmon farmers and significant number of islands being studied in the Pre-Feasibility Study, it was decided by the team to ignore the potential benefit of including the Salmon farmer loads in the demand assessment at this stage of the project. Later assessments can be made when specific islands are proposed for renewable systems during the Feasibility Study phase, when we should have fewer islands to study. It was generally agreed that inclusion of the salmon farms into the system can only improve the project economics.

6) Recent developments appear to indicate that the cost of wind derived renewable energy may be even more cost competitive for the Salmon Farmers due to recent proposed mandates concerning stricter requirements for the transport of fuel and related developments where electric power for automated fish feeding systems must be placed ashore and not on barges. The opportunity for "excess" wind energy capacity to be sold to the fish farmers could provide significant benefit to the rural electrical system operator with minimal incremental cost. Exactly how the Salmon farms can be provided from these rural electrical systems must be carefully examined so that the Salmon Farmers cannot be claimed with having benefited by government subsidy (in the form of the rural electrification subsidy).

9.0 CDM CRITERIA AND ELIGIBILITY (TASK 7)

9.1 CDM GOAL AND OBJECTIVE

1) In the MOU, CNE, the e7 Fund, and UNDP agreed to prepare the necessary documentation for the project registration in order to apply for greenhouse gas emission reduction or mitigation programs, especially within the CDM of the Kyoto Protocol.

9.2 CDM PROCESS IN CHILOE

1) During the January 2004 e7 Mission, CONAMA provided an overview of the CDM process being used in Chile. For CDM type projects, Chile has been using the World Bank's Community Development Carbon Fund (CDCF). Mr. Phillippe Durand of the World Bank, Buenos Aires Office, was able to join the meeting to discuss Chile's use of the CDCF.

2) As indicated at the January 2004 meeting, Chile had proposed five (5) domestic projects to the CDCF. All of them have been accepted by the CDCF Board although none had made there way through the complete process yet. The five projects consisted of the following:

- 26 MW Hydro
- Agri-waste, manure to methane for process
- Coal-natural gas conversion for a boiler
- Cogeneration Project
- Forest Reforestation Project

3) Registration within the CDCF process comes with some World Bank conditions attached, such as due diligence technical and project management review by WB staff. These conditions will need to be investigated before the e7 Fund decides to take the CDCF path for CDM registration.

4) CNE indicated that they had already made an application to the World Banks CDCF program for the Chiloe Project. The e7 Team present at the meeting did not make any commitment on using the CDCF process, and indicated that further consideration of this matter will be needed (in the Feasibility Stage of the project).

10.0 LOCAL GRID DESIGN & OPTIMISATION (TASK 6)

10.1 METHODOLGY

1) SAESA agreed to participate in the Pre-Feasibility Study and provided information related to grid design, capital cost, operating costs, tariff, and demand assessment. SAESA developed grid system design costs using the GPS coordinates for homes and roads provided by CNE from the field assessment teams. The grids were designed considering topography and existing roadways. Methodology is described in Appendix 10.1.1 with some unit equipment costs provided in Appendix 10.1.2.

10.2 RESULTS

1) SAESA has estimated that the cost of providing the medium voltage and low voltage distribution grids was $8,570,000. (This cost excludes generator switchyard and interconnection costs, and inter-island connection costs; these costs are included within the total system cost – see Section 14 herein). A breakdown of costs is provided on an island-by-island basis, and includes a comparison to projected costs using the NREL VIPOR Model tool (Appendix 10.1.3).

2) As previously stated, two islands, Caucahue and Tranqui, were determined to be good candidates for rural electrification by grid extension. SEASA indicated the interconnection cost between the mainland grid and new island grid at US$ 289,000 for each island.

3) SEASA developed AutoCAD drawings for the proposed island grids and made these drawings available to the CNE and e7 Fund team for reference during balance of plant system design. Copies of these files have been retained by e7 and were uploaded to the project website.

11.0 SYSTEM DESIGN BASIS (TASK 8)

11.1 METHODOLGY

1) To define the generating systems, a preliminary optimization study was performed by EDF using the NREL HOMER Hybrid model, followed-up by a conceptual design study of balance of plant systems "in-country" by a Chilean consultant. The HOMER model results of hybrid system and conceptual design of the balance of plant systems, when taken with the SAESA developed distribution grid, provided a detailed baseline for each of the 32 island hybrid systems. Performance data was provided for diesel generation and wind generation sources, as well as expected life-cycle of key generation equipment. Quantities of materials were identified on an island-by island basis, to provide accurate data for later cost and financial studies

11.2 NREL HOMER MODELING

1) EDF prepared a detailed report entitled "Power Systems Design Study", included herein as Appendix 11.2.1. The Power Systems Design Study explained the key data used to develop the HOMER models, methodology, and assumptions. Component Manufacturer's data and cost information was also included. *(The EDF Power Systems Design Study report is slightly outdated as later changes were made to the HOMER models with respect to system topology and how the DC buses were handled with respect to the AC wind turbines. The EDF Power Systems Design Study report has not been updated to address these later changes).*

2) Appendix 11.2.2 contains the HOMER Model summary sheets for the 32 islands modeled. Table 11.2.1 below provides a summary of the HOMER Model results.

