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Leningrad Wind Power Plant Feasibility Study

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TABLE OF CONTENTS

Letter from the Russian Federation Energy Commissioner, December 2002
Letter from the Leningrad Oblast Government, March 2003

1.3. Market Survey and Power Customer Acquisition
Marketing Sample Letter
Sample Questionnaire
Sample Results from Survey of Large Industrial Energy Consumers
Issues Raised by Companies Included in the Survey
Project Implementation Process Plan

1.4. Seminar on Wind Power held 22 May 2002
Agenda and Key Speakers
List of Seminar Attendees
Presentation Material of American Company Participants

1.5. Economic Analysis and Project Proformas
Wind Resource Assessment
Power Plant Business Economic Model
Assumptions Used in the Preliminary Financial Analysis
Preliminary Results of Analysis

1.6. Environmental Assessment
Summary of New Russian Environmental Laws and Regulations
Procedures for Environmental Assessment for Wind Power Plant Projects
Terms of Reference for Conducting and Environmental Assessment

1.7. Technical Paper on “Operational Constraints and Economic Benefits of Wind-Hydro Integration in the United States and Russia,” to be presented at the European Wind Energy Conference in Madrid, Spain, 16-19 June 2003.

APPENDIX - II: **[Proprietary and Confidential]**

2.1. Preliminary Project Siting Report
2.2. Wind Resource Assessment and Results
2.3. Weather Service Wind Data Report
2.4. Detailed Site Layout (3 Sites)
2.5. Preliminary Wind Speed Analysis, Preliminary Micro-Siting and Preliminary Energy Estimates
2.6. Assumptions Matrix and Sample Economic Model Results and Cash Flow Analysis
2.7. Preliminary Project Proformas
2.8. Letters of Intent on Power Purchase Agreement
2.9. Oblast Tax Credit Legislation and Supporting Rationale
2.10. International Energy Academy Grid Connection Report
2.11. Technical University Ornithological Report

Leningrad Wind Power Plant
Feasibility Study

1. INTRODUCTION

ABB is very pleased to present this Feasibility Study Report to TDA on a proposed utility scale wind power plant in the Leningrad Region of Russia. The Study has been completed within the time frame laid out in the initial proposal to TDA and with all the various activities as delineated in the proposed Terms of Reference.

The grant was provided by TDA in November 2001. At that time, planning sessions of all the participants were held in St. Petersburg. All steps necessary on the American and Russian sides to undertake the various aspects of the Feasibility Study were laid out, agreed upon, and put in place within two months. Data collection and major activities of various kinds began in February of 2002. All aspects of the Feasibility Study were completed by March 2003.

Wind energy is the fastest growing energy source. By the end of 2002, the installed capacity of wind turbines worldwide totaled over 31,000 megawatts (MW) and an additional 28% was added in 2002. However, nearly 90% of these installations are in Europe and the United States. Wind power plants installed in Russia total less than 10 MW despite the vast wind resources in many parts of the country.

Before beginning this project Feasibility Study it was determined that Russia, in particular the Leningrad Oblast, has tremendous wind resources that are suitable for energy production. Renewable energy resources, including wind, have been assessed and mapped throughout the Russian Federation.[1] Wind resources in Russia are shown in Figure 1. Sites are considered potentially suitable for wind power plants if the average annual wind speed is greater than 5.5 meters per second (m/s) at the standard measurement height at 50 m above the ground, the level of the rotor on a typical wind turbine. These sites have an energy density of 200 watts per square meter (W/m^2). Additional examination of the wind resources in the Leningrad Oblast indicated that there were potentially good wind resources in the vicinity of Saint Petersburg, an area where the demand for electricity is growing and there is progressive interest and support for business innovation.

[1] Bezrukikh, Pavel, "Resources and Efficiency of the Use of Renewable Sources of Energy in Russia," ISBN 5-02-024971-8, May 2002.

2. PROJECT DESCRIPTION

As approved by TDA, the purpose of the grant to Lidesm, with ABB as contractor to Lidesm, was to undertake a Feasibility Study to develop a 75 MW wind power plant in Northwest Russia. Considerable advance analysis of the Russian power market, its changing structure, growing power demand in the Leningrad Oblast, available data on the wind regime in various sites within the Leningrad Oblast, identification of experienced and knowledgeable Russian partners to assist in the Feasibility Study, and a strong, experienced support team-- had all led ABB to view the project as potentially a major opportunity to enter the wind power market in Russia. The estimated cost of building such a project was approximately $100 million.

At that time, ABB expressed interest in investing in and participating in the ownership structure of the proposed project, should the project outcomes be favorable and economically viable. ABB was also interested in acting as project developer. However, ABB and other participants in the Feasibility Study experienced significant changes that are detailed in Section 3.

Figure 1. Wind Resource Map of the Russian Federation[2]

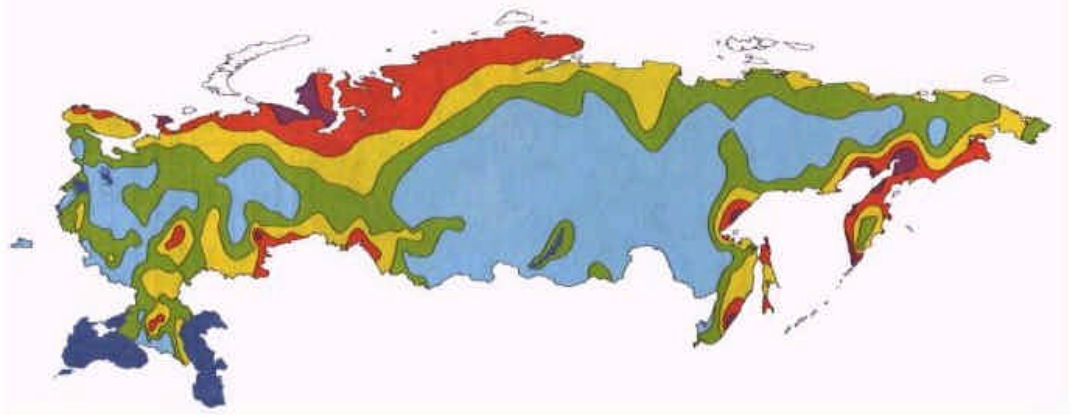


Figure: Wind resources at the hight of 50 m above ground level for five different topographic conditions.

	Sheltered terrain		Open terrain		Sea coast		Open sea		Hills and ridges	
	m/s	W/m²	m/s	W/m²	m/s	W/m²	m/s	W/m²	m/s	W/m²
	>6,0	>250	>7,5	>500	>8,5	>700	>9,0	>800	>11,5	>1800
	5,0 – 6,0	150 - 250	6,5 – 7,5	300 - 500	7,0 – 8,5	400 - 700	8,0 – 9,0	600 - 800	10 – 11,5	1200 - 1800
	4,5 – 5,0	100 - 150	5,5 – 6,5	200 - 300	6,0 – 7,0	250 - 400	7,0 – 8,0	400 - 600	8,5 – 10,0	700 – 1200
	3,5 – 4,5	50 - 100	4,5 – 5,5	100 - 200	5,0 – 6,0	150 - 250	5,5 – 7,0	200 - 400	7,0 – 8,5	400 – 700
	<3,5	<50	<4,5	<100	<5,0	<150	<5,5	<200	<7,0	<400

[2] Source: http://www.winddata.com/, supported by EU Joule project JOR3-CT95-0061, 1996- 1998 and the International Energy Agency Wind Energy Agreement, Annex XVII with 6 participating countries: Sweden, Norway, The Netherlands, Denmark, Japan and United States.

3. PARTICIPANTS

3.1. Contractor

ABB Inc., designated as the Contractor by TDA, assembled a team of Russian and American, as well as European, companies and participants with the capabilities, knowledge and experiences uniquely suited to fulfill all aspects of the Feasibility Study. The quality of the participants, the seriousness of their efforts, and the commitment they have demonstrated to fulfilling the goals and tasks of the Feasibility Study help provide the necessary credibility to the conclusions reached in the Study.

The roles and relationships of the participants are shown in Figure 2. In addition, Appendix 1.1 provides detailed information on each of the companies involved and CV's for the leading individual participants. This section provides general information on the team and significant changes in the makeup and intentions of the team members, which have occurred during the course of the Feasibility Study. These changes do not impact adversely on the potential feasibility of the planned power plant, and, in fact, may strengthen the likelihood of the project going forward.

ABB is a global engineering and technology group dealing in power technologies, automation technologies, project management services and contracting, and financial services. ABB is a leading global component manufacturer for the wind energy sector and has been a principal supplier of generators, cabling, and other electrical equipment for utility-scale wind plants. ABB Wind Power was a business unit of ABB Group with local organizations and operations in the United States, as well as a number of European countries. US operations are headquartered in Raleigh, NC, where the focus has been on development, engineering, design, and construction of wind power plants throughout the country. ABB was also providing financing for wind projects on multiple continents through its Financial Services Division.

ABB brought in as a supporting participant to the Feasibility Study, Enron Wind Corporation, a subsidiary of Enron Corporation. Headquartered in Tehachapi, California, Enron Wind was the leading designer, manufacturer, and owner of utility scale wind turbines in the United States. Enron wind turbines employ many ABB electric power and control systems components and the firm assisted ABB on technical and business issues during the first part of the Study.

3.2. Grantee

On the Russian side, the Grantee and sponsor of the project is Lidesm ZAO, a closed joint stock company, established in St. Petersburg in 1989. The company specializes in design and engineering in the fields of civil and industrial constructions, primarily of energy projects. Lidesm has participated or led in construction or renovation of major power facilities in both the Leningrad Oblast and throughout Russia.

3.3. Changes in Participant Roles

Two significant changes in regard to company participation and anticipated roles have occurred since the Feasibility Study was undertaken. These changes occurred for reasons having nothing to do with the actual conducting of the Feasibility Study and are entirely due to corporate re-structuring or changes in corporate policy and capabilities.

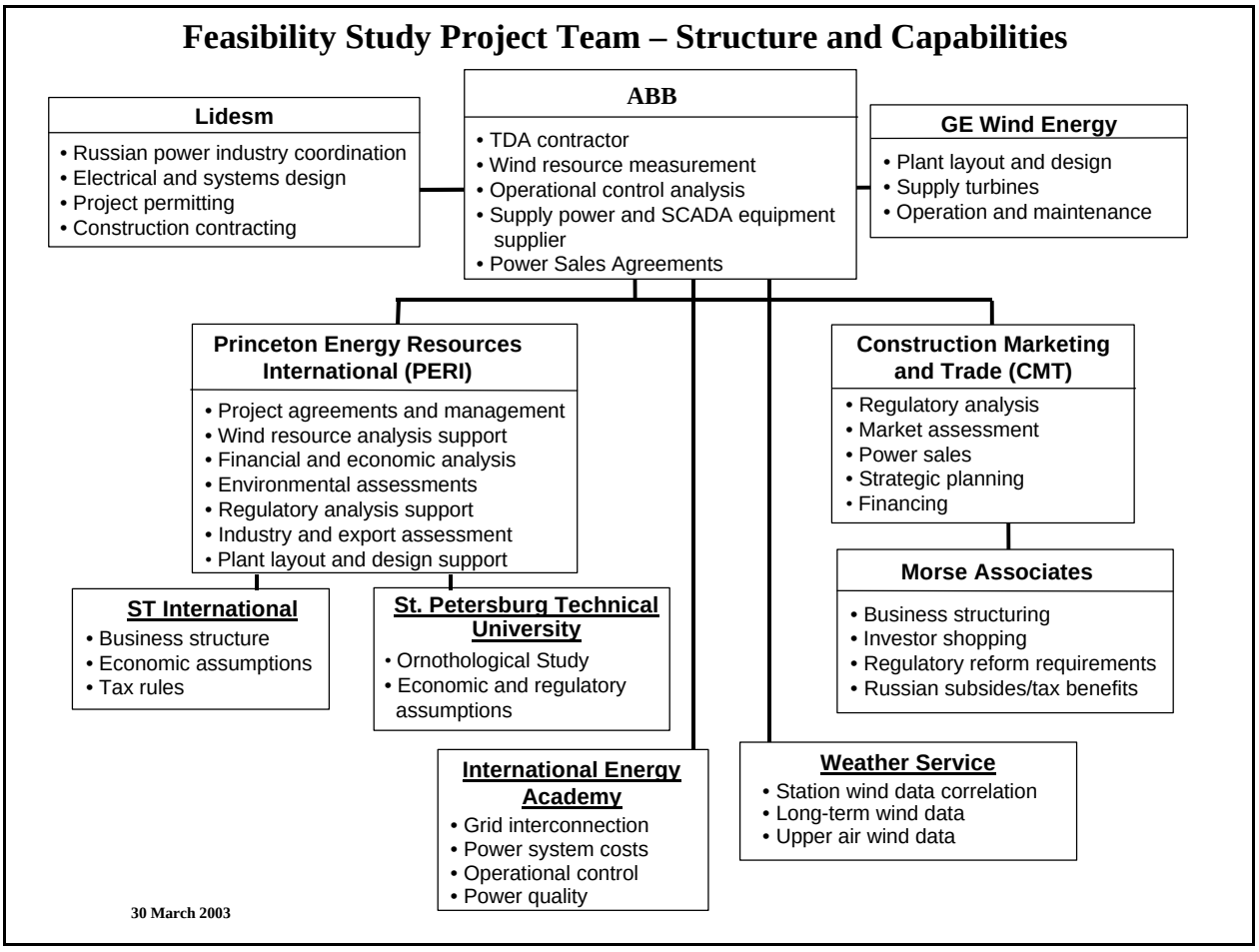


Figure 2. Feasibility Study Project Team – Structure and Capabilities

GE Wind Energy
The first significant change that occurred early on during the Feasibility Study was that General Electric purchased the Enron Wind capabilities and operations and formed GE Wind Energy. ABB then brought GE Wind into the Feasibility Study team. GE Wind Energy then assumed and fulfilled the technical and other aspects defined in the study for execution by an American turbine manufacturer of worldwide experience and capability. GE Wind's participation in the Feasibility Study in support of ABB's goals has been substantial.

Developer/Investor Shift
The second significant change was as a result of restructuring in ABB for financial and other reasons that caused the company to shift in priorities and sell certain assets.These changes included the sale of the major elements of the Financial Services Division and an exit from the project development activities in the renewable energy industry. ABB thus found itself no longer able to commit to the roles of project developer or investor on the projected wind power plant.

Developer: GE Wind Energy
The Feasibility Study team then worked to support ABB in seeking replacements as investor and as developer. Because the outcomes of the Feasibility Study were deemed generally positive and because GE Wind through its participation throughout the Study had a clear knowledge of the project in all its various aspect, GE Wind is expected to replace ABB as planned project developer.

Investor: General Electric Capital Corporation
General Electric Capital Corporation has replaced ABB as investor and will be responsible for arranging the financing of the project. Appendix 1.2 includes a letter from GE Capital to this effect.

Sales of American Equipment and Services
It is anticipated that, as planned previously, both GE Wind and ABB will also be involved in the implementation of the project as suppliers of equipment and services.

3.4. American Team

Throughout the Feasibility Study, ABB has been supported, by a team of three US consulting firms, each of which brings special skills, experience and background in renewable energy and Russia to the undertaking of the Feasibility Study.

Princeton Energy Resources International LLC (PERI) a professional consulting firm established in 1980 and headquartered in Rockville, Md. supplies engineering, economic, environmental and management services to a wide range of public and private clients on power projects. PERI has a long record of participation and expertise on a wide range of renewable energy projects, especially on wind projects, and on fossil-fueled power plants. PERI performed all the financial, economic and environmental analysis for the project. PERI also assisted ABB directly by serving as Project Manager for the Feasibility Study and coordinating all sub contractors.

CMT Consulting, formerly Construction Marketing and Trading, Inc. established in 1987, with offices in Washington and Moscow, has been assisting major US companies and government entities in the energy and construction fields to enter and develop new projects and renovate existing facilities in the Russian market. CMT has a long record of successful projects in Russia. CMT is responsible for conducting the Market, Financial, and Customer Assessments of the Feasibility Study and for identification of institutional and regulatory issues.

Morse Associates, Inc. (MAI), a Washington based consulting firm, is advising and supporting development of large-scale public and private projects in energy and environment, with emphasis on renewable energy technologies. MAI acted as sub-contractor to CMT, providing support and expertise on business, market and financial issues.

3.5. Russian Subcontractors

Several Russian sub-contractors located in the Leningrad Oblast have participated and contributed significantly in the execution of the Feasibility Study on technical matters and business and economic related issues. These firms are the following

International Energy Academy (IEA) is a private company with a branch located in Saint Petersburg that does electric power systems planning and analysis for the regional electricity generation, transmission and distribution companies. IEA also does project and power system studies, economic analysis and cost estimates for regional governmental authorities. IEA completed a detailed power system connection and operational integration study on alternative project sites for ABB.

ST International (ST Inter), a Russian-German business, management and financial consulting firm, operating in Saint Petersburg since 1992, is in the authorized consulting structure of the Leningrad Oblast government, a status achieved through international competition. For the wind plant study, ST Inter provided valuable input on business and financial assumptions and taxes in the Oblast and the Russian Federation, as well as other significant issues, used to form the assumptions underlying the Business Plan proformas. ST Inter also reviewed and provided analysis of the team's financial projections. In addition, the firm helped in a coordinating role with the Oblast government.

Leningrad Regional Center for Hydrometeorology and Environmental Monitoring, a Russian Federation State Agency, often called the Weather Service. The Center was established in 1991 and is the official representative of Rosgidromet of Russia in the Leningrad Region. A Limited Liability Company (OOO) Rosinvest, served as contracting agent for the Weather Service on this project. Under a contract with ABB, the Weather Service prepared long-term wind resource data for comparison with the detailed records from the three candidate sites. Weather service records during the intensive wind measure campaign were correlated to records from the past 25 years. Surface winds as well as winds aloft were analyzed.

4. OUTCOMES

We are pleased to report that the outcome of the study is generally positive and that those involved in the study, including the principal US and Russian companies, our consultant study team of specialists, and the various levels of government officials, believe that the technical and financial feasibility of the proposed project has been demonstrated. The conclusion that the project is economically viable has been demonstrated satisfactorily to the Russian authorities and to the financial community. Financial and tax incentives needed for economic viability are planned and are in the process of being implemented in time for this initial project, and scenarios were developed showing that wind energy can provide a low cost source of clean energy in the long term without the need for subsidies for many different applications in Russia. Next steps to go forward with implementing the project are already underway with construction completion and initial operations planned for 2004.

The positive outcomes of the Feasibility Study are the following:

1. One of the potential sites studied in the Leningrad Oblast throughout the year-long Feasibility Study in terms of wind data and market characteristics has been selected as a feasible site for the planned 75 MW Wind Power Plant.

2. Two major Russian companies in the oil industry, operating within the Leningrad Oblast near the site selected have committed to signing long-term Power Purchase Agreements. Letters of Intent to sign these agreements are being executed**.** These companies have financial credibility with the international financing community.

3. An independent wind power company, licensed to supply power in the Leningrad Oblast, has been established and registered in the Leningrad Oblast. This company will act as developer in concert with the turnkey developer and supplier of wind turbines and other equipment.

4. GE Wind Energy, one of the major participants in the TDA Feasibility Study is being looked at to develop the project for the Leningrad Wind Power Company.

5. General Electric Capital Corporation has taken over from ABB the role of investor and the responsibility for obtaining financing necessary for the wind power plant.

6. The Leningrad Oblast Government has agreed to introduce legislation providing for an industrial users tax credit for wind power. This initiative will assist in the feasibility of this first utility-scale wind power plant. This legislation will also act as an incentive for the development of future wind power projects in the Oblast.

7. The Leningrad Oblast Government has agreed to provide certain tax breaks as incentives to support the project and encourage foreign investment in the Oblast.

8. The Regional Energy Commission and Leningrad Oblast government have agreed to work with the project team to facilitate the interconnection and operation of the wind plant with Lenenergo.

9. European Bank for Reconstruction and Development (EBRD) has expressed its strong interest in working with GE Capital Corporation on financing the project.

10. The Global Environmental Facility (GEF) has agreed to provide a grant for a Medium Sized Project (MSP), under the auspices of EBRD, which will allow the project team to develop the legal and regulatory framework for wind power in the Leningrad Oblast. This GEF grant, which is aimed at replication of the first wind power plant, will allow the team to undertake all the steps necessary to bring the project to implementation.

11. The institutional and regulatory steps to implement the project have been laid out and are anticipated to begin in the third quarter of 2003 and to be accomplished within six to nine months.

12. Nordic Environmental Finance Corporation (NEFCO), based in Helsinki, Finland, has indicated strong support for the project and agreed to take an equity position.

13. There is interest from local manufacturing firms in building wind turbine components. Wind equipment manufacturing in joint ventures with American firms could begin as a result of this project.

5. ACCOMPLISHMENTS ON STUDY TASKS

The major Tasks identified in the Terms of Reference submitted in the proposal to TDA have all been accomplished. These include the following:

Task 1 - Wind Resource Assessment
Six potential sites in different regions in the Leningrad Oblast were evaluated. Three of these were selected for detailed study. Selection of these three sites were based on wind characteristics; growing power demand in the regions; and presence of strong, financially suitable industrial consumers as potential customers, local governmental support, land availability and environmental considerations. Multi-level digital high resolution meteorological stations were placed in these three sites in the Leningrad Region in early 2002, and wind data was collected at heights from 30 to 70 meters above the ground and analyzed for a year. Data has been correlated with long-term wind records from the Weather Service and other sources, as well. Additional data on wind resources and the wind assessment methodology is included in Appendix II. Detailed results for the assessments at the specific sites considered in the study are included in Appendix 2.2. Because of the substantial Feasibility Study project cost-sharing by the commercial participants, the results of the detailed wind evaluation at the selected sites are considered proprietary and confidential.

Task 2 - Plant Preliminary Design
GE Wind Energy project team completed engineering studies and detailed plant construction and operational cost estimates that were used to evaluate the potential for possible project development on each site under consideration. The GE Wind Energy 1.5SL was selected as the best turbine for the wind and site conditions. GE used topographic and other site data to determine the preliminary turbine placement designs, along with the intra plant power system, substations, wiring and System Control and Data Acquisition (SCADA) systems. Engineering cost estimates were completed, based on these three preliminary plant designs and related experience with wind and other power plant projects. Cost estimates were compared to existing project cost information in a proprietary database at PERI that includes other manufacturers' equipment.

Energy production estimates were made and refined based on the actual wind measurements, long-term Russian Weather Service data from stations near the sites and from stations throughout the nearby Nordic region. This wind data is used to estimate turbine performance characteristics and the interaction and wake effects from adjacent machines. Wind measurements are continuing at the selected site to insure the best possible estimates of energy production needed for final financial projections.

Procedures and typical results are described in Appendix 2.1. The detailed results of the actual site design studies are included in Appendix 2.4. Because of the substantial Feasibility Study project cost sharing by the commercial participants, the results of the detailed siting analysis are considered proprietary and confidential.

Task 3 - Electrical Systems Design
ABB, through a sub-contract with the Saint Petersburg Branch of the International Energy Academy, has completed a detailed study for the conceptual design of electrical connection of the wind plant at the three potential sites. Grid interconnection and power system operational control requirements were studied and the costs of new substations, new lines, and system reinforcement were analyzed and estimated. In each case the wind power plant connection scheme was designed for connection to the existing RAO-UES and Lenenergo owned 35-330 kV power networks, with reinforcement as necessary to insure smooth operation and no degradation of power quality results from changes in wind velocity.

One of the interesting conclusions from the power systems analysis was that the wind plant actually supports and compliments the existing hydropower plants in the region. Energy production from the six hydroplants declines significantly during winter months and typically peaks during spring and summer runoff. The wind resources normally peak during the winter months in the Leningrad region. And this coincides with electricity demand trends that peak in the December- January timeframe. The value of this beneficial coincidence of peak wind and electrical load is being analyzed. A technical paper on the subject has been accepted for presentation at the European Wind Energy Conference on 16-19 June 2003. The abstract for the paper is included in Appendix 1.

Task 4 - Market Assessment - included four Subtasks – Market Survey and Outreach, Seminar on Wind Power and Project, Financing Strategy and Contacts, and Customer Acquisition.

Market Survey and Outreach
A Market Survey was undertaken to identify the major companies in the Leningrad Oblast wholly or partially owned by major US or foreign corporations and to include also major Russian companies successfully exporting from the Oblast. The goal was to identify companies as potential customers for the wind power that were likely to be judged as credit worthy by investors and financing entities. These companies were therefore good prospects for potential customers for the wind power. An initial list of 50 companies was assembled with the necessary coordinates for the General Directors and Chief Engineers. Companies on the list included such internationally known production firms as Caterpillar, Coca Cola, Ford, Proctor and Gamble, and internationally known firms in production of aluminum, paper products, oil processing etc. This list was modified and increased as market outreach activities progressed.

Outreach to companies on this list consisted of initial letters, interviews, follow-up meetings and a Seminar to help educate them on wind power and the planned wind power plant. Letters were first sent to the General Directors, by the American team describing the project. Next, follow-up interviews were then conducted by the Russian support team in the Leningrad Oblast. A Questionnaire to be used at the initial interviews was prepared.

Questionnaires provided information on current and projected electricity demand, as well as financial information. Analysis of these Questionnaires and the more general information on production and utility needs obtained at the interviews allowed the Market Feasibility Team members to narrow down the initial customer base and target financially solid companies with growing demand for electricity. Project team members paid several visits to those companies

judged the best prospects for power off-take to evaluate their company energy use trends and policies toward clean energy. The results of the survey and visits yielded a list of about thirty credit-worthy companies that expressed interest in becoming customers of the clean energy from the wind power plant.

In addition, separate surveys of potential industrial customers were done for regional divisions in the Oblast in the three sites in which the wind was being measured on an ongoing basis. These sites were regions with active industrial growth. This outreach activity yielded an additional viable 50 companies.

The Market Task team prepared a list of common questions raised during the meetings with the firms surveyed. These questions had to do with the quality and guaranteed supply of the wind power, transportation issues, tariffs and fees, and so on.

Seminar on Wind Power and the Leningrad Wind Power Project

To answer these questions and as a general educational outreach, the Feasibility Study Team held a day-long Seminar in St. Petersburg for about 80 attendees of industrial firms, government and power industry officials of the Leningrad Oblast and the Russian Federation. A Fact Sheet and agenda for the Seminar, copies of presentations by American participants and the attendee list are in Appendix 1.4.

The Vice Governor of the Leningrad Oblast chaired the Seminar. Presentations and discussions on the wind power industry and on the proposed project were structured for high-level decision makers that were being introduced to new technology concepts and ideas for implementing clean energy. Members of the Feasibility Study team made presentations on wind power worldwide and in Russia, on the proposed project, on equipment, on financing issues, and other topics. The Regional Commissioner of Energy of the Leningrad Oblast spoke about power trends and usage in the Oblast and the Commission's support in providing access to the grid; the Vice Governor of the Oblast in charge of investments spoke of the Oblast commitment to supporting the project through tax incentives; the Chairman of the Oblast Department of Energy described how the proposed wind power plant would help meet anticipated growth in demand for electricity in the Oblast among industrial users; and the Director of Renewable Energy Programs from the Russian Federation Ministry of Energy and Power described Russian government support of wind power and the project.

Financing Strategy and Contacts

In parallel with the market survey and identification of potential customers, the financial strategy for obtaining of debt and equity for the project were pursued. Meetings and discussions continued with International Financing Institutions and other international organizations. These contacts and support are detailed below in a separate Section on International Support.

Customer Acquisition

In the final quarter of the Feasibility Study, the team focused on several key industrial customers that had already been analyzed as suitable for committing to and honoring long term Power Purchase Agreements. . Letters were sent to the heads of these firms and meetings were held.

The results were commitments from several credible companies in the petroleum industry to sign long-term Power Purchase Agreements.

Additional information of the efforts completed under this Task are included in Appendix 1.3, including: sample outreach letter to firms included in the market survey; sample completed questionnaire; list of comments, questions and concerns raised by companies about wind power that were addressed during the May Seminar.

Material on the Seminar appears in Appendix 1.4 and includes the Seminar Agenda and Participants, a list of Attendees, and Presentations of U.S. companies.

Task 5 - Economic Analysis

A thorough analysis was completed that included evaluating alternative business models and structures, developing a business plan, proformas and financing options.

Several different wind power business concepts and the regulatory and institutional issues involved in these concepts were analyzed. A decision was made to establish an independent power production company that will sell electricity to large industrial consumers. For this initial wind plant, a project financed business model was used.

To help offset the extra costs and risks of entering a new market in Russia, a package of financial incentives was developed that included both tax concessions and incentives from the Oblast and grants and concessions from international donor organizations. These incentives have been formulated as written offers where possible or are in advanced stages of the approval process. The incentives are planned for this and other early market projects, but are structured to phase out as power prices rise to global market prices and experience in developing such wind power projects in Russia grows.

Financial and economic analysis of the project was done with close cooperation between experienced wind energy and power project analysts in the U.S. and a team of expert business consultants in Saint Petersburg that fully understand local business rules and laws. Given the team's past experience in international power plant project finance, a Discounted Cash Flow Return On Investment (DCF-ROI) model was developed for the 75 MW wind energy plant. A series of scenarios were developed and continue to be refined as assumptions are clarified regarding capital costs, energy production, and operations and maintenance. Assumptions are likewise being refined and clarified regarding insurance, upfront VAT and customs duties, ongoing property and profits taxes, financing fees, return on debt and equity, incentives, and tariff to power purchasers. Based on these assumptions, financial proformas for each scenario were developed to show an earnings statement, statement of cash flows, and debt redemption schedule.

Specifically, the 75 MW plant's estimated loaded capital cost of $98.7 million, including plant and equipment cost, 10% import tax, 20% Value Added Tax (VAT), interest during construction and construction insurance, debt and equity financing fees, contingency, and so forth, is expected to be financed at about 60% debt to 40% equity. The plant will sell power retail to industrial

customers who have committed to buy its electricity and will sign a long-term power purchase agreements (PPA's). Given expected contract life of twenty (20) years, limited recourse project debt in hard currency, with terms of twelve (12) years, is available. The developer works to balance three goals: 1) an attractive Internal Rate of Return (IRR) for equity investors, 2) satisfactory debt coverage for lenders, and 3) the lowest possible Cost of Energy (COE) or tariff schedule for power customers.

Detailed descriptions are included in Appendix 1.5, "Economic Analysis and Project Proformas." For meetings in Russia in December 2002, the Project Team presented two cases: 1) wind at 6.0 meters per second at 80 meters height and 2) wind at 7.3 meters per second at 80 meters height. Given an attractive IRR and satisfactory debt coverage, for the first case, the tariff charged is US$ 0.095/kWh in year 1; dropping to US$ 0.052/kWh in year 13 after debt is paid. For the second case, the tariff charged is US$ 0.067/kWh in year 1, dropping to US$ 0.038/kWh in year 13 when debt is paid. Tariffs are expressed in money of the year and do not escalate. Because Russia's electricity prices are rising toward market rates, because capital-intensive wind does not involve on-going fuel expense that can rise over the years, and because with learning curve effects, wind's cost will decline, these tariffs are attractive. It must be stressed that project cash flows and therefore these results are preliminary, so the COE is expected to change.

Nonetheless, the net result is that the project appears to be financeable. These preliminary project proformas were presented to GE Capital Corporation. GE Capital has agreed to take responsibility for obtaining financing for the project. The commitment letter from GE Capital is in Appendix 1.2.

General results of the Feasibility Study were presented to the Federal Energy Commission of the Russian Federation in Moscow. During the meeting and in a subsequent letter, Commissioner Gregory P. Kutovoy, expressed support for the project. He indicated that this project would serve as a "pilot" leading to the development of wind power plants throughout Russia in regions with high wind potential. Mr. Kutovoy further stated that tariffs for wind energy in the wholesale power market will be set to allow for repayment of loans and to create a stable business for wind developers. Mr. Kutovoy's letters in Russian and English are included in Appendix 1.2.

Task 6 - Environmental Analysis

Environmental considerations are an important element of planning any energy project, despite the fact that a wind power plant is, by its very nature, "clean energy" that displaces electricity generated by burning fossil fuels.

Russian Laws and procedures for environmental assessment were collected, translated and analyzed. From these Laws and experience with wind power plants in the U.S., procedures and process for environmental assessment were adapted and used to prepare Terms of Reference for a full environmental assessment of the project to be used during the next phase of development. The primary concern to be addressed in the assessment involves the potential for bird collisions with the turbines. With proper mitigation this issue has been overcome in other countries and there is no indication that this should be a problem here.

An immediate result from the environmental analysis was the elimination of one of the candidate sites from consideration, because it was considered to be a roosting site for migratory birds in both spring and fall. In addition, a noted ornithologist from a local university was consulted regarding bird species and flight patterns at the remaining three candidate sites. This report was considered in the plant site selection.

6. CHANGING RUSSIAN MARKET FOR WIND ENERGY

6.1 Project Background and Key Issues

The Feasibility Study set out to document the technical, environmental, economic, business, financial, regulatory and institutional issues and requisites for development of the first, utility-scale wind power plant in Russia. The proposed 75 MW plant was to be located in Northwest Russia, in the Leningrad Oblast. The wind power to be produced was to be targeted for industrial customers. The technical aspects of the Feasibility study have also been analyzed and correlated in the changing context of the Russian energy market. Following is a discussion of key technical and non-technical issues that influence the potential success of this project.

6.2 Leningrad Oblast

Site selection
Preliminary study and activity by the participants in advance of the Feasibility Study dictated the choice of the Leningrad Oblast as the site of the wind power plant for technical, marketing, and other advantages to be found in the Oblast.

First, on the key technical issue of wind resource, preliminary data provided by the Russian meteorological services on wind potential on certain coastal and interior sites in the Leningrad Oblast indicated that average wind velocity at 30 meters height is in the range of 6 to 7 meters per second. Independent data provided by the US Department of Energy, National Renewable Energy Laboratory and based on World Meteorological Organization sources indicated that wind resources in the Gulf of Finland region are in the 4 to 5 Wind Power Classes.

Equally important, the Leningrad Oblast is a region of active economic expansion and development, having attracted very substantial foreign investment from major European and US companies, as well as from leading Russian companies making products for export. Many of these firms have set up wholly owned or joint venture industrial production facilities in the Oblast. Annual investment increased yearly in the Oblast from a level of $200 million in 1995 to a level of $1 billion in 1999. Pepsi, Caterpillar, Coca Cola, Otis Elevators, to cite just a few, have established major production facilities. In addition, major Russian oil and pipeline companies are expanding oil related operations and terminals. Overall the rate of industrial output in the Oblast increased in 2000 by 9 percent.

This active industrial growth in the Oblast offered three important attractions to the proposed project: potential for marketing Power Purchase Agreements to financially credible industrial customers; growing demand for power linked to industrial growth; a sophisticated and credible Oblast government structure, with a regulatory and institutional business environment which is flexible and welcoming to new investments.

In addition, environmental awareness within the Oblast created an atmosphere favorable to the development of renewable energy projects. This awareness and sensitivity to environmental issues in the Oblast is in part generated by it its proximity to Europe and the Nordic countries; by the numerous foreign firms operating in the Oblast, many of which have green policies; and also

because of the very educated and aware citizenry living in the region. During our interaction with the Oblast government in the course of the Feasibility Study, the Governor and his Vice Governors called the proposed plant a "noble project" and provided active and significant support.

The anticipated advantages of working on the proposed project in the Oblast turned out indeed to be justified as work went forward on all aspects of the Feasibility Study. These advantages have contributed substantially to the positive outcomes of the Study.

Advantageous Outcomes from the Oblast include:

Oblast Government Support -

- Oblast Government offered tax advantages for the proposed project consisting of generous tax holidays on profit and property taxes for the plant project;

- Oblast Government provided active support throughout the Feasibility Study on coordination involving data collection, identifying and approaching key contacts, and with support for the Seminar and assumption of the Chairmanship of that event

- Oblast Government support for the development of wind power in the Oblast by instituting an important incentive in the form of a tax credit for industrial users of wind power.

Industrial Interest and Support –

- Rising power demand and rising tariffs for electricity create interest;

- Industrial customers willing to sign a Power Purchase Agreement for the wind power; and

- Industrial customers expressed strong interested in supporting green energy initiatives.

Structural Changes in the Russian Power Industry As They Impact the Project

As the Feasibility Study began, participants were already focused on following and taking advantage of changes underway in the Russian power market. These changes began with the reorganization of Russia's Unified Energy system (UES), the monopoly supplier owner and distributor of Russia's vast electricity generation and transmission network. The network was to be broken up and privatized into new companies for generation and distribution. It was the intention of the Russian government to encourage competition in the power market. One important goal of the Russian government was to deal with the great gaps between cost within the system and the artificially maintained and subsidized low tariffs for both industrial and residential consumers. Industrial tariffs were, particularly for large-scale exporters, kept low to make those industries competitive abroad. Regional governments still heavily subsidize tariffs for residential users. This is to avoid political pressure from a populous long-used to cheap energy.

Research undertaken before the ABB proposal was submitted to TDA for its support had tracked hikes in the tariffs for industrial consumers, which, particularly in the Leningrad Oblast showed a steady upward trend. Middle sized industrial companies, in particular, were becoming used to an escalating price environment. The ABB study team assumed from the beginning that tariffs for the wind power from the proposed plant would be higher than those for conventional power. Therefore changes in the power sector and trends in tariffs, which would enhance the competitiveness of wind power, became an important part of the Feasibility Study under the Tasks having to do with Market Assessment, Business Assumptions and Projections, and Economic Trends.

Another significant change underway in the Russian power industry was the need, long ignored but finally acknowledged and beginning to be addressed, to upgrade the aging generation and distribution infrastructure. Substantial price hikes were anticipated to occur in tandem with the need to find investors that would loan the billions needed to effect the necessary power system upgrades.

Throughout the Feasibility Study, the anticipated changes and the impact on tariffs have been carefully monitored. One important source of policy, analysis and results has been the Commissioner of Energy of the Leningrad Oblast. The Feasibility Study team met with the Commissioner very early during the course of the Study and periodically throughout the Study. The Commissioner has been a major support for the project and gave a presentation supporting the planned project at the Seminar on Wind Power. The tariff for industrial users was to have risen in the first quarter of 2002 by 25 percent. In actuality, the price increase was adjusted to only 15 percent because of concerns within the Federal Government on a slowing of the economy. In the future prices were projected to rise again, and that was before the major changes in the power industry were passed in February of 2003 by the Duma, the Russian legislative body.

As the Feasibility Study team well knew, the legislation passed for reform of the power industry has been in the works for the past three years with the technical assistance of the World Bank. The reform outlined is a major economic overhaul in the Russian Federation. The world's largest power grid, as was anticipated when work on the Feasibility Study began, will be broken up and restructured. UES will no longer have a monopoly on generation and transmission of electricity. The electricity sector will be reorganized into groups of power producers and distributors. This restructuring will accelerate the current move toward market pricing.

A major goal articulated by Anatoly B. Chubais, head of UES, is to move ahead rapidly to attract investment and financing to renovate and update the aging Soviet era- electric power sector. The enormous cash infusion required will contribute towards the acceleration of price increases. UES is unable to raise sufficient investment from cash flow to undertake the needed modernization. In February of 2003, Chubais sent a team from UES, key ministries and energy companies to participate in a seminar in Washington sponsored by US Department of Energy and the Edison Electric Institute. The stated objective of the three-day meeting was for the Russian delegation to learn more about deregulation and competitive market mechanisms. It was also designed to attract investors to the Russian power industry. Approaches have been made to the major international financing agencies.

Although prices for electricity may not rise as quickly as needed to reach the market levels required to attract major foreign and domestic investment, Chubais is working with the Federal Government to set up a "guarantee fund," whereby the Russian government will pay the difference between state-determined prices and market rates. This fund may not be necessary as in certain regions, prices will rise rapidly as demand increases with economic growth and the old monopoly structure of the suppliers and utilities is broken up. The Feasibility Study team learned that a new company has already been formed to deal with electricity dispatch in the Leningrad Region.

Impact on Planned Project

The financing of the Leningrad Wind Power Plant is not contingent upon closing the gap between current electricity prices in the Leningrad Oblast and the estimated cost of the wind power to be produced. The Feasibility Study team found that customers were attracted to the wind power for environmental rather than price considerations although the guarantee of stable prices against the background of projected steady increases also proved to be an incentive to customers.

However, it is very clear to the Feasibility Study team, as it is to most observers, that prices for power will rise throughout Russia, and particularly in the high economic growth area of the Leningrad Oblast. Nevertheless, anticipated price rises may not occur as rapidly as most observers and those within the Russian government now think likely. The Feasibility Study team is comfortable only with conservative assumptions of such rises, at an increase of 10 percent per year till market price for power is reached, probably between year 7 and 11. Circumstances in the Russian economy may necessitate, as they did in early 2002, a slowing of price increases.

However, in terms of what is going on currently in the Russian economy, a downward trend is not anticipated by observers watching current world oil prices, which have risen to new heights and are likely to plateau at levels much above where they were five years ago. So the assumption of a yearly increase of 10 percent may err on the side of caution.

Another factor indicating that prices may increase more rapidly in the Leningrad Oblast is the dependence in the Oblast on gas for power generation. More than 60 percent (64 percent) of the fuel source in the Oblast power generation system is gas. The price of gas is also rising because the production for current gas fields is declining and although there are vast gas resources, the new fields are increasingly expensive to tap. Also there is increasing pressure to sell the gas in Europe at 2-3 times the domestic price.

Another driver is the need for additional power sources to meet the increasing electricity consumption in the Oblast, which rose in 2002 by 35 percent.

In summation, it is likely that the price gap between estimated costs of wind power and conventional power prices in the Leningrad Oblast is likely to narrow quickly in coming years. The impetus for increases in power prices will be the combined impact of restructuring and privatization within the Oblast power structure, the cost of the cash infusion required to upgrade

the existing generation and distribution system, increasing prices for gas, high industrial growth with increased demand for electricity.

Oblast Government Legislative Initiative
In terms of the planned project, the above discussed changes in structure and price within the power market, while not necessarily impacting the financing of the project will be taken into account and studied carefully as the project team plans and works with the Oblast in drafting the agreed-upon legislation to provide a tax credit to industrial users of wind power.

6.3 Federal Support for Wind Power and the Project

The Russian Federal Government has expressed strong support for the Leningrad Wind Power Plant. The Russian Ministry of Energy sent the head of its wind power program to the Wind Power Seminar sponsored by ABB in St. Petersburg to make a presentation on the Ministry's support for wind power development in Russia. He described the government's policy for support of wind power throughout Russia and the demonstration projects the Ministry has established. Because thus far, these projects have been small-scale, the Ministry is all the more interested in supporting the proposed utility-scale wind power plant as a spur to developing the industry in Russia. In follow-up meetings later held with the Ministry in Moscow, the Deputy Minister requested that the Feasibility Study team work with the Ministry on clarifying for his department technical approaches in the project plan and also on exchange of more general, technical information which could help them further the development of wind power in Russia. The informational exchange between the Ministry and the Feasibility Study team has proven to be most useful in clarifying current regulatory requirements in Russia pertinent to the success of the project and potential for future projects. The Ministry has expressed strong endorsement of the proposed Leningrad Wind Power Plant and has committed to providing the needed support and licenses necessary for establishing both the first utility-scale power plant and the overall regulatory methodology and framework to encourage wind power development.

Another significant development on the federal level is the support of the Federal Energy Commission for the Leningrad Wind Power Plant. In meetings with the Commission and in a follow-up letter by Mr. Kutovoy, the Federal Energy Commissioner, to the Feasibility Study team, the Commission expressed strong support for the project. Mr. Kutovoy and his colleagues conveyed their commitment to help establish a utility-scale wind power plant to give impetus to the development of a wind power industry in Russia. The Commission's promised support is explicitly to develop a mechanism allowing the wind power to be sold into the Russian Wholesale Power Market (FOREM) under a long-term Power Purchase Agreement. The vast size of this wholesale market would easily absorb any price differential between wind power and conventional power sources. Such an approach would act as a major incentive for the development of wind power throughout Russia.

The Russian government is, in addition, considering both a Presidential Decree and legislation to encourage wind power development. Thus far, one attempt to introduce such legislation last year did not go forward, but the Ministry of Energy and other supporters from the Federal Energy commission plan to prepare the Dumas more thoroughly about the need to encourage wind

power development, and re-introduce the legislation. The major overhaul going on in the power sector is likely to raise the government's awareness of the need to encourage alternative forms of power generation, and the push to encourage privatization of the industry will also bolster such efforts.

It is not required that the government necessarily target funds for development of wind power. The Russian government has, in the period of the last five or six years, developed a successful nation wide program in energy efficiency after first issuing a Presidential Decree and then legislation. The program began as demonstrations in 10 cities and then spread throughout the country. Projects are designed to make both generation and distribution more energy efficient. What the government was able to accomplish was to set the framework in place to encourage such projects to develop and attract financing from domestic and foreign investors.

Russia is presently awash in monetary resources pouring in from abroad. Oil prices are up substantially from last year's $20 dollars per barrel range to $40 dollars. To avoid inflation, the government has said it will try to avoid ruble appreciation by spending on long-term structural reforms as in the utility sector. The current high price of gas, a major fuel source for electricity, will also both encourage the government to push export as much as possible and to develop alternative fuel sources.

6.4 International Support

Four key international financial organizations have been involved throughout the Feasibility Study. It is anticipated that all four will be involved in implementation of the project. These four are the two leading International Finance Institutions (IFI's), both long-active in Russia; a specialized Nordic environmental fund targeted for Russia, particularly as Russian pollution impacts the neighboring Nordic countries; and a global fund which supports projects, through grants and other mean, favorably impacting the environment. They are the following:

- European Bank of Reconstruction and Development (EBRD)
- International Finance Corporation (IFC), the project finance arm of the World Bank
- Nordic Environmental Finance Corporation (NEFCO)
- Global Environment Facility (GEF)

The Feasibility Study team has had meetings, reviews and discussions with each of these entities. All four support the utility-scale Leningrad Wind Power Plant as a new and important groundbreaking clean energy activity in Russia. They are all committed to assisting in the development of the project with grants, equity and debt support. They are all interested, as is the Feasibility Study team, in using this project to establish a process that is replicable throughout the Russian Federation and which will lead to further development of both wind power plants and a Russian wind power industry.

In terms of the roles of each organization, it is anticipated that EBRD will take the lead role in supporting GE Capital Corporation in providing or syndicating debt and additional equity required for the project. EBRD will bring IFC into the project to work in cooperation with them

as suppliers of debt and equity. NEFCO has committed to providing equity, especially as the planned wind power plant is to be located in an area close to the borders of the Nordic countries; GEF will work in cooperation with the other agencies and is primarily interested in replication in Russia.

6.5 Regulatory and Institutional Issues

The Feasibility Study team, under its Market and Business issues Task activity reviewed all issues pertinent to implementing the project. Appendix 1.3 includes a description of alternative steps and processes for implementation.

The regulatory and institutional issues germane to the project have to do with basic formation and operational questions regarding the issues described below. The goal of the Feasibility Study team is not, during the Study phase, to achieve any of the requirements listed but to understand fully all the requirements for implementation of the Leningrad Wind Power Plant. A parallel goal is to develop a long-term acceptable framework for wind power projects in Russia and in the Leningrad Oblast. This goal can be achieved in the implementation phase of the project by regarding the fulfillment of all these requirements and their step-by step achievement as a means of establishing model methodologies for development of wind projects throughout the Oblast and Russia.

1. Business formulations, investments, and setting up of operations in Russia as a power supplier and operator in Russia, in general, and in the Leningrad Oblast, in particular

2. Tax incentives for the project to be obtained from the Oblast

3. Oblast legislation for an industrial user’s tax credit for wind power

4. Permits, approvals on federal and Oblast levels to take the project from the design stages to commissioning

5. Land/Lease/Purchase/royalty payment agreement

6. An enforceable long-term Power Purchase Agreement with an industrial customer

7. Customer with a good foreign currency exchange record and access to hard currency for initial projects employing hard currency debt

8. Obtaining of licenses from the Oblast and federal levels for renewable energy companies

9. Grid connection and grid access and priority agreements

10. Methodology for setting up a tariff for the electricity from wind power

11. A model long-term Power Purchase Agreement for selling wind power to the Russian wholesale market (FOREM)

12. Methodology for environmental assessments and environmental approvals.

The first step in the process described above to bring the project to fruition has been taken by some of the Feasibility Study participants. The team reviewed alternative business models for setting up a wind power company, including joint ventures with the few existing independent power suppliers already operating in Russia and which have also been involved as participants or contacts during the Feasibility Study. The members of the team, have concluded that a Limited Liability Company be established and registered in the Leningrad Oblast. This company, in cooperation with the key foreign participants, will help develop the project and maintain operations. This step was completed in February 2003 with the registration in the Oblast of OOO Leningrad Wind Power Company.

6.6 Environmental Issues

Environmental studies have been completed in regard to the general pertinent issues affecting the project. More detailed studies were accomplished for the sites in the Leningrad Oblast selected as the three sites most likely to be potentially acceptable for development.

The environment is a high priority concern in Russia. Legislation has been in place for several years mandating that any industry that harms human beings or nature must pay special taxes. In regard to new, green field production facilities, the environmental regulations are stringent and strictly enforced. Existing, long-established, Soviet–era industries, unlikely to obtain the enormous resources needed to improve their overall environmental performances, are required to pay yearly pollution fees and penalties, which have become substantial. The funds collected are used generally to finance environmental protection initiatives. Russia has set up a fund, with contributions, as well, from the World Bank and commercial banks in Europe to provide financing for viable industrial projects aimed at cleaning up emissions.

Russia has also established an Energy Carbon Facility through RAO UES. The Energy Carbon Facility was begun with some of the funds from a €100 million loan to RAO UES in October 2001 to help the company set in motion a government-approved plan to restructure the country's power sector. A pioneer group within RAO UES operates the Carbon Facility and is seeking to identify greenhouse-gas emission-reduction projects that could attract outside investors. The Bank's support will help the group work with the government to draft the laws and regulations needed to develop such projects. An application for Carbon Facility funds for the wind plant will be developed and the anticipated funding has been incorporated into the financial proformas for the project.

Much of the environmental damage in Russia has come from the energy industry and its antiquated plants. Although the federal legislation is now in place to set up the framework for

attracting investment needed to upgrade these plants and improve their environmental performance, it will be some time before these initiatives achieve widespread results.

Because of their commitment to improving the environment, the federal government and the Leningrad Oblast have embraced the proposed wind power plant. These governmental levels view wind power as an efficient means of meeting both environmental and part of the energy needs of the region. In the Leningrad Oblast, pressure from Nordic neighbors unfavorably impacted by pollution, and support from the Nordic environmental financing agency (NEFCO) has helped encourage receptivity towards renewable energy projects. The Leningrad Oblast, actively and successfully involved in attracting substantial foreign investment, views its support of the Leningrad Wind Power Plant as helping to attract further investment by establishing its forward-looking and positive image.

The industrial facilities in the Oblast which have expressed interest in becoming customers for the wind power are motivated by growing concerns about image and the advantages for their overseas export activities of being viewed as forward-looking green companies.

7. BUSINESS STRATEGY FOR THE PROJECT AND FOR LONG-TERM DEVELOPMENT

From the beginning, the Feasibility Study centered on a strategy aimed at providing wind power for customers with credibility in the international financial community. Early discussions with internal investors and with potential providers of debt and equity, such as EBRD, IFC, and NEFCO, made very clear the need to attract financially viable customers with whom it would be possible to achieve credible off-take agreements or to arrange enforceable long-term agreements in Russia. It was clear from the beginning that the proposed wind power plant not only faced the need to accomplish groundbreaking results in establishing the viability of utility-scale wind power plants in Russia. The wind power plant would also face the general requirement attendant upon development of all new power projects, to obtain necessary licenses and permits as an independent power producer, and to operate the plant well so as to provide power to reliable customers.

Utility Customers

Once, as detailed above, the Leningrad Oblast became the focus of the Feasibility Study, for technical, business, environmental, and industrial growth reasons, the first approach considered was to work with the regional utility as the potential customer for the wind power.

In the Leningrad Oblast, Lenenergo is the major utility owning the grid and substations and responsible for distributing 80 percent of the electricity used in the Oblast, with 20 percent of municipal distribution networks owned by the municipalities. Of the Lenenergo power supplied, 80 percent goes to large industrial users. Power is supplied to residential users and small enterprises through the municipal networks. Given that Lenenergo supplied electricity to the large industrial users, likely to be financially viable, Lenenergo seemed a potential customer for a Power Purchase Agreement for the wind power. Selling the wind power to the utility would be a classical power project approach and would simplify matters having to do with grid access and fees. Given that electricity demand was anticipated to rise by 35 percent in 2002, wind power could be of real benefit to the utility in increasing supply and for peak demand times.

As a first step in opening discussions with Lenenergo, members of the Feasibility Study team met in Helsinki with Fortum, the leading power supplier in Finland and an equity shareholder in Lenenergo. Fortum had invested in Lenenergo a few years ago primarily to be able to buy very cheap energy from Russia. In essence its investment in the Russian utility allows Fortum to help control Lenenergo's policy in regard to supplying Finland with low cost electricity. Given its role with the regional utility, Fortum was invited to participate as investor in the Leningrad Wind Power Plant, and Fortum's response was that it would like to be kept apprised of developments in the planned project and would consider future investments. Discussions did not, however, indicate much that was positive about Lenenergo's financial situation.

In subsequent discussions with energy officials in the Oblast and with industrial users of the electricity supplied by Lenenergo, several concerns surfaced which tended to make questionable the strategy of working with Lenenergo as the major purchaser. Discussions with several major US companies operating from recently established plants in the Leningrad Oblast revealed that

Lenenergo had not had the resources to build the substations or transmission lines needed to supply their plants with electricity and that they themselves took on the capital costs for this construction. While such negotiations with utilities are not so unusual, these discussions also revealed tensions between the three companies and the utility and real problems, under adjudication, in getting Lenenergo to fulfill legal commitments on pricing discounts agreed upon in return for the absorbing of the costs of construction by the US companies. If reliability and inability or refusal to fulfill legally negotiated financial commitments were to be seen as issues in working with Lenenergo, the utility, as the proposed power purchaser, could not supply the financial credibility needed to attract the foreign debt and equity for construction of the wind power plant.

Perhaps an even more serious concern was raised in several sessions with the Regional Energy Commissioner for the Leningrad Oblast. Commissioner Lev Khabatchev has been a strong supporter and advocate of the proposed wind power plant, appearing as participant and presenter at our Wind Power Seminar, and also supplying all needed information and contacts with officials and specialists.

The Regional Commissioner, working closely with the Federal Energy Commission, on the anticipated restructuring of the power industry in Russia, made very clear that the entire Lenenergo would soon be undergoing change and be broken up into multiple ownership companies. This situation could hardly allow for a serious and enforceable long-term Power Purchase Agreement.

Industrial Customers

As a financially viable option, the Feasibility Study team focused on the major industrial facilities in the Leningrad Oblast as potential customers. Extensive research activity by CMT Consulting, head of Market Activity for the Feasibility Study, on customer identification throughout the Oblast and especially in the sub-regional administrative locations adjacent to the three sites where wind was being measured on an ongoing basis, yielded a list of some 50 major industrial producers with worldwide reputations for financial credibility. Leading decision makers at the companies were identified and contacted by direct letter from the US by the head of CMT Consulting. The letters described the proposed wind power plant and requested interviews with a CMT representative based in St. Petersburg and the completion during the meeting of a questionnaire on current and anticipated electricity demand. Follow-up interviews and analysis of the completed questionnaires resulted in a list of 35 companies, all with expressed interest in the wind power and all with the necessary financial credibility needed to attract financing. These companies were then invited to and did participate in the May Seminar on Wind Power in St. Petersburg.

The strategy for final approach and selection of these companies as the main potential customers was then integrated with parallel analysis underway of key technical issues on grid analysis and wind regime. A few potential customers with anticipated strong growth in demand for electricity, with interest in clean energy, and with international financial credibility surfaced as those most likely to be ready to sign Power Purchase Agreements. Finally, the members of the Feasibility

Study team held meetings, with the executives from these companies. The results were commitments by the companies to sign Power Purchase Agreements.

Market Potential in the Oblast and Russia

Industrial Consumers

The strategy for implementation of the first wind power plant, as described above, thus focuses on industrial consumers. For this first project, this approach is clearly the one to lead to timely implementation of the project.