Table 11.2.1 – HOMER Model Results for the Islands

ISLAND	Wind Turbine Size kW / Quantity	Diesel Generator Size kW, Number 1 / 2	% Annual Energy Consumption from Wind	% Excess Wind Energy Available
ACUY	5	5/1	82	18
ALAO	20	10/20	38	9
APIAO	60	25/15	71	85
AULIN + BUTACHAUQUES	60	40/15	62	43
CAILIN	20	25/10	37	5
CHAULINEC	60	30/15	69	70
CHAULLIN	5	5/-	82	17
CHENIAO + TAUCOLON	20	20/10	52	13
CHUIT	5	2/5	48	4
CHULIN	5	10/5	47	3
GUAR	60	80/30	41	10
IMERQUINA	5	2/-	96	297
LAITEC	20	30/10	38	8
LINLIN	20	15/25	28	2
LLANCHID	5	5/-	68	9
LLINGUA	20	10/20	46	11
MECHUQUE + ANIHUE	60	35/20	67	56
MEULIN	60	30/15	70	70
NAYAHUE + AHULLINI	5	10/5	26	1
QUEHUI + CHELIN	2 x 60 KW	130/60	43	21
QUENAC + CAGUACHE	60	45/20	55	30
QUENU	5	10/5	24	1
QUEULLIN	20	20/10	37	11
TABON	20	10/20	34	5
TALCAN	5	10/5	37	1
TEUQUILIN	5	5/-	83	50

3) The HOMER models provided cost data for the island configuration modeled. This cost data was not considered to have sufficient accuracy to be used as the basis for the Pre-Feasibility Study cost and final assessments. The team has relied on the detailed cost data developed in the "in-country" estimate developed as discussed in Section 12 herein.

11.3 CONCEPTUAL DESIGN BASIS AND ASSUMPTIONS

1) AEP was assigned the responsibility of developing the conceptual overall system design and cost data for the study. AEP decided to collaborate with an in-country Chilean consultant to define the balance of plant systems and cost data. Use of the in-country consultant was considered important to obtain accurate information using equipment available in the Chilean market, have an understanding of local construction practices, and be able to more accurately assess the "logistics" costs associated with constructing the systems on the remote islands of the Chiloe Archipelago.

2) GTD of Santiago, Chile was the consultant retained by AEP to prepare the design and cost studies. In preparation for

their work, GTD engineers conferred with SAESA regarding the distribution system engineering work performed by SAESA. GTD Engineers also traveled to the Chiloe Archipelago with Mr. Drago Bartulin to visit one of the project islands [Llingua] to observe first hand the challenges of constructing and operating remote island systems.

3) GTD prepared a detailed report identifying the data used in their work and identified their specific methodology and assumptions, included herein as Appendix 11.3.1. Similar to other project assessments and studies, the design of balance of plant systems was performed on an island-by-island basis considering specific island data to provide accurate results. The GTD work included the generation switchyard and transmission line to the distribution system that was not included in the SAESA data. The building housing the diesel generators, electrical equipment, control area and small storeroom was considered robust and is more expensive than the construction used on TAC Island. For instance, the building walls are panel construction to provide sound attenuation. This was done considering that in the Feasibility Study phase, the generator building may be proposed to be located closer to the harbor facility to reduce fuel transport costs/concerns, thus putting the generation equipment in closer proximity to the village homes typically located near the harbor.

12.0 CAPITAL COST ASSESSMENT (TASK 9)

12.1 METHODOLOGY AND ACCURACY

1) GTD prepared a detailed capital cost assessment on behalf of the project, working in consultation with the e7 team.

2) The Capital Cost estimate was prepared assuming that the project will be constructed on a lump-sum, fixed price contract under an EPC (engineer-procure-construct) turn-key basis. Capital cost estimates were prepared on an island-by-island basis. It was assumed that the island systems would be constructed sequentially, allowing efficient use of labor crews. Specific details on methodology, assumptions, and the data used in the cost study is presented in Appendix 11.3.1. Wind turbine generating equipment and some other cost data was provided in the EDF Homer modeling effort, Appendix 11.2.1. SAESA grid cost data was provided in Appendix 10.1.3.

3) By their very nature, the accuracy of the capital cost assessment is difficult to determine until such time as fixed-price proposals have been obtained. For the purposes of this Pre-Feasibility Study, the project team has performed their work with the expectation that the EPC cost estimates will be accurate within +/-25%. During the Feasibility Study phase of the project, when system design optimization can occur and a cost can be examined in more detail, it is recommended that a cost estimate with an accuracy within 10% be pursued. Prior to making the final decision to implement the project, fixed-price EPC proposals should be obtained.

12.2 EPC COST BASIS

1) Appendix 12.3.1 contains the Capital Cost summary sheets for the 32 islands investigated. Table 12.2.1 below provides the Capital Cost estimate for each island. Installing all 32 islands with wind-diesel hybrid systems as proposed would require approximate funding of US$16.2 million; US$ 19.3 million when the 19% Chilean VAT tax is considered.