Projects which may follow this first plant are likely to continue this strategy of focusing on large industrial customers especially because the Oblast will introduce legislation providing an incentive to these companies to use wind power in the form of an industrial users tax credit. Other interested and viable potential industry customers have already been identified in the above described outreach activity.

Wind Power in Conjunction with Hydropower

In most parts of northern Russia the best wind resources occur during the winter months when power production from hydro is at its lowest. This presents the opportunity for using wind and hydropower resources to firm the capacity of two intermittent resources.

Wind Power in Remote or Isolated Communities

The Oblast government and elements within the Russian Federation are also interested in using this project as first step in the broader use of wind energy. A particular area of interest is the deployment of small-scale wind plants in the northern most communities along Barents and Kara Sea coasts. Publications by the Ministry of Energy indicate that some of the best wind resources in Russia are found along the northern coasts. Long transmission lines to these areas are often unreliable and the cost of adding generation and supplying fuel in these remote areas is extremely high. Experience with wind plants in Alaska in the US has shown that wind can be a useful energy system in these applications, but that is beyond the scope of the current study. Also having a successful project in the Leningrad Oblast is considered to be a prerequisite to developing the more difficult and challenging northern markets.

Wind Power in Combination with CHP for Residential Users

The Feasibility Study team has been requested by the Governor of the Leningrad Oblast to consider the feasibility of improving the very inefficient existing system of delivery of energy to residential consumers by combining wind power with CHP, the major system of supply to large blocks of consumers in the Oblast. For the Leningrad Oblast, heavy subsidies to residential consumers are a drain on the regional budget but maintained because of voter pressure against raising prices for residential consumers. Residential consumers have long been used to very low costs for energy and though raised somewhat in post-Soviet times, these prices are still very low and heavily subsidized. The Oblast government also deals with the pressure of customer dissatisfaction since, particularly, in the winter time the heat and hot water systems supplied from these combined plants is woefully inefficient and unreliable. If the efficiency of this heating delivery system could be improved both by installing efficient control systems and hook-ups to a wind power plant, the resultant improvements in the delivery of heat may satisfy consumer

concerns sufficiently to allow the Oblast government to raise prices to consumers. The Feasibility Study team has committed to looking at this possibility. A financially feasible way for such a project to go forward would be to structure the customer as the Russian Wholesale Power Market.

Russian Wholesale Power Market

As the other necessary steps go forward toward implementation of the first wind power plant, the implementing team will continue its activities with the Federal Energy Commission to develop a methodology for signing a long-term Power Purchase Agreement with the Federal Wholesale Power Market (FOREM). Such an agreement would allow a wind power plant to be built on a commercial basis anywhere in the Leningrad Oblast or, for that matter, in other areas of industrial growth and accelerating power demand in Russia, and in combination with CHP. Given the major changes that have already begun in the Russian power market, it is possible that FOREM itself could be reorganized. It is therefore essential to work out a methodology with the Commission and other federal authorities, which allows for a long-term Power Purchase Agreement and continues in effect despite any changes that may occur. One possibility which will come under consideration is that of tapping into the federal fund that Chubais, head of the UES, has called for as a fund to close the gap for investors in power generation between their estimated tariffs and existing tariffs.

8. CONCLUSIONS

Leningrad Wind Power Plant

Results from the study show that large utility-scale wind power plants can be financed, built and operated in the Leningrad Oblast. Interest in and support for this initial project is high and there do not appear to be any significant obstacles that could block or delay the project. Power prices are currently lower than wind power prices but are rising rapidly and are projected to surpass the projected price of future wind energy. In the meantime the Oblast is willing to offer temporary subsidies to industrial users, and important industrial customers are willing to pay a premium for clean energy from the wind.

All the steps necessary to proceed with implementation of the project have been determined and a realistic timetable planned to complete the activities that must be undertaken in Russia. These steps include the land acquisition process, the obtaining of necessary permits, approvals and licenses, and closing of financing. Given the experience and capabilities of the development team under GE Wind Energy, all issues of design, equipment purchase, transport, construction and commissioning will be handled expeditiously and in parallel with activities in the Leningrad Oblast.

Wind Power in Russia

Continuing steps and accomplishments on this initial project have far reaching benefits for wind energy in Russia. The educational and outreach efforts achieved during the Feasibility Study have raised awareness of the potential and advantages of wind power among all Russian participants and key leaders in government and industry. Dialogue and ongoing activity have been established with the Leningrad Oblast government, with the power industry and its governing bodies on both federal and Oblast levels, and with industry in the Leningrad Oblast. The first utility wind power plant will thus act as a model for replication. Future potential projects and new applications have already been identified and a strategy for development outlined. Events and activities in Russia in regard to changes in the power industry, strengthening of environmental activities, and industrial growth create conditions that support the development of the vast wind energy potential in Russia.

APPENDICES

(Most documents were done in Russian and English, but only English versions are included.)

APPENDIX 1.1:
PROJECT AND INDIVIDUALS BACKGROUND

Project Data Sheet

Key Individuals Designated in the TDA-ABB Contract

Leningrad Wind Power Plant Project

Feasibility Study Completion

ABB Wind Power-US, together with its team of US and Russian companies, is completing a year-long US Trade and Development Agency supported, $1.3 million Feasibility Study to develop a 75 MW wind power plant in the Leningrad Oblast in Northwest Russia. The project team includes GE Wind Energy, Princeton Energy Resources International, CMT Consulting and Morse Associates, Inc., and Lidesm AOZT, a Russian power engineering firm operating in the Oblast since 1987,

During the Feasibility Study three potential sites for the plant were evaluated. Wind has been measured at three heights at all sites since March 2002. In addition, each site was evaluated in terms of local government support in obtaining the site and all needed approvals, grid accessibility and operational control, load growth, environmental considerations and, most important, potential industrial customers interested in clean energy and willing to sign a PPA.

Market Development/Financing

The Feasibility Study team also completed a market survey and market development activities focusing on foreign owned production facilities in the Oblast and major Russian firms exporting products. The Study has produced Proformas, based on assumptions that have been reviewed by all participants and by Russian specialists. Debt financing and grant support for the project have been explored and are expected to come from EBRD, IFC and GEF. Nordic Environmental Finance Corporation and others are expected to take equity positions in the project.

Site/Customers/Timing

Two leading Russian oil and gas companies have major port facilities and processing plants under construction in the region. They have provided Letters of Interest in signing PPA's for the output of the proposed wind power plant. If either or both oil companies become customers, the plant will be built at a nearby large industrial city on Russia's Baltic coast. Energy demand and prices are increasing in that area. If the wind power is sold to the wholesale market, the plant could also be built at another site on the Baltic coast. Construction of the project is targeted for late 2003.

Oblast Support

The Leningrad Oblast government is providing support for the project with profit and property tax holidays for the debt period plus two years. In addition, the government is presently reviewing a proposed tax credit for industrial users of wind energy in the Oblast. The Leningrad Regional Energy Commission supports the project and will assure priority grid access and approve the tariffs for wind energy as projected in the Proformas. There is a strong and growing interest in clean energy through out Russia and especially in the Northwest.

Owner/Developer

Leningrad Wind Power Company OOO, a Russian company licensed to supply power in the Leningrad Region is being established and registered in St. Petersburg. The company will join with existing power supply and distribution companies, which have operated in the power market in Russia for the last two years and have the necessary approvals by the Russian Federation, the Russian Federation Energy Commission and the Leningrad Regional Energy Commission to operate as independent power suppliers in Russia and the Leningrad Oblast. Working with established firms will provide the wind power company with the capability and experience needed to quickly obtain all necessary approvals and permits to bring the wind power plant to operation and then to manage the company. International equity investors will be part of the ownership structure.

Turnkey Construction

Leningrad Wind Power Company OOO will hire GE Wind Energy as turnkey developer of the project and work together with that firm to develop the wind power plant.

Additional Projects

This will be the first project, with additional projects, new applications and domestic manufacturing of components are under consideration.

The Project Feasibility Study

ABB Inc. in the US and AOZT Lidesm, a Closed Joint Stock Company in Russia, with funding from the United States Trade and Development Agency, are conducting a technical and economics feasibility study for a grid-connected wind power electricity generating plant to be located in the Saint Petersburg region. . Wind measurements now are underway at three sites near Vyborg, Kingisepp and Kirovsk. This will be the first large-scale wind power plant in Russia. The wind power plant will provide clean, renewable energy in the form of electricity for industry throughout the region.

Size and Scope

- The feasibility study began in November 2001 and will be completed in 2002 at a value of USD 1.3 million.
- The study is evaluating the technical, economic, environmental and commercial value of the proposed project.
- The study is based on a plant design of 75 megawatts of total capacity.
- The power plant will include approximately 50 wind turbines each with output of 1.5 megawatts.
- Total construction value is estimated to be USD 90 million.

The Participants

ABB Inc., the US-based unit of ABB Group. ABB is an international corporation with extensive experience in the engineering, design and construction of electric generation plants. The wind power division of ABB currently has operating organizations in eight countries and is active in wind and other energy projects around the world.

GE Wind Energy, manufacturer of wind turbines and developer of wind power plants worldwide, is a subsidiary of General Electric Corporation. GE Wind Energy (formerly Enron Wind) has installed over 4500 wind turbines worldwide.

Lidesm, a closed joint stock company, was established in Saint Petersburg in 1989. Lidesm specializes in design and engineering in the field of civil and industrial construction, primarily energy projects.

CMT (Construction, Marketing & Trading), a Washington, DC and Moscow based consulting firm that has been assisting US companies in the construction and energy fields to establish operations in Russia since 1987.

PERI (Princeton Energy Resources International, LLC), based in Rockville, Maryland, is a recognized leader in the field of energy technology analysis, supplies engineering, economic, environmental and management solutions to a wide range of clients in both the public and private sectors.

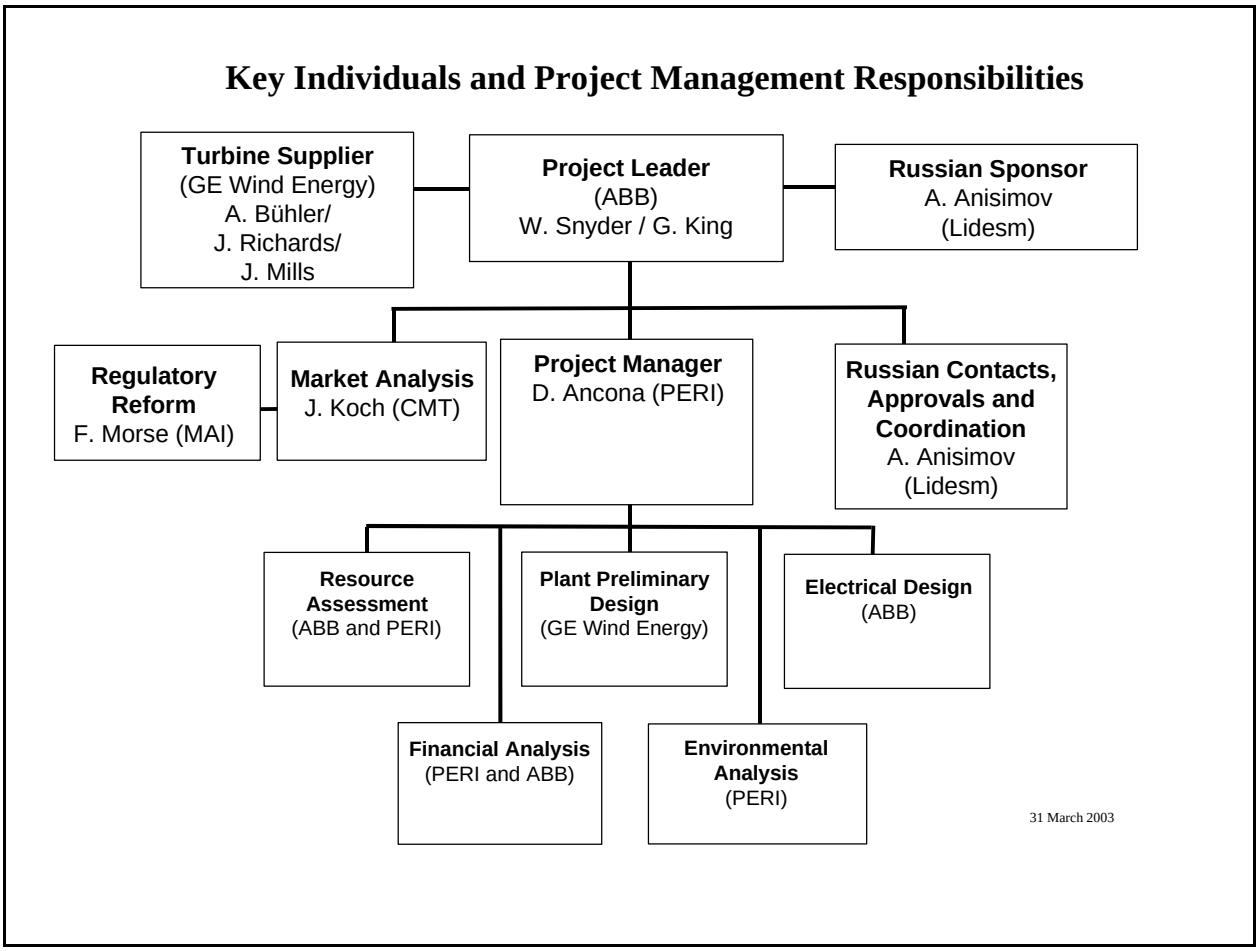
MAI (Morse Associates, Inc.), an energy and environmental consulting firm is based in Washington, DC with unique expertise in renewable energy technologies, energy conservation and sustainable development. The firm provides strategic planning and support services to energy companies and other organizations.

The Process

The participants are conducting the study in close cooperation with local and regional authorities, business and industry, power companies, landowners and other interested parties. The study will evaluate both the technical and the commercial feasibility of such a project. Engineering studies are being conducted on the connection and operation of the wind plant on the local electricity grid system. Project financing and economics will be analyzed along with necessary financial incentives. The process includes this educational seminar for prospective energy purchasers and investors in the project and discussions with government authorities about the benefits this project can bring to the region.

Contact Information

Alexander Anisimov, General Director
Lidesm (Closed Joint Stock Company)
15 A Kondratyevsky pr., Office 22
195197 Saint-Petersburg
Russia
Phone 7(812) 540-8598
Fax 7(812) 540-8498


Key Individuals and Project Management Responsibilities
Turbine Supplier
(GE Wind Energy)
A. Bühler/
J. Richards/
J. Mills
Project Leader
(ABB)
W. Snyder / G. King
Russian Sponsor
A. Anisimov
(Lidesm)
Regulatory Reform
F. Morse (MAI)
Market Analysis
J. Koch (CMT)
Project Manager
D. Ancona (PERI)
Russian Contacts, Approvals and Coordination
A. Anisimov
(Lidesm)
Resource Assessment
(ABB and PERI)
Plant Preliminary Design
(GE Wind Energy)
Electrical Design
(ABB)
Financial Analysis
(PERI and ABB)
Environmental Analysis
(PERI)
31 March 2003

Curriculum Vitae
William L. Snyder

Name: William Luther Snyder

Date of birth: 02/17/1950

Place of birth: Richmond County, North Carolina, USA

Education: Bachelor of Science degree in Engineering Operations from North Carolina State University, Raleigh, NC
Master of Business Administration degree from Babcock Graduate School of Management, Wake Forest University, Winston-Salem, NC

Languages: English

Present position: Mr. Snyder has since March, 2001 served as Director of the ABB wind power business in the USA. Prior to this position, he was marketing and sales director of the ABB Utility Solutions business. He joined ABB in 2000 after working in the utility industry for approximately 20 years with experiences in distribution system operations, customer service management, marketing and product development, business development and project management. Mr. Snyder has also had experience in manufacturing in the textiles and automotive industries. His placements have been:

Ford Motor Company, Louisville, KY	1972-1976
Burlington Industries, Raeford, NC	1976-1979
Carolina Power & Light Co, NC	1979-2000
ABB Power T&D Co, Raleigh NC	2000-present

PRINCETON ENERGY RESOURCES INTERANTIONAL (PERI)
DANIEL ANCONA

Key Qualifications:

More than 35 years experience in the renewable energy and energy efficiency fields managing research, development, technology assessment, deployment, and policy analysis in over 25 countries. Experience is focused on wind energy systems and applications, but included integrating all types of renewable electric power technologies with conventional fossil-fueled power plants. Broad management experience in program planning, management, and execution, both government and private sector programs in the United States and international renewable energy projects in Eastern Europe, Asia, South America, and Continental Europe. He has demonstrated expertise and thorough knowledge of: renewable energy resource and conversion data analysis for wind, biomass, solar photovoltaic, solar thermal, geothermal technologies. He has planned and executed wind power plant programs in Poland, Ukraine, former Yugoslavia, and China. Mr. Ancona's engineering experience includes work with power systems, renewable energy, transportation and industrial engineering. His expertise covers power generation planning and plant site evaluation; wind energy resource assessment; preparation of procurement documents for equipment, applicable standards and codes, and training for mid to senior level managers in utilities, industry and government.

Mr. Ancona served as Chairman and organizer for many international groups and organizations. He served as Chairman of the International Energy Agency (IEA) Wind Turbine Systems Agreement Executive Committee, with 17 member countries. He led U.S. bilateral energy programs with Poland, Ukraine, Serbia, and People's Republic of China. He has evaluated projects and tasks for Department of Energy (DOE), Agency for International Development (AID), Department of Defence (DOD), World Bank, and private clients.

Professional Experience:

International Program Manager, Princeton Energy Resources International, LLC (PERI), Rockville, MD, 1998-present. PERI is a small energy and environmental consulting firm providing engineering, technical, economic, policy, and regulatory services to various government agencies, bilateral and multilateral financial institutions, and private sector clients worldwide. In addition to traditional project services such as feasibility studies, planning, policy design, environmental review and assessments, engineering design, construction management/ inspection services, PERI provides technical assistance to the governments, their agencies, and private sector organizations to strengthen institutional capabilities through organizational development, sector reform, technology transfer, and training.

Mr. Ancona is an internationally recognized expert on wind energy, with experience on other renewable energy technologies including biomass, solar photovoltaic, solar thermal, geothermal, and biomass, conducted or organized planning and analysis of policies for research, technology development, economic projections, financial incentives, project feasibility, and training. Results are completed assignments for U.S. government agencies, National Renewable Energy

Laboratory, World Bank, and International Energy Agency.

Selected Projects (1998 – present)

For U.S. Trade and Development Agency, planned and conducted the Orientation Visit on Photovoltaic Energy for top executives from Greek power company, government agencies, and commercial companies to meet with U.S. solar industry, research organizations and power companies. The meetings included planning for using wind and solar energy to power the 2004 Athens Olympic Games.

For Commercial Client, developed plans for building a 25 MW wind power plant in Central America. This assignment involved planning the wind resource assessment, project feasibility study, financing, construction and operation. Initial steps of obtaining requisite government and power company approvals have been completed.

For National Renewable Energy Laboratory, planned and executed international programs involved bilateral and multi-lateral science and technology cooperative agreements and international standards on wind and other renewable energy technologies with Asian, Latin American, and European countries.

On a DOE Science and Technology Mission, to the People's Republic of China that explored government and business initiatives on renewable energy, efficiency, environmental, and automotive electric vehicle transportation. Subsequently, was the author of the Progress Report on the U.S.-People's Republic of China Energy Efficiency and Renewable Energy Protocol that was published in Chinese and English.

For DOE, organized the first Joint Working Group Meeting held under the Protocol for Cooperation in the Fields of Energy Efficiency and Renewable Energy Technology Development and Utilization between DOE and the People's Republic of China, Ministry of Science and Technology. Meeting included projects on rural electrification, large–scale wind power plant development, energy efficiency, renewable energy business development, electric and hybrid vehicles, and geothermal energy.

For State Power Corporation of China, conducted a three day seminar in Hangzhou, China on Wind Power Business Development and Government Policy Analysis. Top leaders from Beijing and Provincial government, along with planners and managers from the electric power industry, attended the working sessions to plan, model, and evaluate options to accelerate the introduction of wind and other renewable energy technologies in China. A case study was presented on financing 100-MW wind plants in China. Seven variations in the case study illustrated the effects on energy cost of project scale, wind speed, development experience and learning curves, European style economic tied-aid, and Chinese tax laws and concessionary bank financing.

For AID Global Bureau, Environmental Center, speaker and panelist on "Transferring Wind Energy Lessons Learned to Developing Countries" at the International Conference on Clean-Energy Partnerships: Developing Global Solutions in Seattle, WA. The talk and breakout session focused renewable energy cost trends and on the mechanisms to accelerate urgently needed deployment of renewable energy in developing countries.

For World Bank, authored a "Factsheet on Utility-Scale Grid-Connected Renewable Energy Power Plants for Developing Countries." Results from a study done for the Electric Power Research Institute and U.S. DOE on "Renewable Energy Technology Characterizations" are being adapted to possible applications in developing counties.

General Engineer, US Department of Energy, Washington, DC, 1976 – 1998. Primary responsibility as Wind Program Manager for planning and managing wind and other renewable energy programs.

As the Director of the Wind Technology Division, at DOE, supervising a staff of fifteen engineers, analysts, and clerical personnel managing a wind energy research, development, and deployment program with a $60 million annual budget. These programs played a key role leading to today's wind industry with over $1 billion in annual commercial sales of wind turbines in utility power systems in the U.S., Asia, Europe, South America, and the former Soviet Union.

As Chairman of the Chairman of the International Energy Agency (IEA) Wind Turbine Systems Agreement Executive Committee, with 17 member countries, conducting research, development and deployment program for wind technology, implementing policies to accelerate technology introduction.

For the Brazilian Government, evaluated technical and economic feasibility of installing wind power plants in several regions of the country. Assisted Electrobras in planning renewable energy policy and presented a three day technology training program for utility managers.

For Government of Ukraine, assisted in developing a joint venture with Kenetech Windpower to manufacture 100 kW wind turbines in Ukraine and to install a wind power plant in the Crimea. Reviewed project specifications, procurement requirements and other associated engineering details for this demonstration program.

For the former Yugoslavia, under a bilateral agreement organised a wind measurement program throughout the country. Plans were being developed for wind/diesel power plants when strained international relations terminated the program.

For the Ministry of Agriculture and Farm Machinery in Poland, developed a detailed plan for reducing dependence on coal fired power plants. The proposed project involved integrating wind plants with an existing pumped hydro power plant. Wind measurements and a national resource were completed. A Danish wind turbine manufacturer won the bid to build the project.

For Mongolia, assisted the aid mission in planning a renewable energy resource assessment for the country. Evaluated plans for a commercial wind power plant to be used to supply electricity to a local mining operation and reduce dependence on Russia for electric power.

Automotive Engineer, U.S. Army Tank and Automotive Command, Warren, Michigan, 1968 – 1976. Responsible for developing, field testing and deploying diagnostic test equipment for Army and commercial vehicles.

Industrial Engineer, Sharpe Army Depot, Stockton, California, 1963 – 1967. As Director of the Production Engineering Office, responsible for all plant and equipment needed for the overhaul of construction equipment, aircraft engines, and other Army equipment.

U.S. Army Reserve Lieutenant Colonel (Retired), 1963 –1991. Various line, staff, and command assignments, with service in Operation Desert Storm as Special Fuels Project Team Leader.

Education:

MS	University of Michigan, Industrial Engineering, Ann Arbor, MI, 1969
BS	University of Maine, Mechanical Engineering, Orono, ME 1963
Graduate	US Army, Command and General Staff College, 1980

Languages: English

JUNE Q. KOCH, Ph. D.

AREAS OF QUALIFICATION

Eighteen years of experience in the Russian and NIS market on construction and energy efficiency projects. Emerging market finance for industrial and municipal users in energy efficiency and construction, involving upgrades of industrial facilities, district heating systems, municipal housing, single family housing development with autonomous heat supply, new and existing hotels and office facilities; development of energy efficiency policy guidelines for Russian banks for financing; green field production of energy efficient building materials in the NIS; upgrading of existing plants; project development, management, and implementation.

EMPLOYMENT HISTORY

* President of CMT Consulting, February 1999 to present
- CEO of Construction Marketing & Trading, Inc., a Washington and Moscow based
- International consulting firm, 1987-1999
- Assistant Secretary for Policy Development and Research, U.S. Department of Housing and Urban Development, 1982-1987
- Deputy Under Secretary for Intergovernmental Relations, U.S. Department of Housing and Urban Development, 1980-1982
- Vice President, Koch Associates, a Washington based lobbying firm representing cities and states on issues of energy and construction policies 1976-1980
- Washington Representative for the Philadelphia Bicentenial Commission, 1974-1976
- Assistant Professor, Bryn Mawr College, 1970-74

PROFESSIONAL EXPERIENCE

Energy Efficiency: public sector

Dr. Koch has had extensive experience over a twenty- year period in initiating, financing, managing and implementing energy efficiency/ construction projects. She has both in the public and private sectors demonstrated great skill in working with senior government officials to achieve the consensus necessary for implementation of innovative projects.

As Assistant Secretary for HUD (U.S Housing and Urban Development Agency) (1982-87), she initiated privatization of public housing units coupled with the use of energy management companies to reduce the costs and increase the efficiency of heating in U.S. public housing by providing incentives for conservation. Savings achieved through the energy efficiency initiative were shared with the public housing resident/owners.

Also as Assistant Secretary, in early 1985, she was responsible for renegotiating a bi-lateral agreement between the U.S. and the Soviet Union. For three years under this agreement, she co-chaired with the Soviet Deputy Minister a Working Group on Internal and External utility Systems, with an emphasis on district heating. In addition to technology exchanges, under her aegis, the Working Group undertook renovation and installation of control systems in district heating systems in three Soviet cities. The group developed alternative financing mechanisms for such projects.

Public sector activity included chairing a committee at OECD on urban policy; chairing U.S. participation in the UN International Year of Women; and initiating and running a three-year series of seminars for large institutional investors in the U.S and Japan on innovative financial securities to increase investment in housing.

Private Sector: as President of CMTr

International Advisor to Working Group 2 of the UNDP project in the City of Vladimir (Capacity Building to Reduce Key Barriers to Energy Efficiency in Russian Residential Buildings and heat Supply), from mid-1998 to present.

Responsibilities include advising on development and implementation of autonomous boiler projects, development of policy, institutional issues involving ownership and maintenance; pricing mechanisms; financial models for installation of various systems, assist in tender process; assistance in coordination of federal and local levels.

Financial Consultant to the U.S Department of Energy under the Memorandum of Understanding on energy efficiency between the U.S. Department of Energy and the Russian Ministry of Fuels and Energy and the Russian Committee of Science and Technology under the Gore-Chernomyrdin Framework Agreement, from 1995-1998.

Dr. Koch's role was to, develop financing mechanisms and secure financing for joint U.S.-Russian municipal and industrial projects in Russia. Working with both the US and Russian agencies and private sector firms, Dr. Koch helped the firms develop projects endorsed by both governments. She then worked with the World Bank, EBRD, US Trade and Development Agency and AID, to secure financing for several projects.

These included the following:

Installation of automated control systems by Johnson Controls in the district heating system of the City of Zelenograd, $3.5 million grant for US Aid;

Energy efficiency upgrade undertaken by Energy Performance Services Inc., a US ESCO, for Karelsky Okatysh, an iron pelletiziing plant in Karelia., $10 million from the World Bank onlending program in Russia through Russian commercial banks; $1.5 million grant from NEFCO;

$489,000 grant for Dunkirk Radiators from the US Trade and Development Agency to install autonomous boilers in apartment houses in the city of Vladimir to monitor the efficiency of heat supply as compared to district heating; the project also included weatherization retrofit;

a grant of $350,000 from the US Trade and Development Agency for Owens Corning to undertake a Feasibility Study with a Moscow Region mineral wool facility on production of fiber glass insulation;

Organized and Led Seminar on Energy Efficiency, February-March 1995

With the co-sponsorship of the US Department of Energy, the Russian Ministry of Fuels and Energy and the Russian Ministry of Construction, Dr. Koch organized and led a three day seminar on energy efficiency in construction for 200 Russian local officials and private firms participating in the UN-sponsored Energy Zones Demonstration Cities in Russia. Presenters at the seminar included the following firms: Carrier Air Conditioners, Johnson Controls, Owens Corning, Dunkirk Radiator, Lockwood Greene Engineering, Radva Corporation.