Table 12.2.1 – Capital Cost Summary for the Islands

ISLAND	Capital Cost without VAT tax, in US $	Capital Cost with 19% VAT tax, in US $
APIAO	762,285	907,119
AULIN + BUTACHAUQUES	1,270,555	1,511,960
CAILIN	683,618	813,506
CHAULINEC	968,693	1,152,745
GUAR	1,305,460	1,553,498
LINLIN	538,450	640,756
MECHUQUE + ANIHUE	1,073,904	1,277,946
MEULIN	773,940	920,989
QUEHUI + CHELIN	2,137,239	2,543,314

QUENAC + CAGUACHE	1,330,255	1,583,003
ALAO	508,724	605,381
CHENIAO + TAUCOLON	544,927	648,463
LAITEC	591,558	703,955
LLINGUA	379,064	451,086
QUEULLIN	421,106	501,116
TABON	464,619	552,896
ACUY	183,422	218,272
CHAULLIN	213,787	254,406
CHUIT	222,294	264,530
CHULIN	356,359	424,068
IMERQUINA	172,935	205,793
LLANCHID	189,936	226,024
NAYAHUE + AHULLINI	368,876	438,962
QUENU	253,075	301,159
TALCAN	296,767	353,153
TEUQUILIN	177,566	211,304
Total for 32 Islands	**$16,189,415**	**$19,265,404**

2) As seen from Table 12.2.1, some islands were considered to have a single generation system, with a "mini-grid" connecting nearby islands. This approach presented a good solution for several islands where distance between islands could be measured in several hundred meters or less. The use of mini-grids allowed greater economy of scale and reduced O&M costs as less generation units were required and operators were only needed to oversee the generators on a single island. For completeness of study, the project team did look at alternatives where the transmission line distance between islands was significant. These alternate configuration cost estimates are included in Appendix 12.3.2. A detailed discussion of this matter is included in Appendix 11.3.1.

3) For one configuration involving Chelin and Quehui Islands, it did appear that having separate systems was appropriate instead of a "mini-grid". The distance between transmission towers for Chelin and Quehui was identified as approximately 860 meters, and the transmission line would need to be quite high as it passes over a main shipping channel. Eliminating the inter-island transmission line will require the addition of a building and diesel generators for one of the islands (with one wind turbine being placed on each island). The elimination of the inter-island connection resulted in an approximate capital cost savings of over $300,000, however, O&M costs would rise as operators would now be needed on each island and there would be more equipment to maintain. The project team decided to consider that Chelin and Quehui should be implemented with separate generation systems. (Financial modeling showed a slightly higher tariff rate for the separate systems, but this is still considered a preferred approach to reduce the risks to the project associated with permitting, constructing, and maintaining the 860 meter transmission line across the shipping channel).

13.0 OPERATIONAL & MAINTENANCE COSTS (TASK 10)

13.1 METHODOLOGY

1) GTD also prepared the detailed O&M cost assessment on behalf of the project, working in consultation with the e7 team.

2) The O&M Cost estimates were prepared on an island-by-island basis, similar to the Capital Cost study. It was assumed that the island systems would be maintained by a single company, with administrative cost shared between the islands dependent upon the number of households. Specific details on methodology, assumptions, and the data used in the cost study is presented in Appendix 11.3.1.

3) Appendices 12.3.1 and 12.3.2 contain the O&M Cost summary sheets for the 32 islands investigated.

4) As part of the HOMER modeling effort, EDF needed to identify transportation costs to the islands and estimated tank

size. Fuel delivery "routes" were developed for groupings of islands to categorize delivery costs. In the detailed O&M cost study, GTD performed more investigation and fine-tuned the concept of fuel delivery routes in light of new proposed restrictions on the transportation and delivery of fuel proposed for the islands. (The reported proposed new fuel transport regulations are included in Appendix 13.1.1). Fuel tank sizes were also optimized such that groupings of islands would not require fuel delivery more often than once per month.

14.0 FINANCIAL AND ECONOMIC ASSESSMENT (TASK 11)

14.1 FIRST FINANCIAL INDICATORS

1) EDF performed a preliminary financial economic assessment based on the cost data contained in HOMER models. The figures were considered gross assumptions to be defined more accurately in the next step. The primary purpose of the First Financial Indicators (Appendix 14.1.1) was to support dialogue between the e7 members on levels of investment required and possible next steps at the time. Subsequently, a more updated financial assessment was performed using the detailed capital and O&M costs discussed in Sections 12 and 13 above.

14.2 DETAILED FINANCIAL ANALYSIS

1) GTD prepared the detailed Financial Assessment on behalf of the project, working in consultation with the e7 team.

2) Similar to the cost estimates, the Financial Assessment was prepared on an island-by-island basis. GTD developed a single Excel workbook, incorporating the elements of the HQ Demand Assessment for each island, the HOMER model results for each island, and the detailed Capital and O&M cost estimates. The workbook spreadsheets are included herein as Appendix 14.2.1. (15 MB file size)

3) The assumptions and methodology used to generate the financial assessment are identified in Appendix 14.2.2. Some of the key assumptions made in the model are as follows to obtain a "reasonable" tariff rate:

a) E7 investment was assumed to be 51%, with a JV partner providing 49%. The e7 fund also provided some working capital to help maintain positive cash flow during the early years of the project when electricity sales and related revenue is low (which is typical of rural electrification projects).

b) E7 investment was repaid in 20 years at 4% ROI and included a three-year grace period for low revenue early years. JV Partner investment was repaid in 20 years at 12% ROI with no grace period.

c) VAT tax recovery and depreciation were not accelerated, but did offset the need to pay any income tax on the project. (Accelerated VAT recovery and depreciation could be very beneficial to an arrangement where the owner /operator has a large tax liability in Chile, offsetting the need for working capital. VAT recovery is possible in Year 2, including all of the 19% VAT on government's capital subsidy!).

d) In addition to energy payments on a $/kWh basis, assumed fixed monthly tariff for all users at $7.78 per month, as this was amount identified by SAESA as the Tac Island fixed tariff. (Region X officials later advised that Tac tariff is higher…need to resolve during Feasibility Study phase).

e) The model assumptions discussed in paragraphs 14.2.3.a and 14.2.3.b above were arrived at during the course of the model development for two reasons: keep cash reserves positive every year during the project's life and provide tariff rate comparable to Tac where possible.

14.3 FINANCIAL MODELING RESULTS

1) Detailed financial models were developed for each of the 32 islands assuming 35% and 70% capital subsidy levels by the REP. Results are contained in Appendix 14.2.1 with average monthly electric bills indicated for low, middle, and high-income provided for each island. Summaries of levelized bills across Municipalities were developed in Appendix 14.3.1.

2) Island tariff rates vary significantly, with less populated islands generally having higher tariff due to less "economy of scale" and having many of the same fixed operating and capital costs as larger islands. For small islands, the tariff costs can be reduced if the project financials are considered across a larger group of islands (levelized or cross-subsidy). Since the Rural Electrification Program subsidies are given on a Municipality basis, a financial assessment was performed by groupings of municipalities. Key indicators of this analysis are included in the Tables 14.3.1 and

14.3.2 below, for 70% and 35% REP capital subsidies. Municipalities with average customer monthly bills greater than $40 may not be viable systems considering the population's ability and willingness to pay. To address these islands, treating all of the 32 islands assessed as one project would lower the tariffs for the "challenging" islands by increased cross-subsidization among all users.

Table 14.3.1 – Levelized Tariff within Municipalities, 70% Capital Subsidy

Municipalities	Average Monthly Customers bill in $ (2005 with VAT) $	Total e7 Funding (includes working capital) $	Total Project Funding Required $ (Project Costs and working capital)
Calbuco	*23.66*	370,855	2,982,841
Castro	*28.62*	284,715	2,290,001
Chaitén	*50.63*	215,030	1,729,512
Hualaihué	*70.77*	28,818	231,787
Queilen	*53.93*	27,830	223,838
Quellón	*32.00*	225,913	1,817,049
Quemchi	*29.40*	438,392	3,526,048
Quinchao	*25.55*	825,229	6,637,428
	Total e7 Funding	$ 2,416,781	

Table 14.3.2 – Levelized Tariff within Municipalities, 35% Capital Subsidy

Municipalities	Average Monthly Customers bill in $ (2005 with VAT) $	Total e7 Funding (includes working capital) $	Total Project Funding Required $ (Project Costs and working capita
Calbuco	*32.60*	1,019,852	3,112,640
Castro	*41.14*	782,966	2,389,651
Chaitén	*71.06*	591,331	1,804,772
Hualaihué	*102.43*	79,250	241,873
Queilen	*78.16*	76,532	233,578
Quellón	*45.74*	621,261	1,896,118
Quemchi	*40.22*	1,205,578	3,679,485
Quinchao	*36.41*	2,269,379	6,926,258
	Total e7 Funding	$ 6,646,149	

3) From Tables 14.3.1 and 14.3.2 above, it is clear that the amount of capital subsidy impacts the affordability of the project for the customers. With 70% capital subsidy, the average bill of three (3) of the eight (8) municipalities exceed $40.00 per month. With 35% capital subsidy, the average bill of six (6) of the eight (8) municipalities exceed $40.00 per month. For the discussion regarding implementation scenarios, it has been assumed that subsidy levels will be at or near the 70% maximum level allowed under the REP.

14.4 CAPITAL REQUIRED

1) Identify Estimated Capital Required for all 32 islands wind-diesel hybrid systems:

a) 70% Subsidy – As shown in table 14.3.1 above, based on the assumptions used to develop the Financial Model, the e7 Funding required for investment and working capital is $2,416,781.

b) 35% Subsidy - As shown in table 14.3.2 above, based on the assumptions used to develop the Financial Model, the e7 Funding required for investment and working capital is $6,646,149.

2) Given the results of the Financial Assessment and projected tariff rates, the project team would propose that for planning purposes at this time, the e7 planning assume that subsidies at or near the 70% level should be anticipated. Final subsidy levels and more defined funding amounts will be determined in the next phase of the project.