Moscow Representative Office for the US Department of Commerce CAHNIS grant to transfer US energy efficient home-building technology and capacity building in Russia, 1993 to 1996

Dr. Koch organized a series of seminars and training sessions for Russian builders in the cities of Moscow and St. Petersburg on how to work with energy efficient building materials.

CEO, Construction Marketing &Trading, Inc. (CMT), from 1987 to 1999

Dr. Koch supervised a network of client activity in the former Soviet Union, Eastern Europe and Turkey involving production, construction, development, marketing, financing, and distribution with an emphasis on construction and energy efficiency.

Clients were generally major companies and included the following: Ace Hardware, Allied Plywood, American Standard, The Beacon Company, Energy Performance Services, Inc a division of PECO), Grinnell, Interface Carpet Tiles, JA Jones Construction Company, Johnson Controls, KPMG, Lockwood Greene Engineering, Otis Elevators, Owens Corning, Partek, Pepsico, Reynolds International, Ryland Homes, Senco Tools, Tishman Speyer Properties, Weiler and Company.

Assistant Secretary of HUD Activity, 1982-87

Responsibilities included administering a staff of 300 and a yearly $80 million fund for demonstration projects and studies designed to shape and improve US housing and urban policy.

EDUCATION

Ph. D. Economic Theory dealing with government treatment of the Poor, Columbia University, 1968

M.A. English, Temple University, 1962

B.A. Political Science and English, Brooklyn College, 1958, Magna cum laude, Phi Beta Kappa.

AWARDS, MEMBERSHIPS

US National Endowment for the Humanities Grant, 1975
Government Service Awards from the World Conference of Mayors, National Association of Neighborhoods, National Conference of Mayors, and numerous City and State governments.

Member of the Boards of NCI Research, the Institute of Urban Economic Development; member of the council of Excellence in Government

MARITAL STATUS

Married with five grown children

FREDERICK H. MORSE , Ph.D.

TECHNICAL EXPERTISE

Assessment of policy, planning, management and strategy for large, complex private sector or government programs in energy technology. Advising domestic or international business, utility, or government on strategic market investment and technology opportunities in energy and environment, with emphasis on renewable energy technologies. Identification and development of business opportunities for the provision of energy services to rural areas in developing countries.

EDUCATION

Ph.D. Stanford University, Mechanical Engineering, 1966
M.S. Massachusetts Institute of Technology, Nuclear Engineering, 1959
B.M.E. Rensselaer Polytechnic Institute, Mechanical Engineering, 1957

BACKGROUND

Forty years in responsible business, government, and university positions, including:

- Founder, Rural Investment Opportunities, Inc., 1996 – 2000
- President, Renewable Energy Consultants, Inc., 1990 – present
- President, Morse Associates, Inc., 1989 – present
- Director, Office of Solar Heat Technologies,
  U.S. Department of Energy, 1981 – 1989
- Director, Office of Solar Applications,
  U.S. Department of Energy, 1979 – 1981
- Chief, Solar Heating and Cooling R&D,
  U.S. Department of Energy, 1976 – 1979
- Manager, Solar Energy Program,
  National Science Foundation, 1972 – 1973

PROFESSIONAL EXPERIENCE

Morse Associates, Inc., Washington, DC, 1989 – present

President. Energy and environmental consulting for domestic and international, government and private business clients. Clients include:

- American Solar Energy Society (ASES)
- Argonne Naitonal Laboratory
- Bechtel Hanford, Inc.

- Center for Resource Solutions
- Commission of the European Communities (CEC)
- Conphoebus (Italy)
- CORE International, Inc.
- Danish Technological Institute
- Danish Energy Agency
- de Lucia and Associates, Inc.
- Duke Solar
- Ecofys (Netherlands)
- Edison Electric Institute
- Energy Center Denmark
- Energy, Mines and Resources Canada
- Esbensen Consulting Engineers (Denmark)
- Florida Solar Energy Center
- Global Environment Facility (GEF)
- Idaho Power Company
- International Energy Agency (IEA)
- IEA Executive Committee for Demand-Side Management
- IEA Executive Committee for Energy and Environmental Technologies Information Centers
- IEA Executive Committee for Heat Pumping Technologies
- IEA Executive Committee for Hydrogen Use
- IEA Executive Committee for Photovoltaic Power Systems
- IEA Executive Committee for Solar Heating and Cooling
- Italian Electricity Authority (ENEL)
- Italian National Agency for New Technology, Energy, and the Environment (ENEA)
- Jefferson Waterman International
- Kearney & Associates, Inc.
- Lockheed Martin
- Idaho Technologies Company
- Luz Development and Finance Corporation
- National Renewable Energy Laboratory (NREL)
- Netherlands Agency for Energy and the Environment (NOVEM)
- Oak Ridge National Laboratory
- Organization for Economic Cooperation and Development (OECD)
- Ontario Ministry of Energy (Canada)
- Piers Consultancy (Netherlands)
- Rural Investment Opportunities, Inc.
- Sandia National Laboratory
- Science Applications International Corporation (SAIC)
- Solar Energy Industries Association (SEIA)
- Swedish Council for Building Research
- Swedish National Board for Industrial and Technical Development (NUTEK)
- Swiss Federal Office of Energy
- Swiss Agency for the Environment, Forests and Landscape
- Triangle Trading and Engineering Company (Egypt)
- U.S. Agency for International Development (AID)

- U.S. Energy Information Administration
- U.S. Department of Energy
- United Nations Foundation
- United Solar Systems Corporation
- University of Central Florida
- University of Fribourg (Switzerland)
- Windborne AB (Sweden)
- World Bank / Global Environmental Facility (GEF)

Renewable Energy Consultants, Inc., Washington, DC, 1990 – present

President. Executive level advice, information and services for the planning, analysis, and integration of renewable energy options for future utility systems. Clients include:

- American Public Power Association
- Boston Edison Settlement Board
- Edison Electric Institute
- Energy Foundation
- Energy Initiatives, Inc.
- Fleming Group
- General Public Utilities International, Inc.
- GPU International, Inc. (GPUI)
- Hansen, McOuat, Hamrin & Rhode, Inc.
- MRS Enterprises
- National Institute of Standards and Technology
- National Renewable Energy Laboratory
- Reedy Creek Energy Services
- Tunisian Agency for Energy Management
- U.S. Department of Energy
- Virginia Department of Mines, Minerals and Energy

Rural Investment Opportunities, Inc., Maryland, 1997 – 2000

President. Project development for the provision of rural energy services based primarily on renewable energy technologies, such as PV and wind, in developing countries. Clients and interested investment partners include:

- GPU International
- Genesis Power, Ltd.
- CEMIG - The Electric Utility Company of Minas Gerais, Brazil
- COPASA - The Water Company of Minas Gerais, Brazil
- New Energy Options, Ltd. (Brazil)
- Amoco/Enron Solar Power Development
- E & Company
- Neste Advanced Power Systems (Finland)

U.S. Department of Energy, Washington, DC, 1976 – 1989

Senior Executive. Significant role in all management aspects of the U.S. solar energy program since its inception in 1972. Held three senior management positions: Director of the Office of Solar Heat Technologies, Director of the Office of Solar Applications, and Chief of Solar Heating and Cooling. Responsible for the development, implementation and management of a highly diversified major government solar energy research, development and commercialization program with annual budgets of up to $250 million. Major responsibility for the active, passive, solar thermal electric, and photovoltaic technologies. Managed a staff of forty-five professionals and the work of several national laboratories, U.S. Department of Energy field offices, and regional solar energy centers. Worked closely with industry, utility, and other elements of the private sector to develop long-range plans for technology development which reflected industry needs and viewpoints.

Senior Executive – International. Represented the United States in numerous international renewable energy organizations and programs, including senior U.S. representative to the International Energy Agency Renewable Energy Working Party; Chairman, International Energy Agency Review Advisory Board For Renewable Energy; Chairman, Vice-Chairman and senior U.S. representative, International Energy Agency Solar Heating and Cooling Executive Committee; Director and U.S. representative, NATO Solar Energy Pilot Study and senior U.S. representative for Solar Energy Bilateral Agreements with Australia, Israel, Mexico, Spain and the United Kingdom.

University of Maryland, College Park, MD , 1968 – 1976

Professor of Mechanical Engineering. Taught courses in heat transfer, thermodynamics, advanced energy conversion, and solar energy technologies. Conducted research in solar cooling systems. Organized and managed a pioneering assessment of solar energy as a national energy resource for the White House Office of Science and Technology.

National Science Foundation, Washington, DC, 1972 - 1973

Manager. While on leave from the University of Maryland to the National Science Foundation, was responsible for developing the first national solar energy research and development program plan. Established the photovoltaics and wind energy conversion programs and advised senior NSF management on solar energy policy and program issues.

INDUSTRIAL EXPERIENCE

Engineer. 1959 - 1968. Employed at various times at General Electric, Northrup Aircraft Company, Atomics International, Swiss Federal Institute for Reactor Research, Lockheed Research Laboratory, and AVCO Space Systems. Work included large steam turbine development, advanced jet propulsion development, design of nuclear reactor components, fluid dynamics research and re-entry physics experimentation.

CONSULTING EXPERIENCE

Consultant. 1959 - 1976. During this period consulted for the American Instrument Company, Development and Resources Transportation Company, National Oceanographic and Atmospheric Administration, White House Office of Science and Technology, World Bank, Energy Research and Development Administration, National Geographical Society, Intertechnology Corporation, National Science Foundation.

PROFESSIONAL ORGANIZATIONS

American Solar Energy Society - Member, Board of Directors	1972 - present
International Solar Energy Society - Vice Chair, Board of Directors	1973 - present
Passive Solar Industries Council - Member, Board of Directors	1980 - present
Solar Energy Industries Association	1989 - present
Environmental Advisory Council, Earth Day/1990	1989 - 1990
International Policy Institute - Member	1991 - present
Energia Global, Inc. - Advisory Council	1993 - present

HONORS

- Elected Fellow of the American Solar Energy Society, 2000
- Associate Editor, Advances in Solar Energy, Plenum Press, 1990
- Solar Energy Industries Association Citation for outstanding support of the industry, 1987.
- American Solar Energy Society Charles Greeley Abbot Award for contributions to the field of solar energy and the society, 1986.
- Passive Solar Industries Council - Certificate of recognition for promotion of passive solar and the betterment of the construction industry,1984.
- Nominated by the Department of Energy for Distinguished Contribution to Research Administration Award, 1981.
- Solar Energy Industries Association Citation for leadership and outstanding support of the solar energy industry, 1980.
- Special Act of Service Award, U.S. Department of Energy, for outstanding leadership in planning and promoting the Solar Cooling and Heating Program, 1979.

APPENDIX 1.2:
SUPPORT AND ENDORSEMENT LETTERS FOR THE PROJECT

Letter from GE Capital Financing Letter dated 6 February 2003

Letter from the Russian Federation Energy Commissioner December 2002 (English and Russian)

Letter from Leningrad Oblast Government, March 2003

GE Capital

Steven W. Howlett
Senior Vice President

GE Capital Markets Services, Inc.
A unit of General Electric Capital Corporation
1299 Pennsylvania Avenue, N.W., Suite 1100W
Washington, DC 20004-2407
202 637-4410, DC 8*212-4410
Fax 202 637 4461, 8*227 4461
Steve.howlett@corporate.ge.com

February 6, 2003

Daniel F. Ancona
Princeton Energy Resources International
1700 Rockville Pike, Suite 550
Rockville, MD 20852

Re: St. Petersburg Wind Project

Dear Mr. Ancona:

On behalf of GE Wind Energy ("GE Wind"), GE Capital Markets Services, Inc. ("CMS"), an indirect wholly-owned subsidiary of the General Electric Company ("GE"), we would like to thank you for including GE Wind in discussions regarding the development of a 75MW, $100MM wind power plant in the region of St. Petersburg (the "Project").

While GE Wind and CMS believe that our discussions regarding the Project, and any participation by GE Wind therein, are at a preliminary stage, CMS, on behalf of GE Wind, would propose to assist you in obtaining the financing necessary to fund the Project including the purchase of the GE Wind equipment. The form that such financing will take, including without limitation its pricing, tenure and definitive structure, can not be proposed with any specificity at this time.

Our ability to ultimately assist you in obtaining the required financing will depend on many factors, including without limitation your ability to provide satisfactory wind data, the successful negotiation of a power purchase agreement with Lukoil and Transneft and a determination by us and/or a prospective lender that the necessary legal and regulatory framework in Russia will be conducive for the successful completion of the Project.

By acceptance of this letter, you acknowledge that none of GE, GE Wind, CMS or any of their affiliates have committed to you to participate in the Project or to provide or obtain for you any financing in connection therewith.

We look forward to continuing our discussions with you.

Sincerely,

Steven W. Howlett
Senior Vice President
International Customer Finance
General Electric Company

ПРЕДСЕДАТЕЛЬ
ФЕДЕРАЛЬНОЙ ЭНЕРГЕТИЧЕСКОЙ КОМИССИИ
РОССИЙСКОЙ ФЕДЕРАЦИИ

103074, Москва, К-74,
Китайгородский пр., 7
тел. 220-40-15

№_____

На №125 от 16.10.2002

Генеральному директору
АО «Инвестэнергострой»
КИРИЛЛОВУ Ю.И.

Генеральному директору
АОЗТ «Лидесы»
АНИСИМОВУ А.Д.

По вопросу строительства
в Ленинградской области
ветроэнергетической станции

Федеральная Энергетическая комиссия Российской Федерации принципиально поддерживает строительство ветроэнергетической станции (ВЭС) в Ленинградской области.

Осуществляя поддержку «пилотного» проекта в России по строительству в Ленинградской области ВЭС мощностью 75 МВт, ФЭК РФ считает необходимым в составе этого проекта, на основании имеющихся в России материалов, разработать Концепцию строительства ВЭС в ближайшей перспективе на территории регионов России с высокими параметрами ветра.

Разработка «пилотного» проекта ВЭС с оценкой перспективы развития ветроэнергетики в России в целом позволит предложить правительству РФ механизмы и масштабы дотаций на поддержку и развитие ветроэнергетики как экологически чистой новой энергетической отрасли.

Для выполнения комплекса работ по перспективе строительства ВЭС в регионах РФ, экономического обоснования тарифов на электроэнергию, отпускаемую ВЭС на оптовый рынок, механизмов возврата заемного капитала и стабильной работы на энергетическом рынке России, необходимо выполнить комплексное «Технико-экономическое обоснование с разработкой бизнес-плана строительства и эксплуатации ВЭС 75 МВт в Ленинградской области».

Такую работу можно поручить «Международному Российско-Американскому Институту проблем регулирования естественных монополий и ресурсосбережения» с привлечением американских и других зарубежных специалистов.

С уважением,

Г.П. Кутовой

CHAIRMAN
OF THE FEDERAL ENERGY
COMMISSION
OF THE RUSSIAN FEDERATION

Kitaigorodsky pr., 7
103074 Moscow, K-74

Tel. 220-40-15

Attn.: **Mr. Kirillov Ju.I.**
General director
AO Investenergostroy

Attn.:**Mr. Anisimov A.D.**
General director
AOZT Lidesm

Re: ***Construction of the Leningrad Wind Power Plant***

The Federal Energy Commission of the Russian Federation supports in principal the construction of the Wind Power Plant in the Leningrad region.

Supporting this "pilot" project in Russia for construction of 75 MW Leningrad wind power plant, the Federal Energy Commission considers necessary within the project basing on the materials available in Russia to develop the Concept of wind power plants construction in different regions with high wind potential in Russia.

The development of the "pilot" wind power plant project and evaluation of projections for wind power industry in Russia in general will allow to suggest the government the mechanisms and scales of subsidies for support and development of the wind power industry as a new clean energy branch.

For realization of the works related to the projections of wind power plant installation in Russian regions, determination of wind power tariffs supplied to the wholesale market of Russia, determination of mechanisms of loan capital repay and stable work at the power market of Russia it is necessary to fulfill the complex Feasibility Study and to develop the Business Plan for construction and operation of 75 MW Leningrad wind power plant.

Such Study could be done by the International Russian-American Institute of Problems of Regulation of Natural Monopolies and Resource Saving together with American and other foreign specialists.

Best regards,

(signature)
G.P.Kutovoy

PLACE HOLDER:

LETTER FROM VICE GOVERNOR GRIGORIEV OF LENINGRAD OBLAST

APPENDIX 1.3:
MARKET SURVEY AND POWER CUSTOMER ACQUISITION

Marketing Sample Letter

Sample Questionnaire

Sample Results from Survey of Large Industrial Energy Consumers

Issues Raised by Companies Included in the Survey

Project Implementation Process Plan

CMT
Consulting

20 November 2001

Gilbert Holmes
General Director
Caterpillar-Tosno
1/1Moskovssoye Shosse
Tosno 187000

Fax: 7(812) 118-4215

Dear Mr. Holmes:

ABB Wind-US, a division of ABB, Inc., is working under a US Trade and Development Agency supported grant together with a Russian partner, Lidesm, a St. Petersburg design and engineering firm, on a Feasibility Study for a Leningrad Region Wind Power Plant. The Feasibility Study began with a signing ceremony at the US Consul General's residence on November 13 and then involved exploration of several potential sites for the wind power plant in the Leningrad Region. Anemometers will be placed at these sites to measure the wind regime over the course of the 12- month duration of the Study. The project proposes to establish a utility scale plant of 75 MW providing green electricity thorough the grid at stable and competitive rates. As UES and its regional Leningrad counterpart undergo a structural transition and as investments in upgrades planned by the Russian government are implemented, tariffs for electricity in the region are anticipated to rise over the next few years. ABB's planned Wind Power plant could provide an alternative source of electricity for industrial facilities anticipating growth in electricity demand.

The ABB team has been fortunate in garnering preliminary support for the project from Leningrad Region authorities and the Commissioner of the Regional Energy Commission, as well as heads of the administrative regions we have visited. We expect to work with these regional and with federal authorities to produce clean and competitive electricity for the Leningrad Region.

Our firm, CMT Consulting, which has assisted US firms in the Russian market since 1987, is part of the ABB team and is responsible for helping to identify potential customers for the electricity to be produced by the proposed the wind power plant. In May of 2002, we will be holding a Seminar in St. Petersburg for potential users and leadership in the region on all aspects of our project and its progress. As part of our effort to identify and help educate potential consumers, Alexander Anisimov, President of Lidesm, and I hope to be able to meet with you over the next two months, to discuss the project and have you fill in a brief questionnaire on your current and anticipated electricity demand.

P.O. Box 60740
Potomac, Md. 20854

Phone 301-251-9150
Fax 301-251-5478
E-mail:cmt_usmos@ibm.net

June Q. Koch, Ph.D.

SAMPLE MARKETING LETTER

I have asked Zina Usdpenskaya, CMT's St. Petersburg coordinator, to contact you to set up such a meeting. Michael Richardson, the US Principal Commercial officer, in St. Petersburg, can be contacted for further information on our TDA grant activity.

Sincerely,

June Q. Koch, Ph. D.
President

Leningrad Wind Power Plant	**Prospective Green Electricity User – Questionnaire** Lidesm - CMT ***Business Sensitive – Private Information***	**Score:** ***Official Use Only*** ***#2 Interested engineering managers. Would be interested rather in shared power supply to avoid risk. Gen.Director originally declined consideration.***

Attempted Contacts: (Note the date -time for attempts made to contact participants and comment on message left – asked when to call back.)	*1–30.11.01*	*2–17.12.01*	*3–8.01.02*
Company Name:	**OOO "Caterpillar Tosno"**		
Address:	**1/1 Moskovskoye Shosse, Tosno, 187000 Leningradskaya Oblast, Russia**		
Director's Name:	**Gilbert Holmes, General Director**		
Director of Electric Power Purchasing - Name:	**Alexey Vladimirovich Chernyshov, Chief Power Engineer. Konstantin Valentinovich Dukul, Chief Engineer**		
Telephone Number:	Phone: **(812) 118-4210**	Fax: **(812) 118-4215**	

1. Prior electricity demand? (year 2000)

Average Demand: (Megawatt-hours per month): **500,000-600,000 kWh** 500-600 kWh	Peak Demand: (Megawatts) and What month: **700,000 kWh (depending on production schedule, not related to season or month)**	Price rubles per kilowatt hour: **appr. R 0.4**	Any problems in supply, price fluctuation, etc.:

2. Current electricity demand? (year 2001)

Average Demand: (Megawatt-hours per month): **800,000 kWh**	Peak Demand: (Megawatts) and What month: **1,200,000 kWh (depending on production schedule, not related to season or month)**	Price rubles per kilowatt hour: **R 0.55** (.5¢)	Any problems in supply, price fluctuation, etc.: **reliability, power quality, rates**

3. Projected electricity demand growth? (year 2002 through 2005)

Average Demand: (Percentage increase in MW-hrs/ month): **possible**	Peak Demand: (Percentage increase in peak demand):	Price increases expected (rubles per kilowatt hour)::	Notes and issues:

4. Financial/Business Information

Production/business Activity: Yearly Turnover, in Rubles/year:	Export Activity: Yearly Turnover, in Rubles/year:	Projected increase (Percentage per year-next five years): **possible**

5. Interest in clean energy sources? Please explain.

As an alternative to the state monopoly

6. Financial stability - Credit/ Payment Reliability or Reputation:

Assured

7. Are there any other benefits that their company would gained from this activity?

Interviewer Name: Zinaida Uspenskaya	Signature:

SAMPLE QUESTIONNAIRE

Summary Table
(results of inquiries of energy consumers)
St.-Petersburg

No.	Company	Address	Demand in power MWh/month		Cost Rub./kWh		Projected demand growth in 2002-2005 in %/month	Expected increase of cost in Rub./kWh	Note
			2000	2001	2000	2001			
1.	OAO Sevkabel		1240,0	1300,0	0,3482	0,4352	0,42	1,28	The potential customer is attracted by steady prices for several years
2.	FGUP RNC Prikladnaya Chimiya		2610,0	2750,0	0,3392	0,4240	0,42	1,225	- " -
3.	AOOT Nevsky Zavod		5000.0	5250,0	0,3420	0,4275	0,42	1,28	- " -
4.	OAO Izhorskiye Zavody		31730,0	33400,0	0,3370	0,1212	0,42	1,25	- " -
5.	OAO Zavod Turbinnyh Lopatok		3690,0	3881,0	0,4850	0,6059	0,42	1,5	- " -
6.	GUP Gorelekrotrans		63650,0	67000,0	0,3326	0,4157	reduction of 0,166	1,25	- " -
7.	GUP Vodokanal		63330,0	66667,0	0,3358	0,4197	0,42	1,3	- " -
8.	OAO Russkiye Samotsvety		620,0	651,0	0,6352	0,7940	0,5	1,5	- " -
9.	OAO Shipbuilding company Almaz		630,0	660,0	0,3694	0,4617	0,40	1,4	- " -
10.	OAO Engineering Plant Arsenal		2470,0	2575,0	0,5624	0,7030	0,40	1,4	- " -
11.	ZAO Kirov TEK		17260,0	18166,0	0,4694	0,5868	0,34	1,5	- " -
12.	OAO Krasny Oktyabr		2500,0	2541,0	0,3470	0,4337	0,5	1,3	- " -
13.	AOOT Leningradsky Metallichesky Zavod		6000,0	6250,0	0,4998	0,6248	0,42	1,4	- " -
14.	OAO Zavod Magneton		850,0	850,0	0,4478	0,5598	0,5	1,2	- " -
15.	OAO NPF Pigment		890,0	905,0	0,5940	0,7425	0,5	1,4	- " -
16.	OAO Petrolesport		1320,0	1341,0	0,4532	0,5665	0,4166	1,2	- " -
17.	OAO Svetlana		3375,0	3375,0	0,4893	0,6116	0,5	1,4	- " -
18.	GP Leningradsky Severny Zavod		600,0	748,0	0,5011	0,6264	0,5	1,3	- " -

Comments, Questions and Concerns
Frequently Formulated by Companies Contacted

1. Guaranteed supply (no interruptions, consistent parameters). Category of power supply.
2. Quality of power supplied (basically, same as No.1).
3. Can it happen that there will be long idle periods due to lack of wind?
4. How will a customer be supplied during the periods when the wind plant is inoperative?
5. Transportation via RAO/Lenenergo's network. –
   Interaction/cooperation between the supplier (wind plant) and the transportation organization (Lenenergo)/
   Will Lenenergo allow it at all, considering it is going to be "competition" power?
   If they allow it, won't the transportation charges be prohibitively high?
6. What is the tariff going to be? Based on two rates, or one rate? (Generally, companies pay on the basis of two rates: one for each kWh, and the other on the basis of the installed capacity).
7. What is the required wind velocity/force for the wind turbines to be operable?
8. Technical issues related to power accumulation, transformation and transportation.
9. Security of the plant.
10. There are precedents of trilateral agreements for power supply. Can it be that such agreements can be concluded in this case?
11. Suggestion: A useful principle would be to provide a system whereby two independent lines are connected to the customer from two independent suppliers, with a switching capability in case of power interruption in one line. (*I do not offer any comments to this!*)
12. It would be useful to provide a video to show the principle of operation and some actual plants.

DATE: April 19, 2002

TO: Bill Snyder

FROM: June Koch, Task 4 Deliverable

SUBJECT: Report on Implementation Process for Establishing and Operating the Leningrad Wind Power Plant and Dealing with Institutional and Regulatory Issues

CC: Dan Ancona, Fred Morse, Alexander Anisimov, Zina Uspenskaya have all reviewed and provided input .

STEP 1: ABB Sets up a Joint Venture Company (IPP) in Russia

Timetable: The end of 2002 and/or the first quarter of 2003

While foreign firms are legally able to set up wholly owned subsidiaries in Russia (as has been done in the Leningrad Oblast by, for example, Ford, Pepsi, Gillette), the IPP should be established as a joint-stock company with Lidesm so as to take advantage of Lidesm's capability of dealing expeditiously with all needed approvals, permits, and oblast and local incentives. Lidesm's contribution would be this ability to bring the plant to operation. The difficulties encountered by Gillette in dealing with its power supply and by Ford in commissioning are indications of the advantages of having a capable local firm, such as Lidesm, as part of the IPP.

Process of Setting up the Fund

Such joint stock companies can be established as either closed (to the original investors) or open, so that shares can be sold publicly. The process for setting up a joint venture company in Russia is very clearly defined and straightforward and can be done within a few months. A key issue is the size of the Charter Fund and whether this should be the nominal minimum or the amount required for implementing and operating the plant. If we learn from the consulting firm, ST Inter, that VAT can be eliminated by how the ABB investment is handled in relation to the Charter Fund, then we may want to increase the Charter Fund. ABB lawyers in Moscow will advise on this, as well, and will know all the steps necessary to set up the Joint venture. Anisimov is very knowledgeable about setting up joint ventures, as well.

Open or Closed Joint Venture

Anisimov currently believes that the IPP could be established through a governmental decree, thus obtaining maximum tax advantages on all levels, and should be an open joint venture company so as to attract investment from governmental structures as well as major investors. This could be a very long process, and, in my view, not, at present, the optimal path for consideration, but we will know more about the likelihood of Russian government support after we meet with them later this year and when we have a report from Helmut Schreiber of the World Bank GEF Fund whether or not the Russian government is going to support a renewable initiative in Leningrad Region.

A further consideration is that if our financing comes from IFC and/or EBRD, they may not want an open joint venture allowing further dilution of shares.

Once formed, the Joint Venture is registered with the tax inspection, social funds, and opens bank accounts. Social funds are set asides (taxes) required for company employees; this percentage has been sharply reduced in the last year and will be almost nominal.

BEFORE STEP 1: ABB Signs a Preliminary Investment Agreement with the Leningrad Oblast

Timetable: Third or fourth quarter of this year while the Feasibility Study is still underway.

Naryshkin, Chairman of the Leningrad Region Government Committee for External Economic and International Relations, has expressed to Anisimov his interest in beginning the drafting in May of such an Investment Agreement between the Leningrad Oblast government and ABB as the key investor in the planned plant. The Agreement would formalize the advantages to be provided by the Oblast in regard to taxes, leasing or purchase of land, incentives, access to the power grid, possible governmental investments, etc. and ABB's planned investment.

ABB would sign this preliminary Agreement with the right to transfer its authority to the IPP Joint Stock Company once it is established. Anisimov could represent ABB in the drafting stages of this Agreement.