3) For the purpose of discussing different implementation scenarios with respect to capital funding needs and percentage of the 32-island population that would receive renewables, an implementation scenario was presented in the financial model and is presented below as Table 14.4.1. The corresponding data file is contained in Appendix 14.3.1.

Table 14.4.1 – Implementation Scenarios – Capital Cost and Percent Population

Municipalities	Total Number of Customers (Note 1)	Percent of Population (Note 1)	Assumed e7 Investment, $ (Note 2)	Total Capital Investment Required, $
Castro	435	12	284,715	2,290,001
Castro + Quemchi	1,063	29	723,107	5,816,049
Castro + Quemchi + Quinchao	2,378	65	1,548,336	12,453,477
Castro + Quemchi + Quinchao + Calbuco	3,144	86	1,919,191	15,436,318
Castro + Quemchi + Quinchao + Calbuco + Quellón	3,455	94	2,145,104	17,253,367
Total 8 Municipalities	3,676	100	2,416,781	19,438,504

Note 1 – Based on 32 islands, not 36 islands.

Note 2 – Assumes REP 70% Capital Subsidy. Includes Investment and working capital requirements.

14.5 COMPARISON OF WIND-DIESEL HYBRID AND DIESEL-ONLY ON TARIFF RATE

1) For reference purposes, GTD performed a high level comparison of Capital and O&M costs for wind-diesel hybrid and diesel-only solutions to determine the relative impact these two systems have the estimated tariff rate. As presented in Table 14.5.1 below, in all cases when applied on a municipal wide basis, the projected tariff for the wind-diesel hybrid solution was lower than for the diesel-only generation solution. The primary reason for the wind-diesel hybrid having the lower tariff is the high cost of fuel and fuel transport to the islands. Even though the capital costs for the wind diesel hybrid are higher, it appears to be a better economic solution for the island residents.

Table 14.5.1 – Comparison of Wind-Diesel Hybrid and Diesel-Only solutions on Tariff Rate

Municipalities	Bill wind turbine/ Bill 100% diesel	Funding wind turbine/ Bill 100% diesel
Calbuco	*93%*	*111%*
Castro	*82%*	*134%*
Quellón	*91%*	*111%*
Quemchi	*66%*	*114%*
Quinchao	*86%*	*114%*

15.0 TARIFF STRUCTURE (TASK 12)

15.1 APPROACH

1) Based on information provided by SAESA for rural electrification systems, specifically Tac Island, the detailed financial models, Appendix 14.2.1, a blended tariff rate was assumed with a fixed monthly component of $7.78 for all users plus an energy charge for the actual power consumed. The detailed financial model calculated the resultant variable energy charge ($/kW-hr) based on the required investment, assumed subsidy level, operating costs, and requirement to keep the cash "on-hand" positive at all times.

2) The detailed financial model assumed a constant price of energy ($ / kW-hr) throughout the year. SAESA indicated that it was common practice to often employ a two-step consumption tariff where high consumption users (high-income) paid a progressively higher tariff when a high monthly threshold of consumption was reached. The financial modeling in this Pre-Feasibility Study did not determine tariff estimates in this manner. The team assumed this level of detail was not required for the Pre-Feasibility phase but would be investigated at a later phase of project development.

3) As mentioned above, the starting point of the financial model assumed tariff levels identified by SAESA for Tac Island. The fixed component was reported to be $7.78 per month plus a variable energy charge of $0.33/ kW-hr. During a meeting in July 2004 in Santiago with Region X representatives attending, government officials indicated their data indicated that the Tac tariff rates were higher than those reported by SAESA. This discrepancy should be investigated at a later phase of the project development now; it is not critical now as it would imply that the project is achieving lower tariff rates than the comparable Tac Island project.

15.2 SUMMARY OF RESULTS

1) Estimated tariff rates for each island are contained in Appendix 14.2.1 with average monthly electric bills indicated for low, middle, and high-income users.

15.3 LEVELIZED TARIFF DESIRED

1) As can be seen when reviewing the projected tariff estimated contained in Appendix 14.2.1, tariffs and associated monthly bills can vary widely for each island. In general, monthly costs for small islands with fewer users are higher since fixed costs and operating costs are shared by fewer customers.

2) Within the context of the Chilean REP, the subsidy process is implemented in conjunction with a Municipality. Therefore, for political, logistical, and reasons of overall economy, it is practical to assume that the projects would at least be implemented on a Municipality basis, with cross-tariff within the islands of the municipality. This would appear to be a reasonable level for an implementation strategy given the subsidy process, geography of the islands, economy of scale for administrating a group of islands, and complexity to implement and contract for several islands simultaneously. This cross-municipality implementation approach is reflected in Table 14.3.1 above. (If this implementation approach is considered, study is required for the fuel delivery routes assumed in the Pre-Feasibility Study as some routes have deliveries assumed to two municipalities. This could change O&M cost assumptions).

3) A cross-tariff between all of the 32 islands identified in this study is being considered by CNE and Region X to develop a more uniform subsidy rate between all of the islands, creating one big project. While this approach has merit in providing a levelized tariff, it does pose challenges considering the ability to manage and implement 32 islands in one project, with one Contractor designated to receive the contractor and build the project at a competitive fixed cost.

16.0 IMPLEMENTATION PLAN PROPOSED

16.1 RURAL ELECTRIFICATION PROGRAM REQUIREMENTS

1) CNE has advised that since the project will consist of isolated rural systems, a condition of the IDB financing is that they project Owner/Operator must be selected by competitive bid.

2) The project team recommended that the e7 Fund remain "bidder neutral" and not be involved in a bidding process for the project. There are several firms in Chile who have expressed interest in the project and would likely submit a bid for the development of the project.

16.2 PARTICIPATION OF SAESA

1) SAESA has contributed to this Pre-Feasibility Study by providing general support and specific information related to grid design and costs. SAESA had consistently said throughout the project that it will support the study but reserved judgment on its participation in implementation based on the final financial indications of the study.

2) SAESA has expressed to CNE, Region X, and the e7 project team that its conclusion is that diesel-only generation systems provide the best overall solution for Chile and rural electrification. SEASA indicated that the diesel solution increases the penetration of rural electrification due to the lower capital cost and is a lower commercial and technical risk solution.

3) In light of the fact that the project will be competitively bid and that SAESA is not an advocate for renewables for this project, it was decided that the potential joint venture arrangement originally considered at the start of the study would no longer be pursued.

16.3 ROLE OF E7 FUND PROPOSED

1) The role of the e7 Fund for the next phases of the project was proposed as follows:

a) Providing continued Development Support:

- Continued e7 member technical expertise to further assist in project assessment and final studies.
- E7 Project Management support with scheduling of project implementation.
- Making GTD available to further update cost and financial models to reflect implementation plan to be developed by CNE and Region X. GTD also agreed they could incorporate elements of the required social and financial NPV assessments into the financial model.
- Assist with planning and follow-on wind monitoring program.
- Assist with preparation of technical requirements of the bid documents and selection criteria such that renewables would have a role in the project.

2) It was proposed that the e7 involvement in project implementation not consider the establishment of a formal Joint Venture Company with Chilean Owners/ Operators of the rural systems. As discussed in Section 14 herein, Chilean law would allow project economics to be favorably improved if the project Owner had a Chilean tax liabilities and could benefit from VAT tax recovery and accelerated depreciation. A JV Company involving the e7 Fund and might not be able take use the VAT recovery and accelerated depreciation tools, leading to higher tariff rates for the residents.

3) Given the proposed competitive bid structure that would be applied for the Owner / Operator, and the e7 position that it would not enter into a competitive bidding process, CNE asked how could e7 possibly participate financially in the project implementation. The e7 project team suggested that it could explore the concept of "Renewable System Incentive Financing" similar to that shared with CNE in Appendix 16.3.1. In concept, it was proposed that if the terms of this incentive financing (loan) could be agreed upon between CNE and e7 Fund, the incentive financing could be included in the project tender documents as being available to all qualified bidders:

a) Conditions of the incentive financing could be:

- Favorable terms – low interest with a 3-year grace period.
- Terms could allow e7 to mitigate commercial risk associated with wind energy – 20 year payback but longer if problems with wind resource occurs.
- E7 could assist with promoting sales of "excess" wind energy to commercial users, such as salmon producers. This could be done at low incremental cost and high profit. Additional profits could be shared and directed at early repayment of e7 loan.
- Amount of e7 incentive funding could be tied to level of renewable penetration proposed by the vendor. Higher renewable content and islands served could receive greater e7 funding.

b) Incentive financing would be contingent upon proper environmental and social screening as well as the e7 Project Manager serving in oversight/due diligence role

Details of the proposed "Renewable System Incentive Financing" were not discussed in further detail with CNE, nor was the approach submitted to e7 Management for approval. The concept is discussed here to record an approach where financial incentives could be provided for deeper renewable penetration and to help reduce commercial risk to

the renewable energy project developer.

16.4 IMPLEMENTATION PLAN PROPOSED

1) Based on the results of the Pre-feasibility technical and financial studies, CNE is working with Region X to formulate an implementation sequence that accounts for the technical, financial, and political considerations of the project.

2) CNE and Region X have some constraints they need to consider in developing the implementation plan and sequence:

a) To reduce commercial risk, it is highly desirable to install wind turbines only after an on-island measurement campaign (preferably on-site campaign) has been conducted to verify the wind resource and / or EDF wind map forecasts. Some islands had wind monitoring systems installed for the wind measuring campaign; some of these wind-measuring towers are now being relocated. New wind measuring systems will need to be installed.

b) The REP subsidy process requires fairly detailed engineering drawings to be developed as part of the subsidy approval process. CNE will proceed with more detailed studies for wind diesel hybrid systems and other alternatives.

c) To perform the detailed engineering studies noted above, sites for the wind turbine, substation, and diesel generating systems will need to be located and agreement reached with land owners. This will take time, especially since the technical studies recommended that locating the diesels near the more populated harbor facilities was suggested to ease fuel transport.