Such an Agreement would be necessary to trigger support from GEF and the financing institutions we are working with.

Role of ST Inter Consulting Firm
Since Naryshkin recommended that we work with ST Inter and relies on them as his arm for investment analysis, we should go forward with our work with them. This work needs to be completed as part of the preparation of the Business Plan as we are negotiating our Preliminary Agreement with the Oblast.

Replication
As we have been informed by the various GEF representatives we met in Washington, GEF support is dependent on the structural changes or initiatives the Oblast or the Russian government will put in place to allow for replication of our project. Certainly, it is to the advantage of both the Oblast and ABB to include a clause in the Agreement dealing with continued benefits for future projects in the Oblast.

STEP 2: The IPP registers its rights to participate in the federal and regional power markets.

Timetable: Second and third quarter of 2003.

Once registered, the IPP can get approval for its tariffs, negotiate transit tariffs and sign final agreements (PPA's) with consumers.

As noted in the March 8 memo on Institutional and regulatory Issues, being registered to deal in the power market is a complex political and by no means easy process.
There are several ways to deal with this issue.

(1) Register the Joint Stock Company as a subsidiary of Kirillov's company. Kirillov's company is registered by the Russian Federation to participate in the power market. As Anisimov's long-term colleague and partner, he would no doubt cut some deal with Anisimov or with ABB for a piece of the joint venture in return for the registration capability. This is perhaps the easiest route to obtain the necessary registration since registration is already in place. Currently Kirillov's company operates in southern Russia, but it has the capability to participate in the power market throughout Russia.

(2) Cut a deal with the Electronic Electricity Exchange as both an investor and consumer of the wind power. This entity is registered and is on a scale of significance far exceeding that of Kirillov's company. A potential problem is that the 14 major industrial consumers in the Exchange all seek cheap power. This can perhaps be overcome by support from the Russian government for the wind power project if it provides incentives or mandates some percentage of clean energy requirements. If the World Bank GEF initiative on renewable energy in Russia goes forward, the federal government is likely to provide such incentives, such as, for example, portfolio pricing standards.

(3) Work with Lenenergo as a potential investor and consumer so that their registration as a utility can devolve on the IPP, or be transferred in some way to the IPP.

(4) Obtain support from the federal government (which is what Anisimov thinks is possible) to set up the IPP and provide it with participation authority. This option requires more and direct federal government support than the second option and is difficult to accomplish.

STEP 3: FINANCING AND MARKETING

Timetable: Third and fourth quarter of 2002. In tandem with the setting up of the IPP

ABB will not set up the IPP unless it is clear that financing can be put in place, and financing from EBRD or IFC will not be committed unless ABB/IPP has a preliminary commitment from one or more major consumers acceptable to the International Financing Institutions (IFI's).

<u>Major Potential Captive or Wholesale Consumers</u>
We have identified four such potential consumers, including the Port of Primorsk, the Port of Ust-Luga, Lenenergo, and the Electronic Exchange. Any one of these or some combination of these would be acceptable to the IFI's. In order to strengthen ABB's ability to conclude PPA's with Lenenergo and the Exchange, we have in our Market Survey explored interest on the part of US and European production companies in the Leningrad Oblast since such interest among large, financially sound industrial users could be decisive factors for either Lenenergo or the Exchange.

Industrial Consumers

Currently, of the 30-40 foreign or joint venture industrial consumers included in our Market Survey, those firms which expressed strong interest in our project and most likely to become consumers of our wind power either through Lenenergo or the Exchange, or in the worst case scenario, directly from the IPP, include the following:

Wrigley St. Petersburg – 100% US owned; manufactures gum; and has a green policy

Gillette – Majority US owned; manufactures razors

ICN Oktyabr – Majority US owned; produces pharmaceuticals

Otis St. Petersburg -100% US subsidiary; manufactures, installs, services elevators

Caterpillar Tosno LLC – Majority US owned; manufactures construction equipment

Ford Motor Company- Majority US owned; manufactures cars

Pepsi Bottling Company Russia – 100% US owned

Unilever-CIS – UK and Dutch owned; produces shampoo, deodorants, detergents

Era-Henkel – Majority German owned; produces detergents

Pobeda-Knauf – 100% German owned; produces bricks and associated products

Bravo International – Dutch owned; produces beer and soft drinks

Baltika Brewery – Finnish and Swedish owned; brewery (largest in Russia)

Kappa Packaging - Dutch owned;

Vena Brewery – Finnish and Denmark

Ilim Pulp – Partly owned by Knauf of Germany; two plants in the region; integrated cardboard and printing plant, and paper factory.

Agreements and Investors

The Business Plan and Prospectus should be completed by late September or early October, at which time we will begin serious negotiations on PPA's and simultaneous negotiations with the IFI's, GEF and NEFCO.

Other investors may be Russian, such as the port, a Russian bank (two of the largest will attend the Seminar) the Electronic Exchange, and Lenenergo and UES, which could participate with direct financing or, more likely, by financing the construction of power lines, substations, or transit subsidies. One can anticipate also that IFC or EBRD, if needed, would syndicate the rest of the required loan.

NOTE: We will need to schedule first meetings while we are in St. Petersburg for the Seminar with the Moscow head of the Electronic Exchange, with the representatives of both ports and Lenenergo. Certainly, we will then want to have meetings with them at their headquarters when we return to Russia, presumably in late summer or early fall.

STEP 4: NEGOTIATONS ON KEY INCENTIVES AND ISSUES

A. With the Russian Government on Tax Incentives and Benefits
B. Finalize Negotiations with the Oblast
C. With the Oblast Regional Commission on Tariffs and Transit Fees
D. With the Local Government on Lease Agreement

Timetable: These activities start following the Seminar in May and continue on parallel tracks with Steps 1 through 3, to be completed by the end of the second quarter of 2003.

The first step, dealing with the Russian government is key to completing our Business Plan and needs to be started soon after the seminar. Steps C and D are dependent on success with the Russian government and the wind data outcomes, although in regard to government incentives, the Leningrad Oblast may turn out to be equally important and pro-active in providing the needed benefits. We will be dealing with the Oblast government on the preliminary Agreement shortly after the seminar and before we go to Moscow since it is important to have the Oblast lobbying on our behalf.

A. Russian Government Benefits and Incentives for Wind Power

Several attendees coming to the seminar are from the Russian Ministry of Fuels and Energy, with a speaker from their department on renewable energy. Participants are also coming from the Russian Ministry of Science and Technology, which has an influential group dealing with energy efficiency and renewable energy. Dan's report at the Seminar on benefits and incentives used in Europe and the US are of great importance for these federal participants, and they will help us get the message to Moscow.

However, we will need to deal with the federal government at the highest levels with the Ministry of Economy, which is far more progressive and influential than the Ministry of Energy, and with the new Minister of Natural Resources, as yet an unknown quantity but rumored to be very capable and influential, with the UES Carbon Fund, and perhaps the Ministry of Finance, as well. Since the legislative route is too long and anyway, under Putin, is totally controlled by the Kremlin, we are aiming at getting a Presidential Decree on Wind Energy and our Project. We have yet to learn whether any of our attempts to get our project on the St. Petersburg Summit Agenda will bear fruit.

NOTE: We will need a meeting in Moscow in late summer or early fall, and I would start setting this up with letters and discussions after the seminar.

B. Oblast Agreement Completed

The timetable for finalizing negotiations with the Oblast is when we have completed the Feasibility Study. Given that the met towers were installed later than had been planned, there is likely to be some slippage on our timetable for turning in the final report to TDA from the planned terminus in November 2002 to some time at the beginning of 2003. TDA generally has no problem with such a delay.

C. Negotiations on Tariffs and Transit Fees

Very preliminary discussions on tariffs have already begun with Lev Khabatchev, the Chairman of the Leningrad Regional Energy Committee. These will need to be pursued and finalized as we near completion of the Business Plan and have gathered sufficient wind data and other necessary data.

D. Lease Agreement

ABB has expressed its interest in having Lidesm undertake the lease agreement with the local administration or authorities as likely to result in the most favorable arrangements. The lease agreement would stipulate that leasing authority will then be turned over to the IPP. Negotiations can begin after determination of the most suitable site sometime in the fourth quarter of this year.

STEP 5: THE IPP PREPARES BIDDING DOCUMENTS FOR CONSTRUCTION, INCLUDING ALL ASPECTS OF LAND AND INFRASTRUCTURE; THIS STEP ASSUMES SUCCESS IN THE PREVIOUS STEPS AND COMPLETED PPA'S AND FINANCING

Timetable: Third and fourth quarter of 2003

Approvals both for the Bid Documents and through the Construction Process

Lidesm, as a participant in the IPP, will be responsible for obtaining all the needed approvals from detailed design, with adjustments to Russian requirements, to certification of equipment to be imported, through adjustment of the equipment in start-up to commissioning. Commissioning requires acceptance from representatives of the government supervising authorities: sanitary, environment, power, technical, and representatives of the Oblast Administration.

Every step of the process requires approval from the Oblast authorities, usually from the Committee of Fuels and Energy or the Regional Energy Commission through the Institutes it recommends as qualified. These various institutes were in Soviet times, parts of the ministries but were privatized after the break up the Soviet Union. They continue as the recognized authority in each field but are now paid for their activity (by the IPP; Anisimov is well experienced in negotiating reasonable deals with these various institutes). In regard to design, hook-ups and land issues, permits and approvals may also be required by the local administration. Again Lidesm is adept at handling these. Approvals by UES and Lenenergo and the Regional Commission will be required for construction of power lines, transformer substations, connecting to existing lines, etc.

It should be clear that Lidesm has anticipated all these future requirements for implementation by setting up us throughout the Feasibility Study with good working relationship with the Leningrad

Oblast government, with the Energy Committee and the Regional commission. Lidesm has also now set up contacts with Lenenergo and UES. Several of the key institutes we will work with are on the list of seminar participants.

APPENDIX 1.4:
SEMINAR ON WIND POWER HELD 22 MAY 2002

Agenda and Key Speakers

List of Seminar Attendees

Presentation Material of American Company Participants

Conference Title

Saint Petersburg, Russia
Date

The Conference

ABB Inc. and Lidesm, a Closed Joint Stock Company, with funding from the United States Trade and Development Agency, are sponsoring a seminar on wind energy and a grid-connected wind power electricity generating plant to be located in the Saint Petersburg region. The wind power plant will provide clean, renewable energy in the form of electricity for homes and businesses throughout the region.

The U.S. Participants

ABB Inc., the US-based unit of ABB Group. ABB is an international corporation with extensive experience in the engineering, design and construction of electric generation plants. The wind power division of ABB currently has operating organizations in eight countries and is active in wind and other energy projects around the world.

Lidesm, a closed joint stock company, established in Saint Petersburg in 1989. Lidesm specializes in design and engineering in the field of civil and industrial construction, primarily energy projects.

CMT (Construction, Marketing & Trading), a Washington, DC and Moscow based consulting firm that has been assisting US companies in the construction and energy fields find and develop business opportunities in Russia.

PERI (Princeton Energy Resources International, LLC), based in Rockville, Maryland, a recognized leader in the field of energy technology and environmental analysis, project engineering, economics, and management.

MAI (Morse Associates, Inc.), an energy and environmental consulting firm is based in Washington, DC with unique expertise in renewable energy technologies, energy conservation and sustainable development.

Alexander Anisimov, General Director
Lidesm (Closed Joint Stock Company)
76 Fontanka Emb., Office 309
191180 Saint Petersburg
Russia

The Agenda

9:00 - 10:00 Registration

10:00 - 10:45 Opening Session, Chairman – Sergey Miakov, President, Leningrad Committee on Fuel and Energy

Governor Valery Pavlovich Serdyukov (Invited) – Importance of Wind Power in the Oblast

__ *Stanev* _____ – Role of Wind Power in Russia's Energy Future

10:45 - 12:15 Wind Power Project, Chairman – Alexander Anisimov, Director General, AOZT Lidesm

William L. Snyder – ABB – Leningrad Wind Power Plant Project

Dan Ancona – PERI – Why Wind, Why Now and Why Here?

Questions and Answers

12:15 - 1:00 Break

1:00 - 2:00 Institutional and Financial Aspects, Chairman – Sergey Naryshkin

Lev Khabatchev – Wind Power in a Restructured Energy Sector

UES speaker – Grid Connection of Wind Power Plants

EBRD/IFC speaker – Wind Energy Project Financing

GEF/NEFCO speaker – Subsidies for Clean Energy

2:00 - 3:00 Closing Session, Chairman - Sergey Miakov

Featured Speakers

Governor Serdyukov - Will discuss the importance of this project and need for clean and sustainable energy sources for the Leningrad Region.

Sergey Naryshkin - Chairman of the Committee for External Economic and International Relations, Leningrad Regional Government - will address the role of international cooperation in this and future projects.

Moscow Person - will describe the electric power industry restructuring and market based initiatives.

Leninergo ??? - _____ - will discuss integrating the wind power plant into the regional electric power network and operate in conjunction with existing hydro and heat/power plants.

Lev Khabatchev - Chairman of the Regional Energy Commission, Government of Leningrad Oblast - describe the changing regulatory environment for electric power, independent power production and how it will facilitate this project.

??? - ***International Finance Corporation - will describe World Bank and other multilateral organizational financing and other support for clean energy projects.***

Gov. (Invited)

Registration

Please fill out the Resistration form below.....

Name (Invited Guests Only): _____

Organization: _____

Address: _____

_____

Phone: _____

FAX: _____

Email: _____

Seminar
On
Wind Power Project in the Leningrad Region

22 May 2002
Corinthia Nevsky Palace Hotel
Nevsky Prospect 57
Saint Petersburg

ABB Inc. and AOZT Lidesm, with funding from United States Trade and Development Agency, in cooperation with the Leningrad Oblast Committee on Fuels and Energy, are sponsoring a seminar on wind energy for electric power production. Information will be provided on the 75-Megawatt wind power plant that is being planned for the Leningrad region. This wind power plant will provide clean renewable energy in the form of electricity for industry.

Agenda

9:00 – 10:00 **Registration**

10:00 – 11:20 **Opening Session,**
Chairman – Vice Gov. Grigoriev
Vice Governor Grigoriev – *Importance of Wind Power in the Oblast*
Daniel Ancona – *Why Wind, Why Now and Why Here?*
Questions and Answers

11:20 – 11:40 **Break**

11:40 – 13:00 **Wind Power in Russia**
Pavel Bezrukikh – *Wind Power Potential in Russia*
Alexander Anisimov – *Leningrad Wind Power Plant Feasibility Study*
Questions and Answers

13:00 – 14:00 **Lunch**

14:00 – 15:00 **Wind Power Plant Systems,**
Chairman – Alexander Anisimov
William Snyder – *Electric Power System Integration and Control*
John Mills - *Wind Turbine Equipment, Construction and Operation*
Questions and Answers

15:00 – 15:20 **Break**

15:20 – 16:20 **Plenary Session, Business and Financial,**
Chairman - Sergey Naryshkin
Panelists: Lev Khabatchev
Sergey Miakov
June Koch
Daniel Ancona

16:20 – 16:30 **Closing Session,**
Chairman – Sergey Miakov
Daniel Ancona - Closing Remarks

Key Speakers and Participants

Vice Governor Ivan Grigoriev - Will discuss the importance of this project and the need for new, clean and sustainable energy sources in the Leningrad region.

Sergey Naryshkin – Chairman of the Committee for External Economic and International Relations, Leningrad Regional Government, will address the role of international cooperation in this and future wind projects.

Sergey Miakov – Chairman of the Committee on Fuels and Energy, Leningrad Regional Government will report on policies and plans to encourage new energy development.

Pavel Bezrukikh – representing the Russian Federation Ministry of Energy, will discuss wind power potential in Russia.

Lev Khabatchev – Chairman of the Regional Energy Commission, Leningrad Regional Government, will discuss the changing environment for electric power production and how it will facilitate this project.

Daniel Ancona – Princeton Energy Resources International (US) and Project Manager, will report on worldwide wind energy technology and economic trends, wind power market development and incentives, power system connections and operations, and environmental issues.

William Snyder – Director ABB Wind Power US, will discuss project development plans and integrating wind power with electric power systems.

June Koch – President CMT, will discuss customer, business and financial aspects of the planned project.

Alexander Anisimov – General Director of Lidesm, will discuss the project feasibility study.

John Mills – GE Wind, will discuss modern wind turbines and wind power plants.

LIST

of the participants of the Seminar on Wind Power

Saint-Petersburg

May 22, 2002

1. RF Ministry of Energy, Moscow
   Deputy Chief of Scientific and Technological Advance Department
   KOTOV Valery Grigorievich

2. RF Ministry of Energy, Moscow
   Deputy Chief of FGUP MNII EKOTEK
   TARATIN Vladimir Vitalievich

3. RF Ministry of Energy, Moscow
   Center of Strategic Development,
   Expert
   Professor, Doctor of Physics and Mathematics
   KOZLOV Vladimir Alexandrovich

4. RAO UES of Russia, Moscow
   Energy Saving Center,
   Deputy Director
   KONEV Alexey Viktorovich

5. RAO UES of Russia, North-West branch, St.-Petersburg
   Center of Advanced Development,
   Director
   KOROTKOV Vladimir Alexandrovich

6. FGUP Gos.A.Ya.Bereznik “MKB RADUGA”, Moscow Region
   Chief of Department
   LAVROV Valeriy Stepanovich

7. AO NPO “NETRAEL”, EEEK Corporation, Moscow Region
   Chief of PTS
   LISOVSKY Vadim Kazemirovich

8. ZAO INVESTENERGOSTROY, Moscow
   General Director
   KIRILLOV Yuriy Ivanovich

9. ZAO INVESTENERGOSTROY, Moscow
   Deputy General Director
   TCHAEV Nikolay Pavlovich

10. NIIEFA-Energo, St.-Petersburg
    Deputy General Director
    RAVINSKY Jury Mavrikievich

11. FGUP NIIEFA NTC “Sintez”, St.-Petersburg
    Chief of Department, Doctor of Technics
    KUCHINSKY Vladimir Georgievich

12. Leningrad Oblast Administration
    Fuel and Energy Committee, Chairman
    MIAKOV Sergey Borisovich

13. Leningrad Oblast Administration
    Fuel and Energy Committee, Chief Specialist
    CHEIDA Victor Andreevich

14. Leningrad Oblast Administration
    Committee for External Economic and International Relations, Chairman
    NARYSHKIN Sergey Evgenievich

15. Leningrad Oblast Administration
    Committee for External Economic and International Relations, Deputy Chairman
    MALYSHEV Valentin Veniaminovich

16. Leningrad Oblast Administration
    Regional Energy Commission, Chairman
    KHABACHEV Lev Davidovich

17. Leningrad Oblast Administration
    Vice-Governor
    GRIGORYEV Ivan Nikolaevich

18. St.-Petersburg Administration
    Fuel and Energy Committee
    Department for Advanced Development, Chief
    VASILIEV Andrey Fyodorovich

19. Deputy Head of Kronstadt Administration, St.-Petersburg
    SKRYABIN Vladimir Panteleimonovich

20. YUZHNAYA TETS (Thermoelectric plant) of OAO Lenenergo, St.-Petersburg
    Director
    NEDOTKO Vladislav Vasilievich

21. Power lines of Kirovsk (Leningrad Region)
    Chief Engineer
    ANISIMOV Alexey Dmitrievich

22. “Urban Power Line”, Kingisepp (Leningrad Region)
    Director
    BOYKO Alexander Alexeevich

23. VODOKANAL, Kingisepp region
    Director
    DENTCHIK Alexander Ivanovich

24. AOZT “Trust 31” Kingisepp **(**Leningrad Region)
    General Director
    KOFMAN Pyotr Semyonovich

25. Vyborg Region Administration
    Deputy Head of Administration,
    Economics and Investment Committee, Chairman
    BEK Vyacheslav Viktorovich

26. Quarry Management, Vyborg **(**Leningrad Region)
    Chief Engineer
    KORYACHKO Vladimir Konstantinovich

27. Power Lines, Vyborg **(**Leningrad Region)
    Deputy Director
    SMIRNOV Alexander Ivanovich

28. Priozersk Region Administration
    Deputy Head of Administration
    KOTOV Dmitry Vladimirovich

29. State Technical University, St.-Petersburg
    Chief of Renewable Energy Sources and Hydropower Department
    Doctor of Technics
    ELISTRATOV Victor Vasilievich

30. AOZT NNTO INSET, St.-Petersburg
    General Director
    BLYASHKO Yakov Iosifovich

31. OOO VEKTOR, St.-Petersburg
    General Director
    PRESNOV Konstantin Mikhailovich

32. Russian Scientific Center of Applied Chemistry, St.-Petersburg
    Chief Power Engineer
    MURADKHANOV Vladislav Arkadievich

33. Lomonosov Region Administration (Leningrad Region)

Municipal Engineering Committee, Chairman
STANKEVICH Alexander Stepanovich

34. Power Lines, Schlisselburg **(**Leningrad Region)
Director
NOSENKO Alexander Alexandrovich

35. OAO Zavod Turbinnykh Lopatok (Turbine Blades Plant), St.-Petersburg
Deputy Technical Director
NIKITIN Nikolay Mikhailovich

36. ST-INTER (Consulting firm) St.-Petersburg
Expert
LOVTSYUS Vladimir Viktorovich

37. ZAO POBEDA-KNAUF, St.-Petersburg, Kolpino
Chief Power Engineer
TRBUNSKIKH Alexander Jurievich

38. OAO VENA, St.-Petersburg
Head of Power Department
SELEZNYOV Sergey Stepanovich

39. ZAO ILIM PULP ENERTPRISE, St.-Petersburg
Head of Department
NIKOLAYEV Andrey Valerievich

40. OOO Caterpillar-Tosno, **(**Leningrad Region)
Chief Power Engineer
CHERNYSHOV Alexey Vladimirovich

41. OTIS, St. Petersburg
Chief Power Engineer
VIZNY Vladimir Stepanovich

42. Wrigley St. Petersburg
Chief Power Engineer
GOLODNOV Valery

43. DELOVOY PETERSBURG Newspaper
Journalist
SHOLMOV Konstantin Evgenyevich

44. ROSSIYSKAYA GAZETA Newspaper
Journalist
CHUMAKOV Kazbek Khalidovich

45. Vyborg Power Lines (Leningrad Region)

Director
NEKRASOV Juri Nikolaevich

46. ZAO Baltic Power Company, St.-Petersburg
General Director
ZINCHENKO Oleg Evgenyevich

47. ODU “North-West”, St.-Petersburg
Director
SINYANSKY Vasily Ivanovich

48. AOZT LIDESM
General Director
ANISIMOV Alexander Dmitrievich

49. AOZT LIDESM
Project Manager
SAAKOV Gleb Alexandrovich

50. AOZT LIDESM
Financial Director
KLAFTON Marina Ivanovna

51. AOZT LIDESM
Administrator
MARSOVA Lyudmila Georgievna

52. AOZT LIDESM
Administrator Assistant
POTAPOVA Galina Sergeevna

53. CMT Consulting Manager
USPENSKAYA Zinaida Izrailevna

54. EGO Translating
Manager
CHISTYAKOVA Olga Borisovna

55. EGO Translating
Interpreter
NOMOKONOV Vadim Nikolaevich

56. EGO Translating
Interpreter
BORENBLID Mikhail Vladimirovich

57. ABB Wind Power
Director

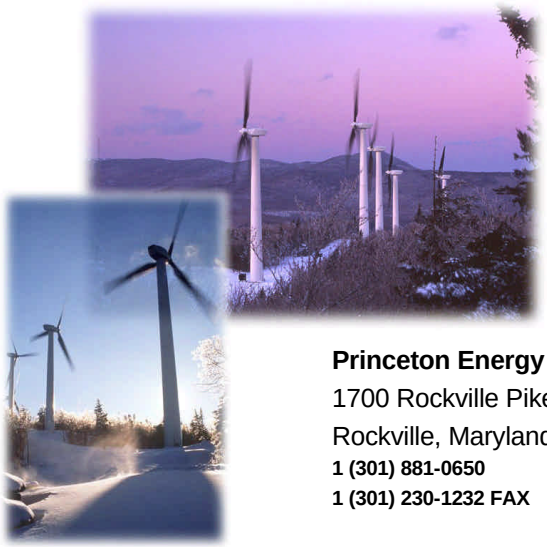
SNYDER William

58. PERI
    International Program Manager
    ANCONA Daniel

59. CMT Consulting
    President
    KOCH June

60. GE Wind Energy
    Department Director
    MILLS John

Why Wind? Why Here? Why Now?