d) There could be a desire by CNE to proceed on the bigger islands first as these are more cost effective and a higher portion of the archipelago population would receive electrical service. E7 has questioned if this approach ("Cherry-picking") may make it difficult to implement smaller island systems later, given their more unfavorable economics. Since there is some desire to levelize the tariff within a municipality, if not the whole archipelago, the implementation plan will need to factor in the constraints of the competitive bid process.

e) The Chile islands are remote and logistics are an important consideration. For construction efficiency, it was assumed that nearby islands would be constructed in sequence. Likewise, for economy of fuel transport and system operation, it was assumed that nearby islands would be clustered for best operating efficiency. These logistical challenges need to be factored into the implementation plan.

f) A final consideration to mention is that the proposed build-out for all 32 islands with wind-diesel hybrid systems was estimated at $ 13.3 million subsidy funding, while only $8 million has been currently set aside. CNE will need to balance the increased capital cost of the wind-diesel hybrid systems against diesel only systems (or other alternates) while seeking additional funding sources, to ensure the electrification of the overall archipelago.

3) Based on the constraints identified above, it is expected that it may take several months for CNE to finalize the overall implementation strategy and island sequence.

17.0 RISK ASSESSMENT

1) The Chilean Rural Electrification Program and CNE staff provide a solid foundation and basis for project implementation. Also, Chile has companies with the technical and management ability to build and manage the proposed wind diesel hybrid systems. Therefore the e7 team considers that institutional or Human Capacity Building issues frequently encountered in other projects are not significant concerns for this project.

2) Considering the mandate from the Chilean Government and commitment from the President to promote rural electrification with defined targets and funding, it can be seen that there is strong support for this type of project in Chile. Furthermore, the fact that $US 8 MM has been especially assigned for the Chiloe Project rural subsidy with an emphasis on including renewables indicates that there is a likelihood of some portion of the project moving forward. Given the strong support from CNE and Region X, the Chilean REP subsidy process, and based on technical and financial studies performed to date, the good wind resource, and no "red flags, it would appear likely that the project should move forward. The remaining question is not "if" wind renewables should be considered for the project, but how many islands can it be implemented on given capital funding constraints. Government officials indicated that wind-diesel hybrid systems must be a significant part of the Chiloe Island project.

3) At this Pre-Feasibility Stage of the project, the following areas should be monitored in the future to minimize risk to the

project success:

a) Lessons Learned from Tac Island – A detailed investigation should be conducted assessing the first five (5) years of operation of the Tac Island system so that applicable "lessons learned" can be applied to these follow-on projects.

b) Cost Risk – The capital cost estimates are assumed to be accurate within +/- 25%. These cost estimates need to be improved during the next phases of the project. Exact locations of the wind and diesel components need to be identified and agreements reached with local landowners. Fixed-price, turnkey, Engineering/Procurement/Construction (EPC) proposals should be obtained before final approval for the project is given.

c) Schedule Risk – Ability to implement 32 islands in one project in a fast implementation schedule, in a cost efficient manner, is questionable. Project should be divided into more manageable components.

d) Logistical Risk – The success of the project will be somewhat related to managing the logistical challenges to ensure efficient procurement and construction of the island projects. "Group " purchases of materials to obtain best pricing, and a sequenced approach to construction must be managed to reduce construction costs. Effective project planning, management, and project controls will be required.

e) CNE REP Subsidy Process – Processing the 32 islands, from eight municipalities, through the subsidy process will be challenging. Consideration should be given for dividing the project into manageable components.

f) Wind Resource – To reduce financial and technical risk, wind resources should be verified with continued monitoring. Relocation of some of the current wind monitoring systems to other locations to verify the EDF wind model is prudent. Installation of additional wind measuring devices where wind turbines are to be located is advisable. Use of simple, inexpensive single monitors would be beneficial and expedient.

g) E7 Due Diligence – Recommend that e7 experts stay involved to provide technical oversight and project management oversight of wind-diesel hybrid project implementation to ensure developer / contractor stays on course. (IDB may also require due diligence monitoring). Contractor progress payments should be based on verifiable project milestones related to engineering, procurement, construction, and commissioning.

h) Environmental – No "red flags" have been raised, but e7 could assist in a more detailed environmental screening for the islands where we will be associated in the implementation. To ensure systems are built and operated in accordance with recognized environmental practices, Environmental Management Plans should be required for all island systems.

i) IDB Loan Conditions – e7 has requested but not received a copy of the terms of the IDB loan. This should be reviewed by e7 prior to project implementation.

j) Salmon Farmers – Pursue sale of wind energy to Salmon Farmers as this can have significant economic benefit to the project and greatly reduce project financial risk.

k) E7 Role – With respect to e7's Mission promoting sustainable development, remain engaged in the project and continue to provide technical and project management expertise and consider financial incentives to promote the maximum sustainable deployment of wind generation systems.