Leningrad Wind Power Plant Project

Dan Ancona
Program Manager

Princeton Energy Resources International
1700 Rockville Pike, Suite 550
Rockville, Maryland 20852
1 (301) 881-0650
1 (301) 230-1232 FAX

22 May 2002

Seminar Sponsors and Contributors

- United States Trade and Development Agency
- ABB
- GE Wind
- Governor Serdyukov
- Leningrad Committee for External Economic and International Relations
- Leningrad Committee on Fuels and Energy
- Leningrad Energy Commission
- Russian Federation Ministry of Fuel and Energy and Ministry of Science and Technology

Outline

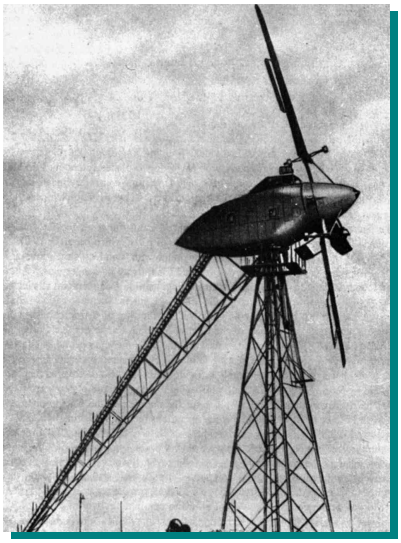
- Wind energy technology
- Global development
- Financial and other incentives
- New energy business opportunities
- Leningrad wind power plant project
- Project Feasibility study

Historical Concern about Energy

- French Engineer – L. Constantin –1924

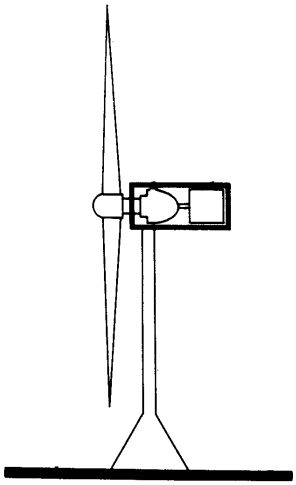
"The earths reserves of fuels, solid and liquid, are rapidly being exhausted, and whatever be the hopes, splendid but distant, that gave rise to the study of radioactivity of matter, ***this threat to our economic life merits the attention of every thinking person."***

Balaclava 100 kW 30 meter diameter Turbine - Installed in Russia on the Black Sea in 1931

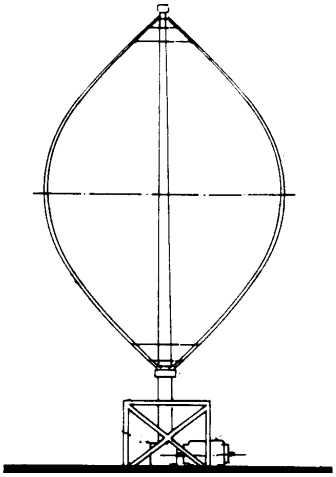


First Grid Connected Turbine

Wind Energy Conversion System Configurations

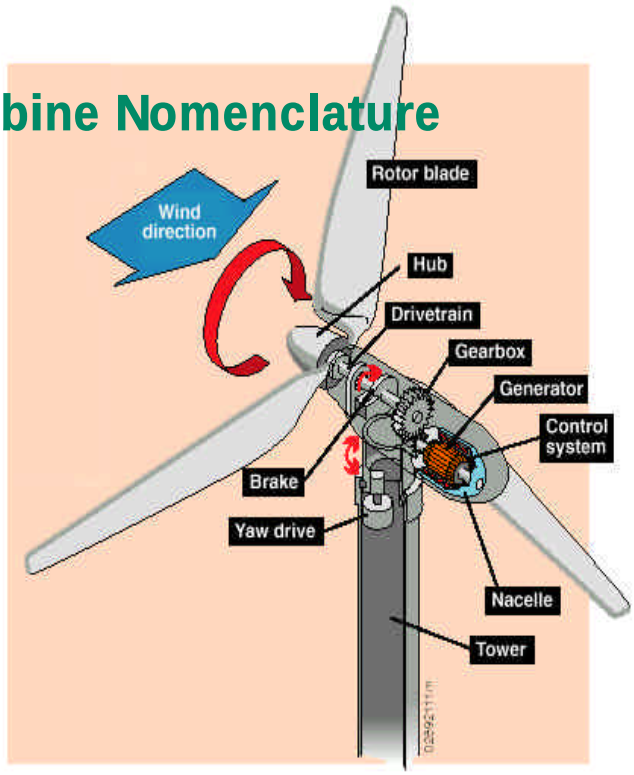


Horizontal Axis Turbine



Vertical Axis Turbine

Wind Turbine Nomenclature



Wind Turbine Operating Principles

Airfoil Aerodynamic Lift

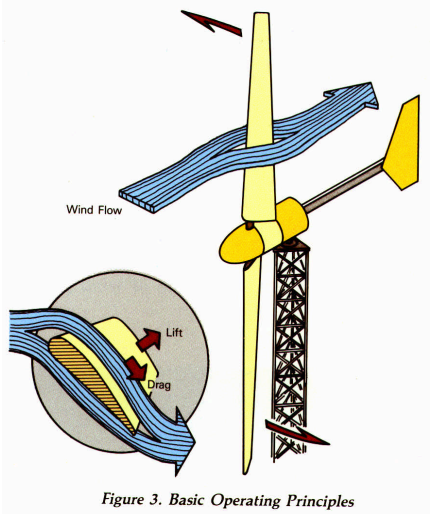
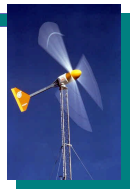


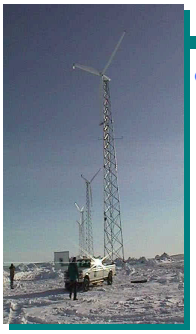
Figure 3. Basic Operating Principles

Ice Boats go 150 km/h in 30 km/h breeze

Modern Wind Energy Applications

- **Small Wind Turbines** - (400 W - 10 kW)
  - Homes and Farms
  - Remote locations for water pumping and telecommunications sites

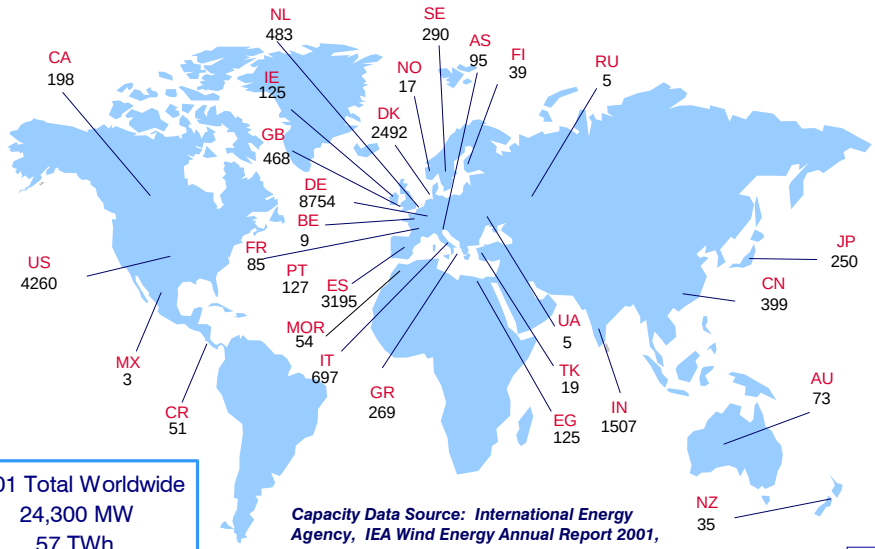




- **Intermediate Turbines** - (10 - 250 kW)
  - Village Power
  - Distributed Power
  - Hybrid Systems (e.g. wind/diesel/ solar/hydro)

- **Large Turbines** - (250 kW - 5 MW)
  - Wind Power Plants
  - Distributed Power

Wind Energy Deployment Worldwide (MW)



2001 Total Worldwide
24,300 MW
57 TWh

Capacity Data Source: International Energy Agency, IEA Wind Energy Annual Report 2001, May 2002

Added Wind Plant Capacity in 2001 (Megawatts)

Country/Region	New Capacity
Australia	41
Austria	17
Canada	60
China	55
Denmark	75
Egypt	62
Finland	1
France	6
Germany	2659
Greece	90
India	287
Ireland	7

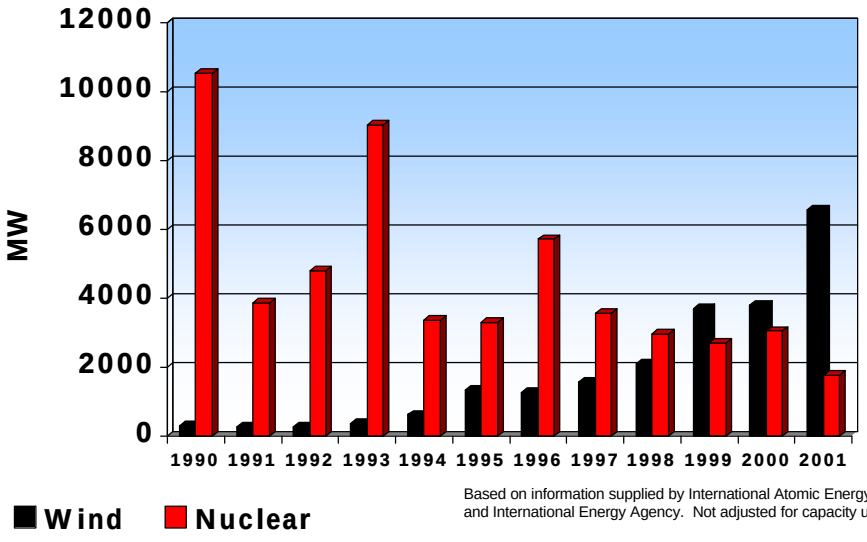
Country/Region	New Capacity
Italy	270
Japan	129
Netherlands	42
Norway	4
Portugal	36
Spain	861
Sweden	49
United Kingdom	59
United States	1694
Rest of World	49
GRAND TOTAL	**6553**

> $6 Billion Annually

Source: International Energy Agency
IEA Wind Energy Annual Report 2001, May 2002,

Since 1999 – More Wind Than Nuclear

Additions to installed capacity



Based on information supplied by International Atomic Energy Agency and International Energy Agency. Not adjusted for capacity utilization.

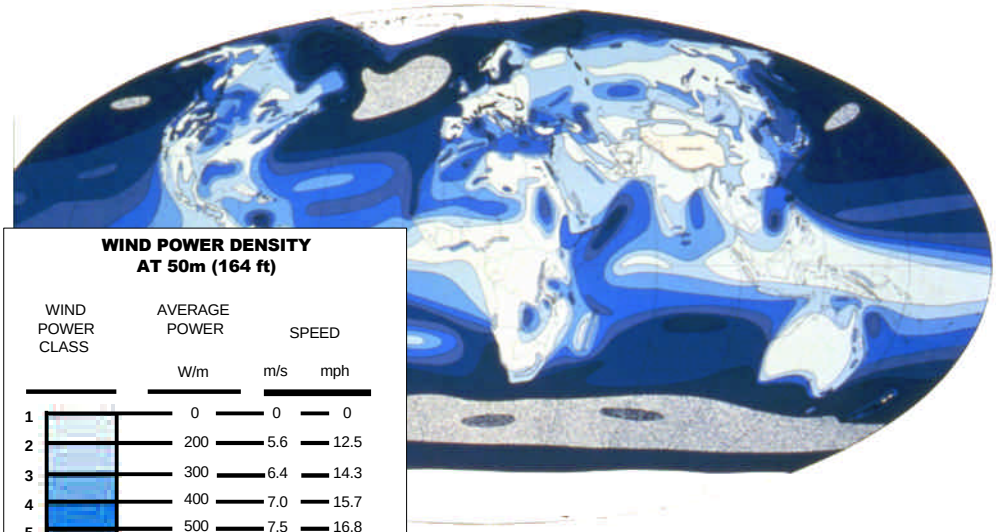
Renewable Energy Market Drivers

- Growing demand for electricity
- Concern about fuel supplies
- Balance of trade issues
- Potential for domestic manufacturing
- Concern about air quality/climate change

Factors that Lead to Wind Development

- Low-cost option
- Government R&D
- Capital investment or tax incentives
- Preferential “green” power pricing
- Limits growth in electricity prices
- Environmental concerns

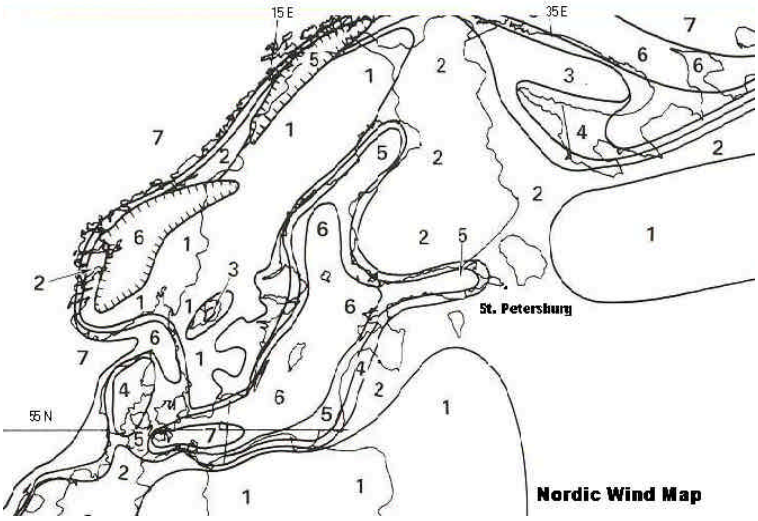
Wind Resources World Wide



WIND POWER DENSITY AT 50m (164 ft)

WIND POWER CLASS	AVERAGE POWER W/m	SPEED m/s	SPEED mph
1	0	0	0
2	200	5.6	12.5
3	300	6.4	14.3
4	400	7.0	15.7
5	500	7.5	16.8
6	600	8.0	17.9
7	800	8.8	19.7
	2000	11.9	26.6

Wind Resources — Gulf of Finland



Three Possible Wind Power Plant Sites - Near St. Petersburg

- Kingisepp
- Vyborg
- Kirovsk

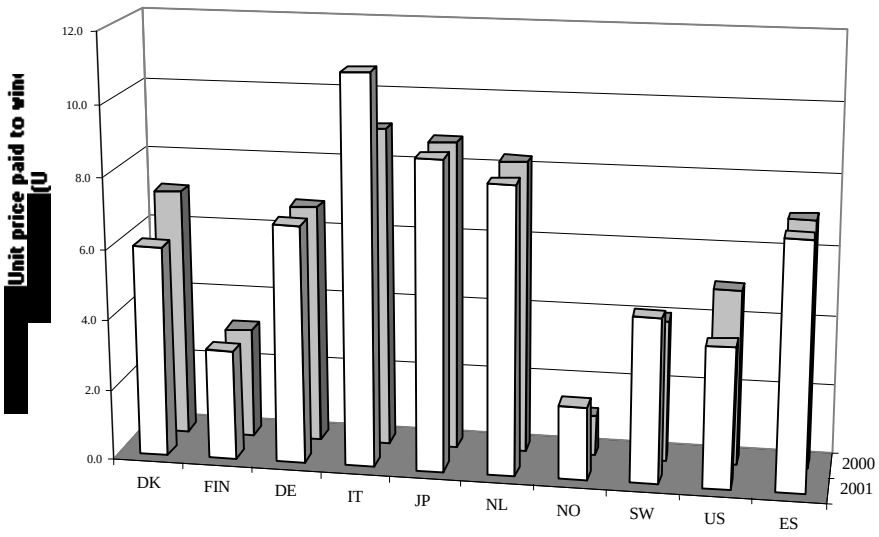
Characteristics of Good Sites

- Strong steady wind resource
- Wind – electric load matching
- Growing electricity demand
- Grid access
- Available land
- No environmental barriers

Works well with hydro and combined heat/power plants

Better Technology — Lower Cost

Wind Energy Costs Vary



Many Incentive Policy Options

Source: National Wind Coordinating Committee, Strategies for Supporting Wind Energy – A Review and Analysis of State Policy Options

- Tax Incentives – 6
- Direct Cash Incentives - 2
- Low – Cost Capital Programs - 3
- Distributed Resource Policies - 4
- Customer Choice Opportunities - 4
- General Environmental Regulations - 4
- Government Purchases – 4

Examples of Incentives in Use

- Energy Production/Use Tax Credits
- Investment/Profit Tax Holiday
- Import Duty Elimination
- VAT Holiday
- Property Tax Elimination
- Mandatory Renewable Energy Feed Policy
  - Green Power Pricing
  - Transmission System Access

Environmental Issues

- Land use
- Birds
- Noise
- Aesthetics
- Air pollution and carbon dioxide offsets

Compatible Land Uses

Avoid Siting Near Bird Sanctuaries

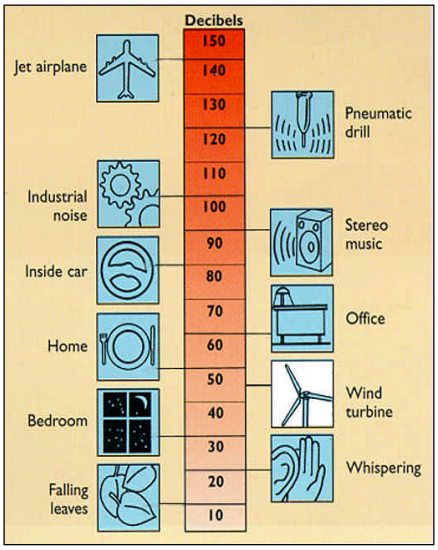
Market Barriers:

Is Noise An Issue?

How Much Noise Do Wind Turbines Make?

45 decibels at 350 meters

Other issues?



Source: American Wind Energy Association based on National Renewable Energy Lab data

Avoid Air Pollution and Carbon Dioxide Emissions

Leningrad Wind Power Plant Project

Project Feasibility Study

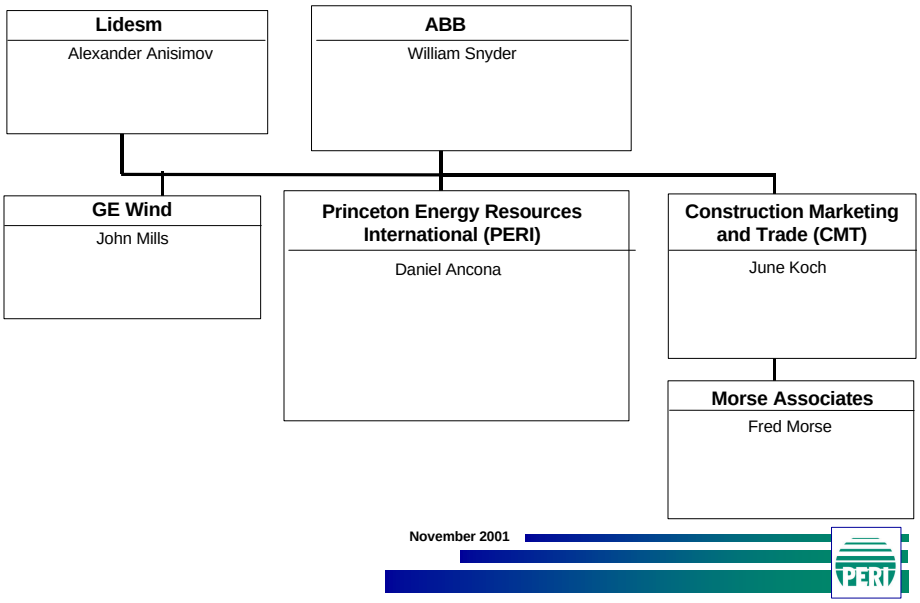
Approach

- Team with Lidesm
- $1.3 million
- Complete during 2002

Scope

- Power plant description - 75 MW
- Wind resource verification
- Economic viability
- Financing
- Environmental issues
- Return On Investment

Project Team



November 2001

Project Business and Financial Analysis

- Goals
  - Stable price for clean electricity
  - Reliable plant with good maintenance and long life
  - Repay debt or other investors
  - Earn a good cash return for the owner and other equity investors
- Financial Analysis
  - Cash flow and financial models – **like any power plant**
  - Cost Of Energy
  - Rate of Return
- Obtain incentives, approvals, permits and power purchase agreements

Lessons Learned – From 25 Years Experience

- Most technical issues have been resolved
- Today's turbines are reliable, low cost and efficient
- Financial incentives are important (small but still necessary) -- focus on energy production/use
- New regional applications and environments can be challenging but have proven success record
- **WIND WORKS!** It is the fastest growing electricity generating option in the world

Why Wind? Why Now? Why Here?

BRIEF SUMMARY

- Large wind power plant installations now total over 25,000 MW world wide and is the fastest growing energy technology. But expansion to date has been primarily in Europe and United States, with about 90% of the utility-scale wind turbines located there. In the U.S., last year the state of Texas added 915 MW – more than the whole country did previously in one year. Some large plants are producing electricity at about $0.04/kWh. In Denmark during 2000, wind turbines produced over 10% of the country's electricity and plan to reach 20% in 2003. The fastest growth in wind installations is Germany with over 8,754 MW operating due to large incentives.
- There is a need for wind power in Russia. The Feasibility Study will resolve technical and economic uncertainties:
  - Wind resource validation
  - Wind plant power purchase agreement terms and transmission access
  - Project financing
  - Incentives,and infrastructure development
  - Environmental benefits/concerns
- Wind Works!

Wind Seminar-St. Petersburg
22.05.02
William Snyder

ABB and Wind Power

here

here

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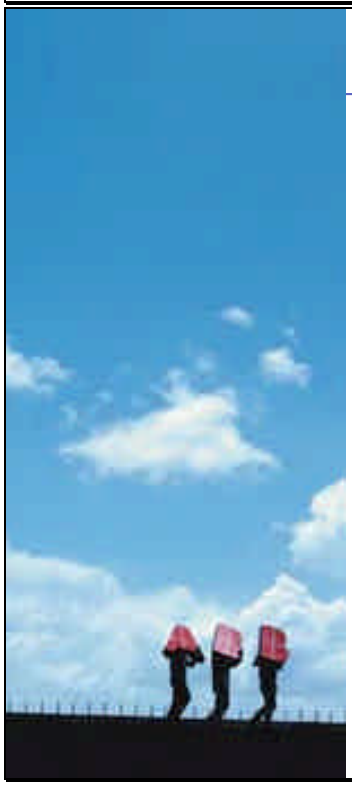

Facts about ABB

- One of the largest power and automation technology companies in the world with broad industry knowledge and geographic scope
- About 152,000 employees in more than 100 countries
- Leading position (1, 2 or 3) in each industry we serve and product areas
- Revenues in 2001: US$ 23.7 billion
  - Revenues Q1 2002: US$ 5.2 billion
- Orders in 2001: US$ 23.8 billion
  - Orders Q1 2002: US$ 5.5 billion
- Headquarters: Zurich, Switzerland
- Listed in New York (NYSE), London/Zurich (Virt-x), Stockholm (Stockholm Exchange) and Frankfurt (Xetra)

Our mission

- Generate value for each of our stakeholders - customers, employees, shareholders, and the communities and countries where we do business
- In 2001, ABB was ranked number one in its market sector by the Dow Jones Sustainability Index, topping the electric components and equipment industry group for the third year in a row

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What we offer

- Complete industry and process specific solutions, from products to turnkey projects in utilities, oil, gas and petrochemicals, manufacturing and consumer industries and process industries
- World-class collaborative business platforms and solutions based on Industrial^{IT} open architecture software
- A full range of financing solutions for ABB's industrial businesses and third party customers

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Focused on power & automation technologies……

…enabling utility and industry customers to improve their performance while lowering environmental impact

Every single customer of ours needs *both* power and automation technologies

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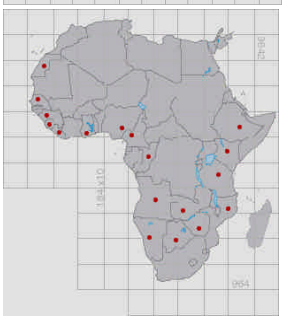
Worldwide presence for local business

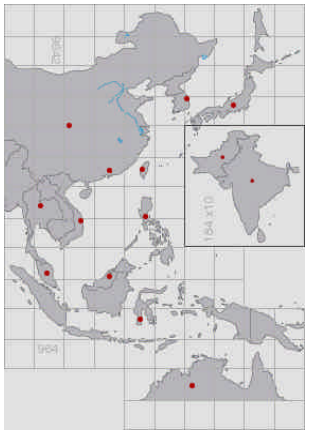
Americas

Europe



Africa/Middle East

Asia



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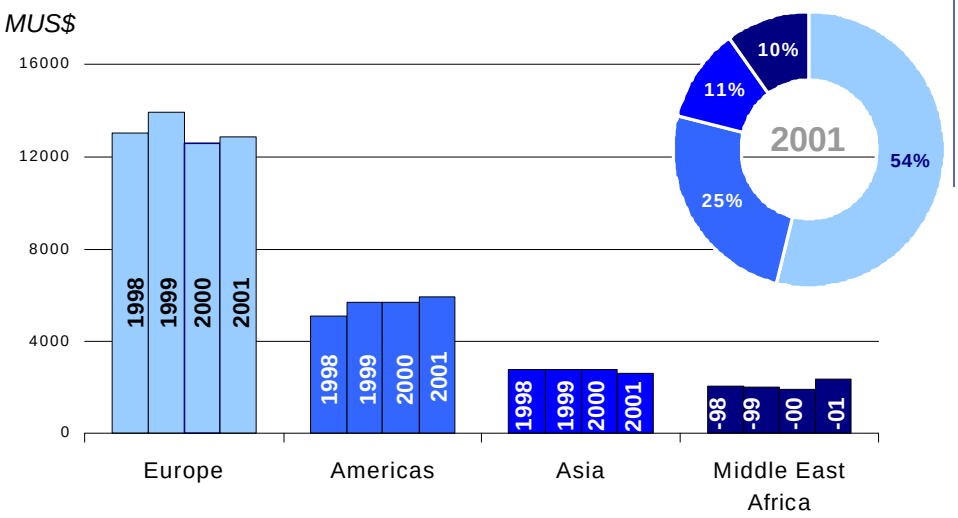
Revenues per region



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Our business….

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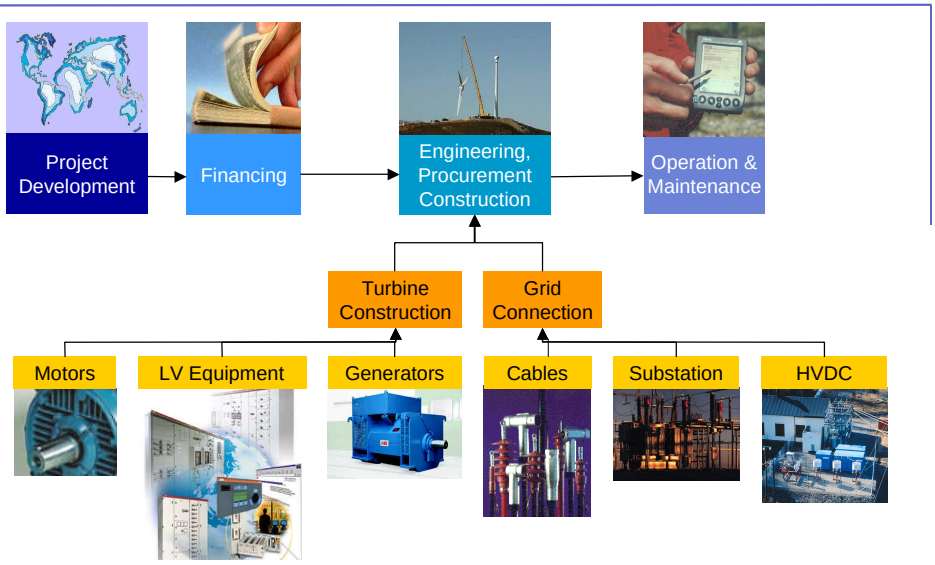
ABB in the wind power industry



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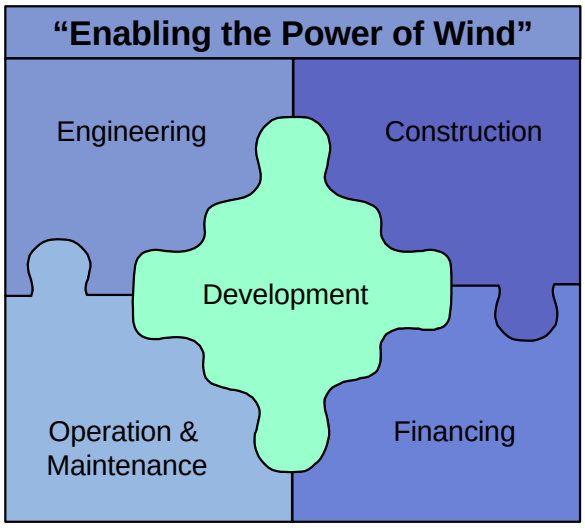
Fully integrated solutions



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Wind plant development process

Project Development	Financing	Engineering Procurement Construction	Operation
Minimum 12 months	2-3 months	6 - 12 months	20 years

The exact time needed for the project depends on the size and the circumstances of the individual plant.

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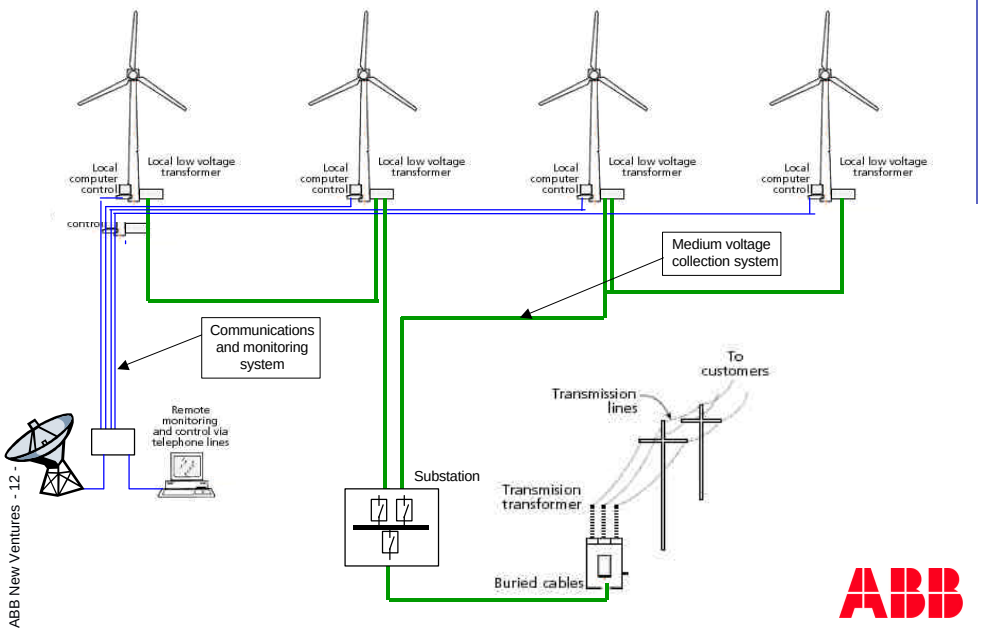
Electrical infrastructure



© ABB New Ventures - 12 -

The movement of energy

34.5 KV

690 volts

115 KV or more

Substation

Local distribution to end users

ABB

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Wind power at work

ABB

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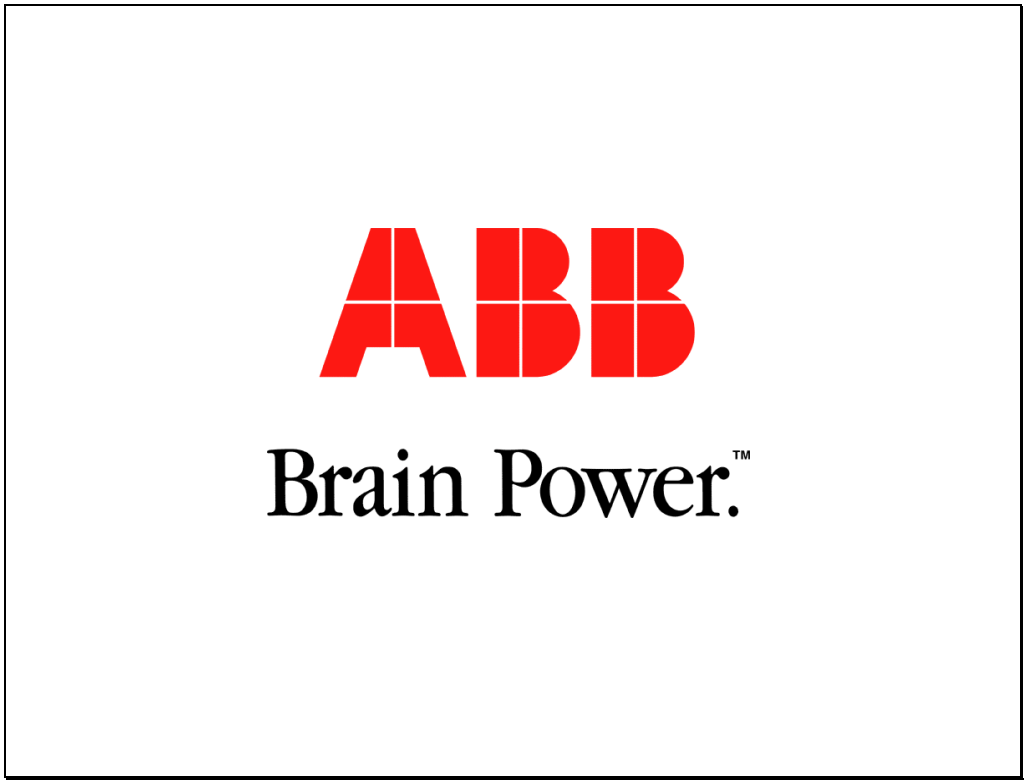
ABB
Brain Power.™

GE Wind Energy

Leningrad Wind Power Plant

Seminar May 2002

Leningrad Wind Power Plant

GE Power Systems

- **more than 30,000 GE Power Systems team members**
- **from the mining of natural resources to the distribution of energy**
- **Numerous businesses structured to meet targeted customer need**

GE Wind Energy

Leningrad Wind Power Plant

GE Wind Energy

- 1,500 employees worldwide
- wind turbine design, manufacturing, erection, installation, commissioning, operation and maintenance
- manufacturing facilities in U.S.A., Germany, Spain and the Netherlands

GE Wind Energy

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Origins of the Wind

- The Wind Derives from Solar Energy
- Trade Winds
- Local Winds
  - Daily Winds
  - Seasonal Winds

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The Energy in the Wind

- **The amount of energy is dependant on three factors :**
  - **Air density**
  - **Rotor area**
  - **Wind speed**

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Pioneers of the Wind Industry

Charles F. Brush (1849 – 1929)

GE Wind Energy

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Pioneers of the Wind Industry

Poul la Cour (1846 – 1908)

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Development of the Wind Industry

First grid connected turbine

- **100 kW**
- **30 metre diameter rotor**
- **installed in Balaclava**
- **1931**

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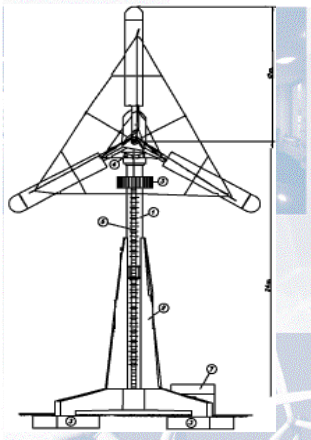
Development of the Wind Industry



The Gedser Wind Turbine

- built 1956 or 57
- three-bladed
- up-wind
- yaw mechanism
- asynchronous generator
- aerodynamic tip brake (stall)

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Development of the Wind Industry

➢ Second World War two-bladed Danish wind turbine

➢ Three bladed wind turbine built in 1942 in Denmark

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Development of the Wind Industry

By early 80s

- 50 to 60 kW machines were typical
- costs per kW hour fell dramatically
- U.S. federal government and California State government provide incentives
- thousands of machines erected in the Great California Wind Rush

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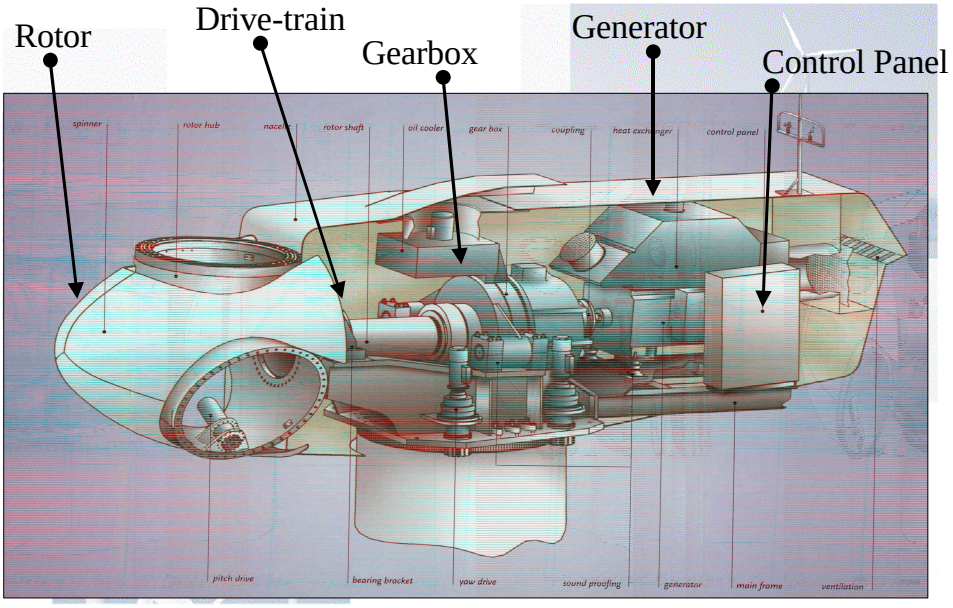

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Glossary of Terms

- turbine
- WTG
- WECS
- nacelle
- rotor
- yaw system
- anemometer
- swept area
- annual average wind speed
- extreme wind speed
- rated wind speed
- wind shear
- power curve
- rated power
- wind classes/zones
- cut-in/out wind speed
- anchor ring

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The ideal WTG for the Leningrad Wind Power Plant is the GE Wind Energy 1.5s .

The GE Wind Energy 1.5s WTG is a variable speed full-span-pitch wind turbine generator.

Let's go through some basic details of the WTG :

GE Wind Energy

Leningrad Wind Power Plant

The Rotor

- 70.5 metres diameter
- three blades
- upwind
- clockwise rotation (view from in front)
- electro-mechanical individual pitching of blades
- rotational speed = 20 rpm (at rated power)

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Leningrad Wind Power Plant

Gearbox

- high performance planetary spur combination
- ratio i = 89.9
- rated power 1,650 kW

GE Wind Energy

Leningrad Wind Power Plant

Generator

- doubly-fed asynchronous
- rated power 1,500 kW (1.5MW)
- combined with frequency convertor
- protection class IP 54
- 690v

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Leningrad Wind Power Plant

Yaw System

- connects nacelle to tower
- used for turning the nacelle to face the wind
- electro-mechanical yawing
- cable twist device

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Leningrad Wind Power Plant

Tower

- **65 or 85m high**
- **conical tubular steel**
- **typically in three sections**
- **houses control cabinet at base**
- **multiple coating protection against corrosion**

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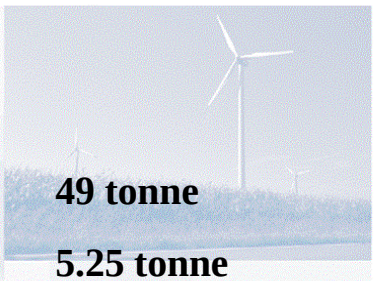
Masses



➢ **nacelle (excluding rotor)**		**49 tonne**
➢ **single blade**		**5.25 tonne**
➢ **hub (including three blades)**		**30 tonne**
➢ **tower sections**	**approx.**	**20 tonne**

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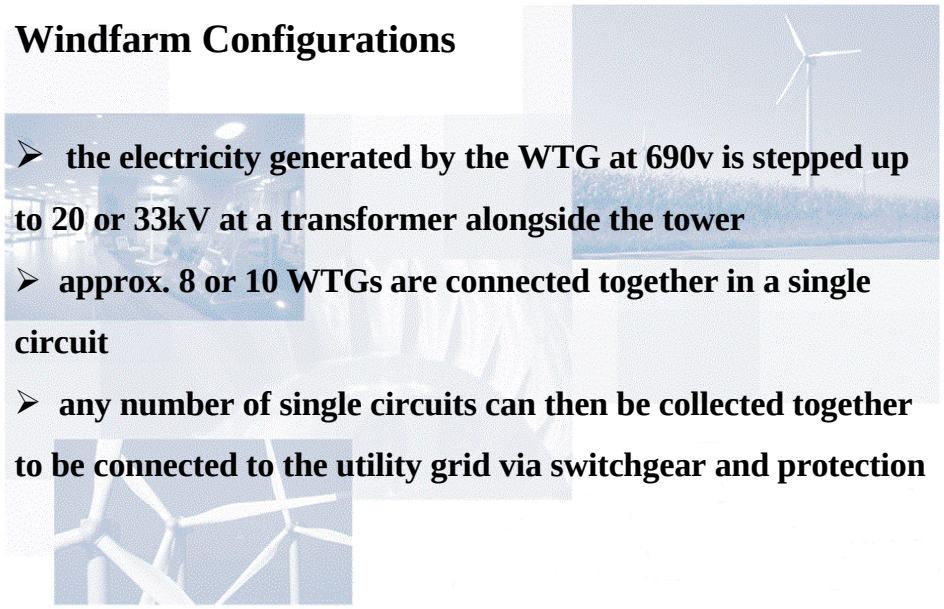
Leningrad Wind Power Plant

Windfarm Configurations



- **the electricity generated by the WTG at 690v is stepped up to 20 or 33kV at a transformer alongside the tower**
- **approx. 8 or 10 WTGs are connected together in a single circuit**
- **any number of single circuits can then be collected together to be connected to the utility grid via switchgear and protection**

GE Wind Energy

LENINGRAD WIND POWER PLANT BUSINESS AND FINANCIAL ANALYSIS

Dr. June Q. Koch
President – CMT, Inc.

1
22 May 2003

LENINGRAD WIND POWER PLANT BUSINESS AND FINANCIAL ANALYSIS

- **Goals**
  - Stable price for clean electricity
  - Reliable plant with good maintenance and long life
  - Economically and financially viable project
- **Financial Analysis**
  - Cash flow and financial models – **like any power plant**
  - Cost Of Energy
  - Rate of Return

2

BUSINESS AND FINANCIAL ASPECTS

- **Overall Business Planning**
  - Project would likely be done in partnership with local companies, organized by ABB as an Independent Power Producer (IPP)
  - Lidesm would participant in the Joint Venture
  - Other Russian Companies as Potential Investors

    Power suppliers
    Utilities
    Major Consumers
  - IPP registers its rights to participate in the Federal and Regional power markets
- **Timetable – Company formed 4th Quarter 02, Registered 1st Quarter 03**

3

PROJECT FINANCING

- **ABB will arrange equity financing if the project is viable**
- **The developer expected to be 40% investor**
- **Additional Equity and Debt**
  - **International Financing Corporation (IFC) and the European Bank for Reconstruction and Development (EBRD) expressed strong interest in this project**
- **Grants or Bonuses**
  - **Global Environment Foundation (GEF)**

    Interest in supporting a project that will be replicable and involve structural changes in the power sector in Russia

4

PROJECT FINANCING (Continued)

- **Additional Equity**
  - **Northern Environmental Finance Corporation (NEFCO)**
  - **Russian Investors**
- **U.S. Export-Import Bank**
  - **Loans or loan guarantees on US equipment and services**
- **Timetable – Preliminary Agreements 4th Quarter 02**

5

PROJECT IMPLEMENTATION

- **Marketing**
  - Market Survey of major U.S., European and Russian owned firms completed by CMT Consulting with Morse Associates and Lidesm
  - Identified four major Russian power users and 20 US and European industrial firms interested in purchasing wind power on long-term Power Purchase Agreements
  - Results are dependent on tariffs and transmission access wind power
- **Power Purchase Agreements**
  - Preliminary Agreements signed in third and fourth quarter of 2002
- **Tax Benefits and Government Incentives**
  - Draft Agreement pending with the Leningrad Regional Government
  - Discussions underway on Federal Government Incentives
- **Timetable – Completed 4th Quarter 2002**

6

APPENDIX 1.5:
ECONOMIC ANALYSIS AND PROJECT PROFORMAS

Wind Resource Assessment

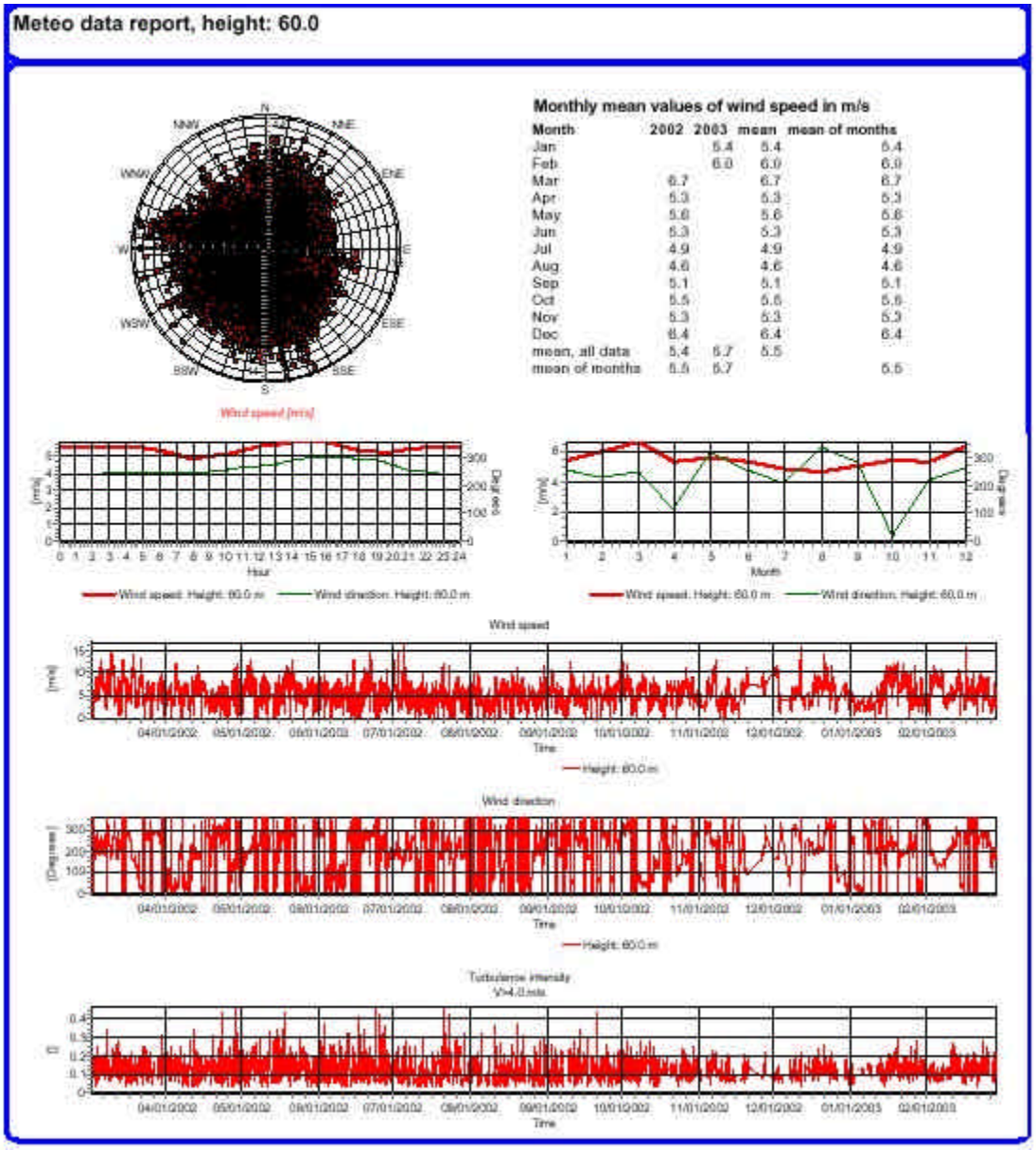
Power Plant Business Economic Model

Assumptions Used in the Preliminary Financial Analysis

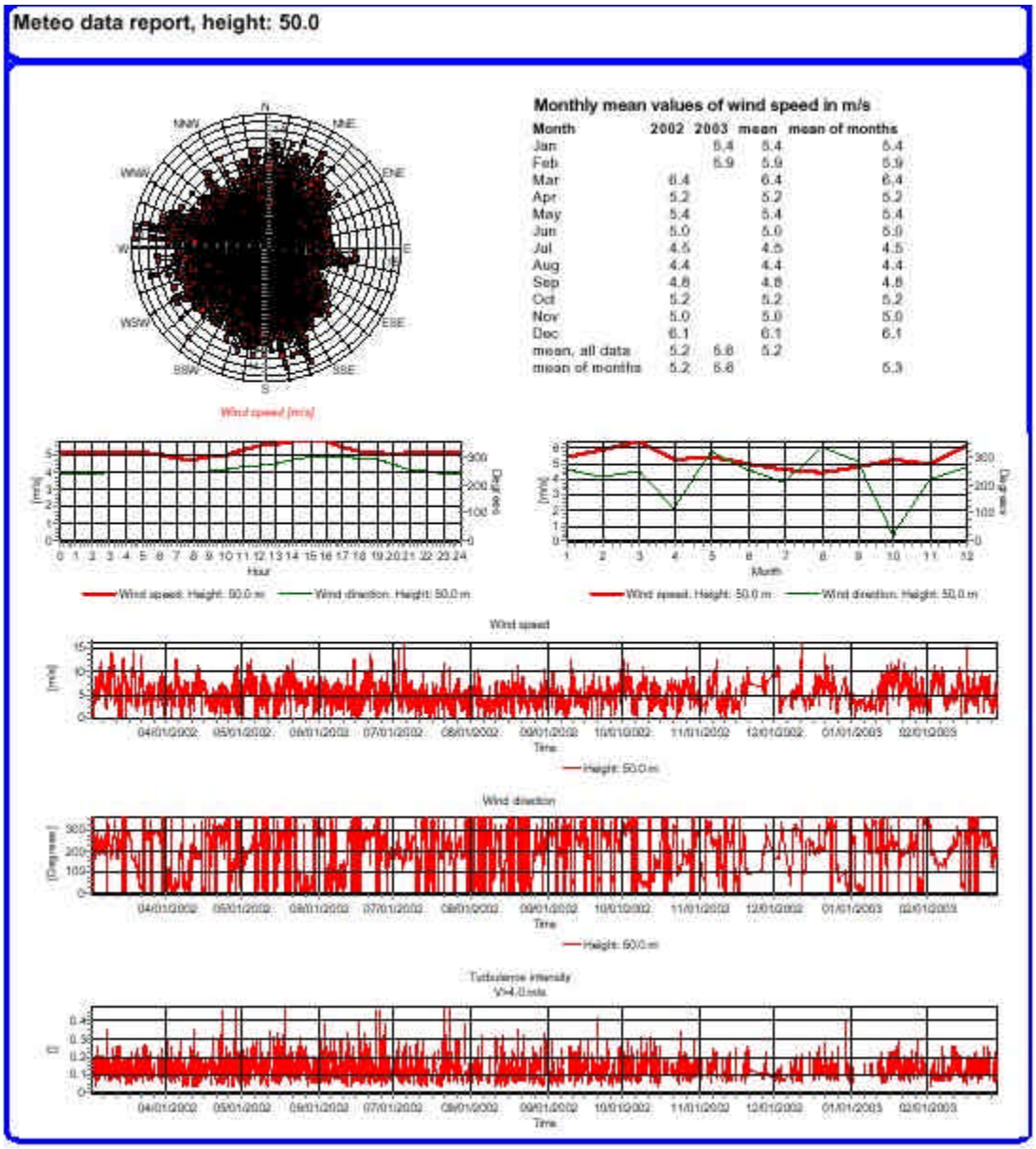
Preliminary Results of Analysis

The following pages show representative wind data from all 3 potential sites. The data for each site includes the top most mast plus the common height of 50m. For each height a speed rose is shown in the upper left hand corner. The speed rose contains a point for every 10 minute wind speed average. The point is plotted based on the average speed and the direction this speed comes from. Next to the speed rose is a table showing average wind speed per month. This table contains the average annual wind speed calculated through two different methods. The first method is the average of all the data available. The second method is through the averaging of the monthly averages. These two numbers typically agree however the average of all data is felt to be slightly more accurate. Below the wind speed rose is a chart showing the average wind speed and direction by time of the day. Typically the average wind speed is slightly higher at night. Below the monthly average table is a chart showing the average wind speed by month. This helps evaluate which months tend to be the windiest. The bottom three charts show the wind speed, wind direction, and turbulence as a function of time.

Site 1

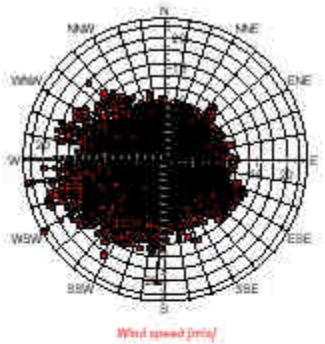


Site 1


Meteo data report, height: 50.0
N
NNW
NNE
WNW
ENE
W
E
WSW
ESE
SSW
SSE
S
Wind speed [m/s]
Monthly mean values of wind speed in m/s
Month 2002 2003 mean mean of months
Jan 5.4 5.4 5.4
Feb 5.9 5.9 5.9
Mar 6.4 6.4 6.4
Apr 5.2 5.2 5.2
May 5.4 5.4 5.4
Jun 5.0 5.0 5.0
Jul 4.5 4.5 4.5
Aug 4.4 4.4 4.4
Sep 4.8 4.8 4.8
Oct 5.2 5.2 5.2
Nov 5.0 5.0 5.0
Dec 6.1 6.1 6.1
mean, all data 5.2 5.6 5.2
mean of months 5.2 5.6 5.3
[m/s]
[Degrees]
Hour
Month
Wind speed, Height: 50.0 m
Wind direction, Height: 50.0 m
Wind speed
Time
Height: 50.0 m
Wind direction
Turbulence intensity
V>4.0 m/s
[-]

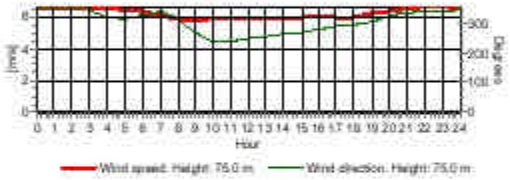
Site 2

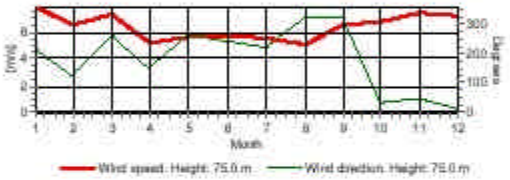
Meteo data report, height: 75.0

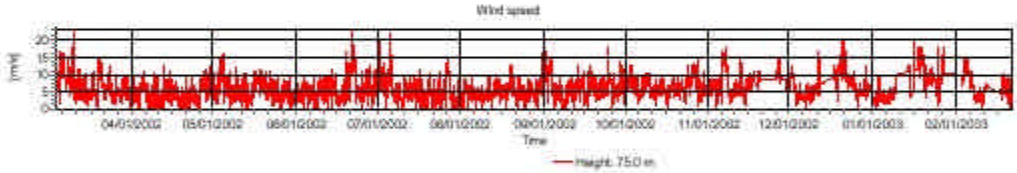


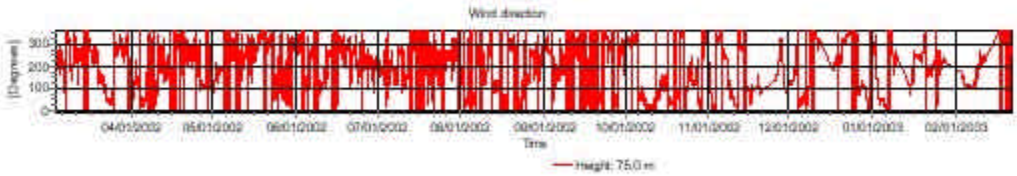
Monthly mean values of wind speed in m/s

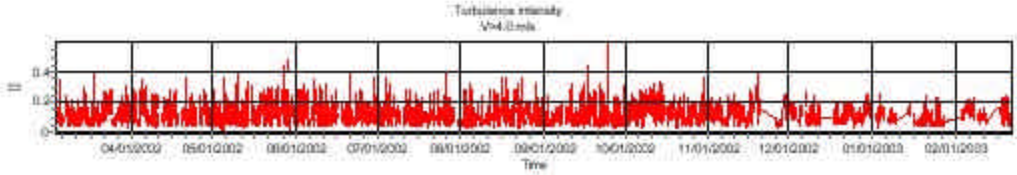
Month	2002	2003	mean	mean of months
Jan		7.8	7.8	7.8
Feb		6.5	6.5	6.5
Mar	7.2		7.2	7.2
Apr	5.1		5.1	5.1
May	5.8		5.8	5.8
Jun	5.7		5.7	5.7
Jul	5.4		5.4	5.4
Aug	5.0		5.0	5.0
Sep	6.5		6.5	6.5
Oct	6.7		6.7	6.7
Nov	7.3		7.3	7.3
Dec	7.2		7.2	7.2
mean, all data	6.1	7.3	6.2	
mean of months	6.2	7.2		6.3