18.0 RECOMMENDATIONS & NEXT STEPS

18.1 GENERAL FINDINGS

1) The e7 project team has conducted an in-depth Pre-Feasibility Study. The following general findings can be stated:

a) The Chilean REP program provides strong institutional and financial support for the electrification of the Chiloe Islands.

b) CNE, Region X, and UNDP staff provide technically competent support to the Project and will take an active role in the Project Implementation under the REP subsidy program.

c) The Chilean government has dedicated approximately $8 million to the Chiloe Project with emphasis on including renewable energy systems in the Project.

d) The technical and financial studies have indicated that installation of wind-diesel hybrid systems is viable, sustainable, and the cost-effective solution.

e) Preliminary indications are that a large percentage of the islands will have the willingness and ability to pay the tariff. Coverage of more islands is possible if where a single tariff is adopted on a Municipal (or larger regional basis).

f) No "red flags" or project stoppers have been identified.

g) Studies have shown that the region has a good wind resource.

h) E7 funding for the Project could be highly leveraged in that 70% of the capital could be from the Chilean RFP subsidy, 10% of the funding will come from the Municipality, at least 20% of the capital funding will come from the project Owner/Operator.

i) CNE has advised that the Project Owner/Operator role will be open to a competitive bid process due to the IDB funding requirements.

j) E7 should not consider a formal Joint Venture partnership for the Project as there will be a competitive bid process and that certain tax treatments involved in the project could substantially improve project economics, but these could only be fully realized by an Owner with Chilean tax liabilities.

k) It is believed that due to the depth of the Pre-Feasibility Study conducted, the Feasibility Phase of the project will require less resources and can move quickly to implementation

l) At least some percentage of the islands could receive wind-diesel hybrid systems. The question is how much renewable (wind) penetration into the 32 islands can be achieved and how quickly.

m) In sharing its preliminary draft of the Pre-feasibility Study with CNE and UNDP, the e7 Fund had proposed a future role in the project involving continued pro bono technical expertise, development, and funding for renewable energy based systems.

18.2 NEXT STEPS

1) After the conclusion of the Pre-Feasibility Phase, CNE advised that it was initiating further studies for electrification of the Chiloe Islands.

2) CNE indicated that it was undertaking the following next steps with respect to electrification of the Chiloe Islands.

a) A preliminary analysis of the alternative of supplying electricity via underwater cable to the islands was conducted. From the standpoint of the level of investment, CNE has indicated that an underwater cable connection to the Central Interconnected System (SIC) is a viable economic alternative for approximately twenty-one (21) of the Chiloe Islands. A Feasibility Study for supplying Guar Island with submarine cable was on-going in December 2004. Similar Feasibility Studies were proposed for supplying the remaining twenty (20) islands via submarine cable from the SIC, with the following configurations:

- Subsystem 1: Quehui, Chelín, Chaulinec, Alao y Apiao.
- Subsystem 2: Cailin, Laitec y Coldita.
- Subsystem 3: Mechuque, Añihue, Taucolón, Cheniao, Butachauques y Aulín.
- Subsystem 4: Lin-Lin, Llingua, Quenac, Meulin y Caguache.
- Subsystem 5: Guar.
- Subsystem 6: Queullin.

b) Two (2) islands (Tranqui and Caucahue) included in the study were being analyzed for aerial connectors. It was anticipated that these projects would be executed in the short term (2005/2006).

c) For the remaining twelve (12) Chiloe islands (Tabón, Acuy, Chaullin, Chuit, Chulin, Imerquiña, Llanchid, Nayahue, Auteni, Quenu, Talcan y Teuquelin), CNE advised the best alternative is to generate electricity within the islands (not connected via cable). Based on this, CNE was planning to initiate the corresponding detailed engineering studies early next year, with the exception of one island, that is scheduled for this year. These studies were to be financed by the GEF project. Wind-diesel hybrid solutions will be included in the study.

d) One (1) island (Llancahue) continues to be proposed with a micro-hydro solution.

3) CNE has restated that it is important to consider that in Chile, funding for rural electrification projects with self generating systems (isolated systems) is only possible after a detailed engineering study is done. This is a pre-condition for fund allocation. Moreover, the project must have a positive social evaluation, using the Ministry of Planning ad-hoc methodology. Further studies need to be undertaken before project execution is possible.

18.3 RECOMMENDATIONS

1) The e7 Fund undertook the Pre-Feasibility Study to develop a "roadmap" for providing rural electrification to the Chiloe islands with renewable systems. The findings of the Pre-Feasibility Study have indicated that installation of wind-diesel hybrid systems is viable, sustainable, and a cost-effective solution.

2) CNE and Region X Representatives are working to determine the implementation strategies and technologies to be used based on the follow-on studies, constraints of the IDB financing, and requirements of the Chilean Rural Electrification Program. At this time, the e7 will await the results of follow-on studies and proposals from CNE before considering a future e7 role in the Chiloe Project related to renewable energy systems.

3) The e7 Fund Chiloe Project MOU signed with CNE and UNDP expired in September 2004. The Pre-Feasibility Study discussed in the MOU has been completed and results shared with CNE and UNDP. It is recommended that the MOU not be extended in its current form. If e7 has a future role in the project, a new MOU will be needed focused more on implementation strategy.