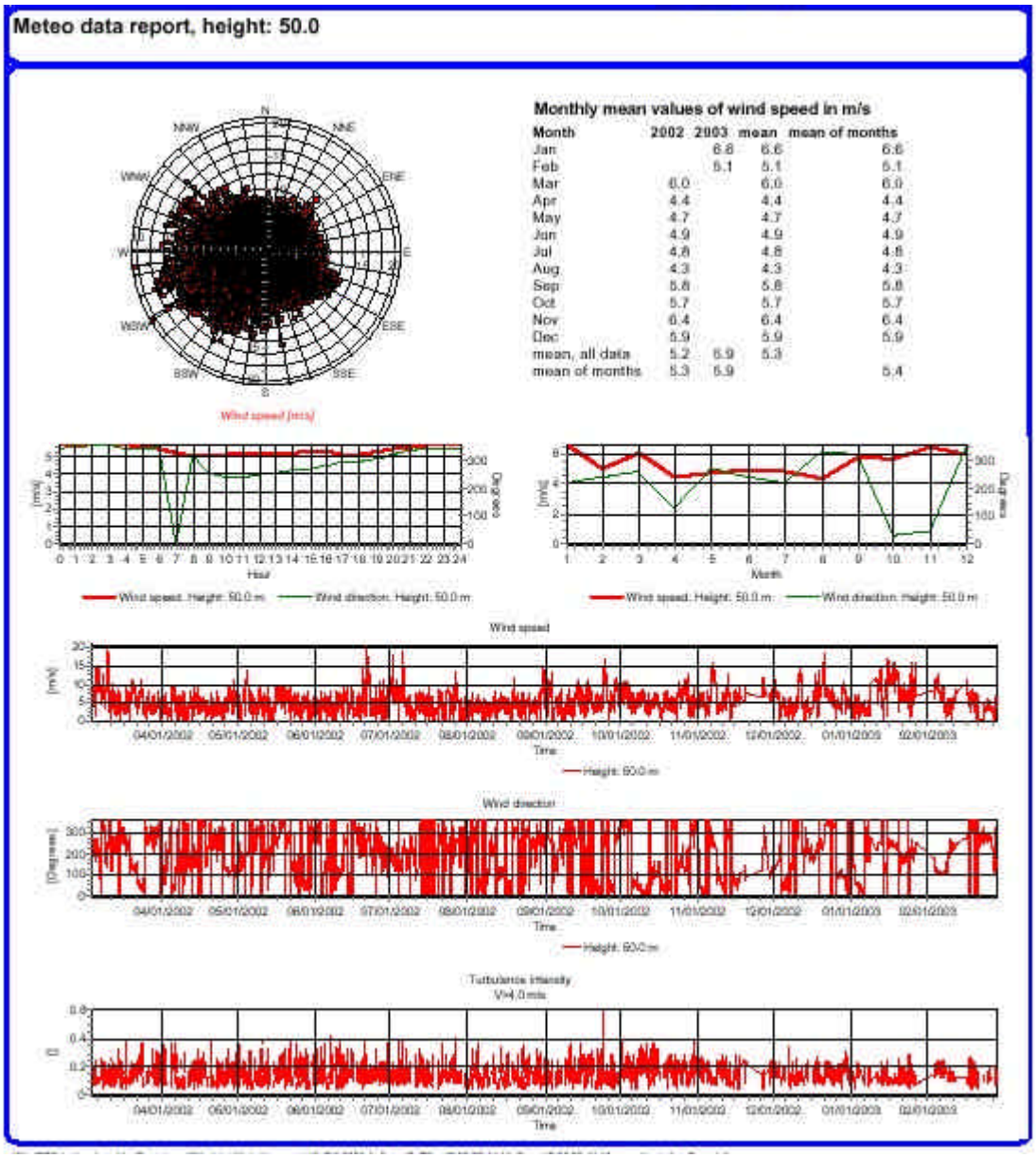






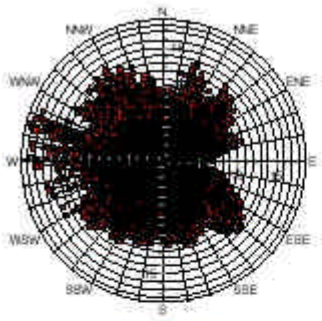


Site 2


Meteo data report, height: 50.0
Monthly mean values of wind speed in m/s
Month 2002 2003 mean mean of months
Jan 6.8 6.6 6.6
Feb 5.1 5.1 5.1
Mar 6.0 6.0 6.0
Apr 4.4 4.4 4.4
May 4.7 4.7 4.7
Jun 4.9 4.9 4.9
Jul 4.8 4.8 4.8
Aug 4.3 4.3 4.3
Sep 5.8 5.8 5.8
Oct 5.7 5.7 5.7
Nov 6.4 6.4 6.4
Dec 5.9 5.9 5.9
mean, all data 5.2 5.9 5.3
mean of months 5.3 5.9 5.4
Wind speed [m/s]
Hour
Month
Wind speed, Height: 50.0 m
Wind direction, Height: 50.0 m
Wind speed
Time
Height: 50.0 m
Wind direction
Time
Height: 50.0 m
Turbulence intensity
Time

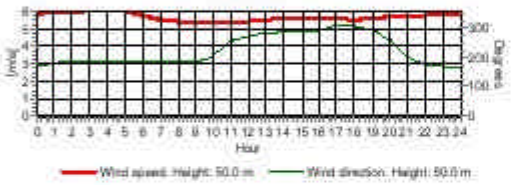
Site 3

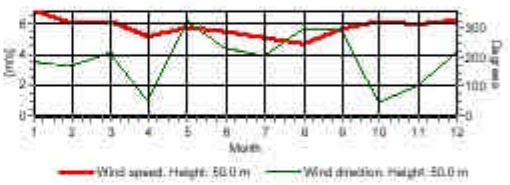
Meteo data report, height: 50.0

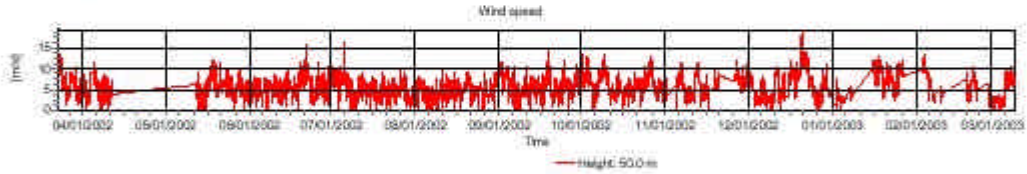


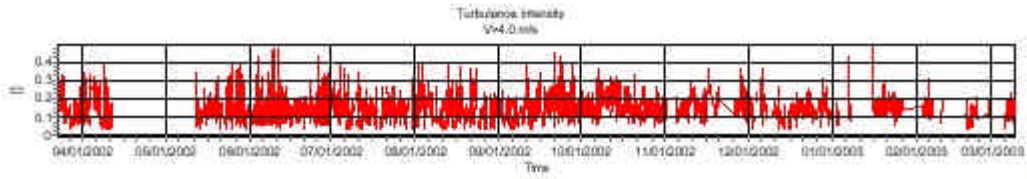
Monthly mean values of wind speed in m/s

Month	2002	2003	mean	mean of months
Jan		6.8	6.8	6.8
Feb		6.0	6.0	6.0
Mar	6.7	5.4	6.2	6.0
Apr	5.1		5.1	5.1
May	5.7		5.7	5.7
Jun	5.4		5.4	5.4
Jul	5.0		5.0	5.0
Aug	4.6		4.6	4.6
Sep	5.7		5.7	5.7
Oct	6.2		6.2	6.2
Nov	5.9		5.9	5.9
Dec	6.2		6.2	6.2
mean, all data	5.6	6.3	5.7	
mean of months	5.6	6.1		5.7









ECONOMIC ANALYSIS AND PROJECT PROFORMAS

To evaluate the proposed 75 MW wind power plant in the Leningrad Region of Russia, it was necessary to prepare a cash flow financial model and review project economics. This Appendix presents that model and describes assumptions and model inputs, including those from our Russian subcontractor, ST International. It presents preliminary results of analysis, including one set of proforma financial statements. These results illustrate the approach to the analysis and the level of detail but, as inputs are becoming better defined and/or are evolving, the results are not final. Furthermore, certain data is proprietary, such that the more detailed level of economic and financial analysis is included in the project's confidential appendix.

1. POWER PLANT BUSINESS ECONOMIC MODEL

As is typical and customary to analyze power plant projects, PERI prepared a discounted cash flow financial model. It reflects the 75 MW plant's capital cost and development schedule, plant performance and operating expenses over 20 years, and a simple and straight-forward ownership and financing structure. As discussed in this Report under Section 7, Business Strategy, the plant sells power retail to an industrial customer who signs a long-term power purchase agreement (PPA) and is committed to buy the electricity that is produced. Consequently, limited recourse project finance is utilized, where debt and equity investments are secured by only the one project, not by the developer/owner's other assets.

Given a PPA term of 20 years, the $98.7 million project is financed utilizing 60% debt, with a term of 12 years. The developer or other lead founding owner invests equity, builds the plant, and operates it, perhaps with help from minority partners. Over time, the lead owner may sell the plant or a large share of the plant to a local, Russian owner who takes on the plant's obligations (e.g., to produce power under the terms of the PPA for the industrial customer, to repay debt to the lender) and reaps its benefits. While the model does not break out such a sale, it shows the basic equity investment and return on equity investment from which any sale would be negotiated.

From construction, finance, and operating assumptions, the model shows 20 years of project cash flow financials, including project earnings, statement of cash flows, and debt redemption schedule. The developer works to balance three goals. The project must 1) provide an attractive after tax discounted return on equity for the developer and equity investors, 2) meet minimum debt coverage standards of the banker/other debt investors, and 3) charge the lowest possible Cost of Energy (COE) to the project's power purchaser.

With guidance from engineers, bankers, and ST Inter, PERI used the model to judge risk and see how various factors influence results, revised the model as needed (e.g., to better reflect wind speed as more data became available, to show Russian depreciation), and confirmed and negotiated certain terms (e.g., Oblast exempts new investment projects from property tax and Oblast share of profits tax till payback plus two years). The model with "likely case" inputs is included at the end of this attachment, with Section 3, "Preliminary Results of Analysis."

2. ASSUMPTIONS USED IN THE PRELIMINARY FINANCIAL ANALYSIS

In order to run the cash flow model, it is necessary to develop basic cost, finance, and operating assumptions, that may be entered as inputs to the model. Basic assumptions are set forth in Table 1, below.

Table 1, Assumptions for the 75 MW Russian Wind Project

		Wind Speed is 6.0 meters/second at 80 meters, so 25% capacity factor	Identical, except Wind is 7.3 m/s, so 35% cap factor
	Wind, Plant & Facilities & Capital Cost		
1	Wind Resource (1)	Wind speed is 6.0 meters/sec at 80 meters	Wind is 7.3 meters/sec
2	Capacity Factor (%)	25%	35%
3	Plant Size (MW)	75, so 50 turbines at 1.5 MW each.	Same
4	Equipment Life (years)	20 years +	Same
5	Capital Cost, including 10% Import Tax and 20% VAT (US$/kW Installed Capacity)	$877 + 64 + 81, which is $1,021/kW or $76.6 million total	Same
6	Loaded Total Cost (2) (US$/kW Installed Capacity and US$ millions total)	$1,316/kW or $98.7 million total	Same
	Operating Expenses		
1	Operations & Maintenance (US$/kWh)	$0.008/kWh	Same
2	Levelized Major Overhaul and Replacement Cost (US$/kW)	$2.00/kW	Same
3	Royalty Payment paid to Land Owners (e.g., farmers, state govt.) where the wind turbines are located	0.015% of revenues for years 1-12 or US$ 2,000/year; then 0.0225% of revenues and also US$ 2,000/year	Same and also US$ 2,000/year
4	Insurance, as percent of depreciable base and escalating, to obtain replacement cost	2.00% (or US$ 1,818,000 in year 1), escalating at inflation less 1% or 1.50% during debt repayment; then 0.50%, also escalating at 1.50% annually.	Same
	Project Financial Assumptions		
1	Debt/Equity Ratio after US$ 10 million GEF Grant	60%/40%	Same
2	Debt (3), from a Western commercial bank or other lenders (e.g., IFC, EBRD)	9.0% for 12 years, as hard currency, amortized with customized principal payments	Same
3	Debt Service Coverage (4) Ratio (times)	1.80 or better as average; 1.50 or better as worst year	Same

		Wind Speed is 6.0 meters/second at 80 meters, so 25% capacity factor	Identical, except Wind is 7.3 m/s, so 35% cap factor
4	Minimum after-tax equity IRR, over 30 years (%)	19	Same
5	After-tax Payback on equity (years)	aim for less than 10	Same
6	GEF Benefits (5) as an upfront grant (US$ millions) and as a production payment (US$/kWh)	US$ 10.0 million grant and US$ 0.01/kWh production pmt for years 1-10	Same
7	Carbon Credit (US$/kWh) (5)	US$ 9.00 per metric tonne of carbon displaced, or $0.0015/kWh for years 1-30	Same
8	Inflation in US$ (%)	2.5 as initial estimate	Same
9	Tariff Escalation	Assume two-tier pricing. That is, assume a flat price in year 1 with no escalation and assume a "second tier" lower price after debt is repaid (year 13) that is again flat, with no escalation.	Same
	Tax Treatment		
1	Federal Profit Tax	7.5%	Same
2	Oblast Profit Tax (not deductible from federal)	0% during exemption for years 1-14, then 14.5%.	Same
3	Local Profit Tax (not deductible)	2.0%	Same
4	Payback Period, allowing a return on equity, to calculate Regional/Oblast Profit Tax exemption and property tax exemption	12 years, so exemption is 14 years (payback + 2 years)	Same
5	Combined Profit Tax	9.5% for years 1-14; 24.0% afterwards	Same
6	Import/Customs Tax	10% of imported plant & equipment	Same
7	Value Added Tax (VAT)	20% of that plant & equipment not paid from Charter Funds. Input VAT is repaid with an offset from Output VAT (lasting two years).	Same
8	Depreciation	Straight line for 20 years	Same

Notes to Table 1:

1 For the wind resource, Class 2-3 wind assumes wind speed at 4.5 meters/second at 10 meter height and 6.0 meters/second at 80 meter height (turbine hub height), with a 25% capacity factor. Class 3 assumes wind at 5.5 meters/second at 10 meter height and 7.3 meters/second at 80 meter height, with a 35 % capacity factor.

2 Loaded project cost includes plant & equipment cost, 10% import tax on the portion of equipment imported, 20% VAT, and interest during construction. It further includes construction insurance, debt and equity financing fees including legal fees, a working capital reserve, developer's fee and contingency and a six-month's debt service reserve.

3 Debt term must be less than life of the Power Purchase Agreement (20 years or possibly 15), so 12 years is agreeable. Customized debt principal payments are slightly lighter in the early years and then level off. Payments are slightly backloaded, but not too much. Percentages paid per year from years 1-12 are: 3%, 4%, 6%, 8%, 9%, 10%, 11%, 11%, 11%, 11%, 8%, and 8%.

The hard currency loan rate is estimated as 9.0%, which is slightly high, to be conservative. (As an aside, note that hard currency loans from Russian banks as of late 2002 are estimated as 12%-15%, but for only 5 years. Russian currency loan from Russian banks are 15% to 25%, but for only 3 to 5 years, as suggested by St Inter consultants. However, no Russian bank loans are used in this analysis.)

4 Debt Service Coverage is one year's operating income over one year's debt payment, where the debt payment includes interest, principal, and any loan guarantee fee (but no fee here). Bankers check the Project's average debt coverage ratio and the worst year's ratio.

5 Special environmental benefits include a GEF (Global Environmental Facility) Grant of US$ 10.0 million at the project's start. Over the plant's years of operation, benefits include a GEF payment of US$ 0.01/kWh production payment for the first ten (10) years. In addition, a Russian Carbon Fund Credit of US$ 0.0015/kWh is paid for each year of operation (20 years), based on a price of US$ 9/metric tonne of carbon displaced and power plant fuel mix of 80% natural gas, 10% coal, and 10% nuclear/hydro.

Another benefit is the Oblast exemption for new investment from Oblast profits tax and from property tax until payback plus 2 years.

The last benefit is the proposed Oblast Wind User Tax Credit, which is available to power purchasers, not to the Wind Plant. The Tax Credit is calculated as the difference in the Wind Plant's power price vs. typical industrial prices. Typical industrial prices are rising to meet market prices, so the credit becomes smaller each year and it is assumed to end slightly before the end of debt repayment After the plant's debt is paid and power purchase price is reduced in year 13, then the power purchaser enjoys a power rate that is less than market. The power purchaser may make a small return payment to the Oblast, for the remaining years.

The five (5) notes above accompany Table 1. St International advised regarding methodology to calculate Import Duties and VAT. They advised that local and Oblast Profits taxes are not deductible from federal, on methodology to calculate depreciation and desirability of an average or mid-year value, and so forth.

3. PRELIMINARY RESULTS OF ANALYSIS

Preliminary results of running the cash flow model are shown below in Table 2. For a site where wind is 6.0 meters per second at 80 meters height, the tariff charged to the power purchaser is US$ 0.0950/kWh in year 1, dropping to US$ 0.0520/kWh in year 13, after debt is paid. These tariffs are expressed in money of the year. If one discounts the year 13 price by 2.50% inflation per year, then it is US$ 0.0387/kWh, expressed in year 1 dollars (.0520/[1.025^12]).

The tariffs do not escalate, despite the fact that O&M and Overhauls are expected to escalate slightly at 1% per year in hard currency terms and that insurance is expected to escalate at 1.50% (hard currency inflation less 1%).

Often for a power project, one wants to express all 20 years of tariff prices as one levelized Cost Of Energy (COE). For 6.0 meters/second wind, the nominal levelized COE is US$ 0.0854/kWh. The constant levelized COE (excluding inflation) is US$ 0.0696/kWh. Note 1 explains COE calculations. Furthermore, COE's at this level were needed to meet IRR and debt coverage requirements.

As shown, for 6.0 meters/second wind, the after-tax leveraged IRR is 19.58% with a 5-year payback. Debt coverages are 1.94 times average and 1.61 times minimum, for the worst year. If the project were financed with all equity and no debt and if it paid no taxes, which is a measure sometimes used to compare projects and ensure economic value, then IRR is 10.29% and payback is 8 years, which are attractive.

Table 2, Results of Preliminary Financial Analysis for the 75 MW Russian Wind Project

		Wind Speed is 6.0 meters/second at 80 meters, so 25% capacity factor	**Identical, except Wind Speed is 7.3 meters/second at 80 meters, so 35% capacity factor**
	Cost of Energy (1)		
1	Year 1 Cost (US$/kWh)	0.0950	0.0670
2	Nominal levelized (US$/kWh)	0.0854	0.0605
3	Constant$ levelized (US$/kWh, no inflation, with discount rate of 5.85%)	0.0696	0.0493
4	Year 13 Cost (US$/kWh, dollars of the year; discounted to year 1, with discount rate reflecting inflation of 2.50%)	0.0520; 0.0387	0.0380; 0.0283
	Debt and Equity Measures		
5	After-tax leveraged IRR	19.58	19.65
6	Payback (years, excluding return on equity)	5	5
7	Debt Coverage (times)	1.94 average; 1.61 as worst year	1.92 average; 1.61 as worst year
	Pre-Tax Unleveraged		
8	IRR	10.29	9.27
9	Payback (years, excluding return on capital)	8	9

Notes to Table 2:

1 To calculate Levelized Cost of Energy (COE): For this project, where hard currency inflation is about 2.5%, assume the discount rate is 8.50%. Long-term debt for a credit-worthy project is about 6.0%. In Russia, inflation is estimated at about 10% per year. Interest rates are about 12% (in local currency). This project is calculated in U.S. dollars, so therefore the discount rate is estimated as 8.50%.

To figure COE, one looks at stream of revenues and discounts them by nominal discount rate of 8.50% per year, to obtain a Net Present Value. To obtain a Current-dollar or nominal Cost of Energy, one then levelizes the Net Present Value with the nominal discount rate, as Rate * NPV / (1 – (1+rate)^(-n)). For example, for wind at 6.0 meters/second, .085 * $132,700,000 / (1 – (1.085)^(-20)) = $14,023,000. One divides by the power produced, as $14,023,000 / 164,250,000 = $0.0854 per kWh. To obtain a Constant-dollar Cost of Energy that excludes inflation, one levelizes NPV with the Constant-dollar discount rate. The Constant-$ discount rate is 5.854% as (1.085) / (1.025) –1. Here, n is 20 years.

Table 2 also shows a more optimistic case, where wind is 7.3 meters per second at 80 meters height, so the capacity factor is 35%, not 25%. Then, the year 1 tariff is US$ 0.0670/kWh and, they year 13 tariff, after debt is paid, is US$ 0.0380/kWh. The year 13 price is US$ 0.0283/kWh, expressed in year 1 dollars.

Furthermore, for 7.3 meters/second wind, the nominal levelized COE is US$ 0.0605/kWh. The constant levelized COE is US$ 0.0493/kWh. These COE's were needed to meet IRR and debt coverage requirements. As shown, the after-tax IRR is 19.65% with a 5-year payback and debt coverages are 1.92 times average and 1.61 times minimum. The pre-tax, unleveraged IRR is 9.27% and payback is 9 years, which are slightly less than the first case, but still attractive.

In viewing these COE and return on equity and debt investment figures, the reader is reminded that the cash flows are yet preliminary. All of the cash flow inputs are not known exactly, so analysis will change and results will change. The engineers must site the project and determine wind speed. Bankers will determine interest rates to charge based upon world events at the time project contracts are finalized. And so forth.

These project financial results will change. Nonetheless, the Project Team is pleased that results from this preliminary financial analysis indicate the 75 MW Wind Power Plant in the Leningrad Region of Russia is attractive. It is hoped that this plant will be financed, built, and operated to provide clean power and to serve as a model for future renewable energy projects in Russia.

4. PRELIMINARY CASH FLOW FINANCIAL STATEMENTS

One set of cash flow financials, for the case where wind speed is 6.0 meters/second at 80 meter height are presented below. These are preliminary. They show summary pages, earnings, cash flow and debt redemption schedule. A chart showing components of COE is included as the last page.

SUMMARY PAGE **75 MW Leningrad Wind Plant** **12/08/02 07:54 PM**

File: Rs43d_wnd.xls

Construction and Development Assumptions and Operating Results

All figures are in thousands of U.S. dollars.

Base Case	02/08/02	1.00	US$ =	30.75	Rus. Ruble		
	07/22/02	1.00	US$ =	31.55	Rus. Ruble		
	10/08/02	1.00	US$ =	31.73	Rus. Ruble		
	12/05/02	1.00	US$ =	31.85	Rus. Ruble		

Capital

Total Project Cost	98,700						
Start Date	2004	at 100.00% for year 1					
Project Description	75 MW Russian Wind Plant using Winds at 6.0 meters/sec at 80 meters, w/ private Project Finance-style owner						

Finance

Debt	53,220	at 9.00%	for 12 years				
Secondary Debt/Grant	10,000	at 0.00%	for 12 years				
Equity	35,480						
Total	98,700						

Operations

Net Rated Capacity	75,000	kW					
Actual Hours/Year	8,760	hours/year					
Wind Resource	Winds at 6.0 meters/sec at 80 meters						
Net Capacity Factor	25.00%						
Plant Annual Electricity	164,250	thou kWh/year					
Equipment Life	20	years				ok	
Contract Term	20	years; sale	1	thous in yr		21	

yr 1-4	yr 5+								
30.0%	80.0%	Major Overhauls (rubles)	$0.60	/kW, equiv. to	$0.0003	/kWh			
		escalating at	1.0%	/year					
70.0%	20.0%	Major Overhauls (US$)	$1.40	/kW, equiv. to	$0.0006	/kWh			
		escalating at	1.0%	/year					
30.0%	80.0%	Operations & Maint. (rubles)	$0.002	/kWh, equiv. to	$5.26	/kW			
		escalating at	1.0%	/year					
70.0%	20.0%	Operations & Maint. (US$)	$0.006	/kWh, equiv. to	$12.26	/kW			
		escalating at	1.0%	/year					
		Site Owner Royalty (land, rubles)	0.0150%	of revenues through year			12		
		Later Site Owner Royalty (rubles)	0.0225%	of revenues					
		Property Tax (rubles)	2.0%	of depreciable base					
		escalating at	0.0%	/year					
		where base depreciates	5.0%	/year till hits	0.0%		ok		
		Property Tax Exemption? Through year		14	14 as payback chk		ok		
		Other (rubles)	$0.00	thous/year					
		escalating at	2.5%	/year					
		Insurance (US$)	2.00%	of depreciable base thru year			12		
		escalating at	1.5%	/year					
		Later Insurance (US$)	0.50%	of depreciable base, at			1.5%	/year	
		Other (US$)	$0.00	thous/year					
		escalating at	2.5%	/year					
		Inflation 1 in US$	2.50%	/year					
		Inflation 2 in rubles	10.00%	/year, and curr. devaluation is			-6.82%	/year	
		Year for Russian wind industry	5	years					

RETURNS

using a discount rate of	19.00%	for developer	
1 Pre-tax Unleveraged IRR	10.292%	over 21 years	
Net Present Value	1,515	using 10%	
Payback, excl capital return	8	years	
2 After-tax Leveraged IRR	19.576%	over 21 years	
Net Present Value	712	using 19%	
Payback, excl eq return	5	years	

Capital Cost per kW installed capacity	1,316	[98700 / 75]	
Cost per Annual kWh	$0.60	[98700 / 164250]	

COST OF UTILITY ENERGY (all excluding VAT)

+---->	$0.0950	/kWh - first year	
+---->	$0.0854	/kWh - nominal levelized	
+---->	$0.0696	/kWh - constant$ levelized	
+---->	$0.0520	/kWh - yr 13 money of the year	
or	$0.0387	/kWh - first year	

using a discount rate of	8.50%	nominal
	5.85%	constant$ rate (with no inflation)
and using currency of	2004	

DEBT COVERAGE

Senior Debt Coverage ratio:	1.943	average
	1.611	minimum
Secondary Debt Coverage ratio:	n/a	average
(NOT subordinated, but together)	n/a	minimum

Notes:

This Excel spreadsheet model shows cash flow financials for wind energy projects. Enter data in cells with blue lettering as: pg 1: project cost & performance;
pg 2 (Sources and Uses): capital costs & selected financial incl'g Revenues; pg 9 (Cash Flow): COE disc rate; pg 12 (Debt): Tax Credit details;
pg 15 (Work Sheet #1): depreciation; pg 18 (Work Sheet #2): senior debt; pg 21 (Work Sheet #3): secondary debt, and pg 24 (Work Sheet #4): Any Sale.
By trial and error, a user seeks low COE, an attractive equity return, and good debt coverage, which results are summarized on page 1.

This particular Project is 75 MW, using Winds at 6.0 meters/sec at 80 meters, with a 25% capacity factor.
Capital Cost is $1021.2/kW with VAT & Import Tax. O&M is $2/kW and $0.008/kWh. Use 20-year straight-line depreciation, 24% income tax, and 20-year project life.
Financing is 54% senior debt at 9.00% for 12 years and 10% secondary debt/grant at 0.00% and 36% equity. Assume Oblast Profits Tax and Property Tax are deferred till year 15
Here, used 2-tier revenues, starting at US$0.095 in year 1 and escalating at 0.00%, then starting over at US$0.052 in year 13, escalating at 0.00%, after debt is repaid.
US Inflation is 2.50%. Russian inflation is 10.00%, so curency devaluation is (1 + 0.025) / (1 + 0.100) - 1, which is -6.82%, for net change of 2.50%. Converted to US$,
Assume Oblast Profits Tax and Property Tax are deferred till payback, VAT is 20% excluding Charter Funds and offset by Output VAT, Import Tax/Customs is 10%. Oblast User Tax
Credit is paid for years 1 through 12. Assume GEF Grant is $ 10,000,000, Carbon Credit is $ 0.0015/kWh, and GEF ongoing subsidy is $0.0100/kWh for years 1 through 10.

Sources and Uses of Funds

75 MW Leningrad Wind Plant **12/08/02 7:54 PM**

Uses of Funds *in thousands of mixed-year dollars*

	Tower		10,125		
	Rotor Assembly	}	0		
	Generator, Electrical	}	44,125		
	Transmission & Nacelle	}			
	Warranty (2 years)	}			
	Legal & "Other Soft" Costs		0		
	Transport, Constr., Commissioning		5,250		
	Bal of Station (transformer, etc.)		6,250		
10.0%	Other - 10% Customs/Import Tax		4,780		
20.0%	Other - 20% VAT		6,060		
	Other		0		
	Total	1,021 /kW		76,590	* depr excl VAT
	Construction Loan Interest, excl VAT		5,911	5,910	*
65,750	(estimated as $78.81 mil * 15%, 12 mos., level draw)				
	Construction Insurance	2,364		2,370	*
	Land			0	
	Debt Financing Fees	1,264		1,270	
	(Debt Closing [lawyers,accountants], Commitment Fee; all amortized-intangible over the life of the debt)				
	Equity Financing Fees	1,419		1,420	
	(Tax Advice, Equity Organizational Costs, etc.; part amortized-intangible in 1 year, part in 5 years, part excluded)				
	Debt Serv. Resrv Fund	3,716		3,720	6 month
	Initial Working Capital: First Year			0	
	Working Capital Reserve: Long-term		1,433	1,400	
	Contingency & Developer's Fee			6,020	*
				98,700	

Misc.

Start Year	2004		
Year 1 Calendar Fraction	100.00%		
Factor w/ 2 debt pmts/yr	100.00%	100.00%	
Interest Withhilding Tax Rate (%)	0.00%		
Equity Cash Withhilding Tax Rate (%	0.00%		
Regional/State Tax Exemption	14	years (payback + 2 years)	ok
Interest Earned on Reserves	3.0%	/year in hard currency account	
Payback Calc's Return on Equity	10.00%	cash distrib; 12 yr pybck chk	
Carbon Credit:	$0.00150	for years 1 through 20	escalating at 0.00%
GEF Subsidy	$0.01000	for years 1 through 10	escalating at 0.00%

Depreciation Rate #1	5.000%, 5.000%, 5.000%, 5.000%, 5.000%, 5.000%, 5.000%
	5.000%, 5.000%, 5.000%, 5.000%, 5.000%, 5.000%, 5.000%
	5.000%, 5.000%, 5.000%, 5.000%, 5.000%, 5.000%, 0.000%
	0.000%, 0.000%, 0.000%, 0.000%, 0.000%, 0.000%, 0.000%
Depreciation Rate #2	3.333%, 3.333%, 3.333%, 3.333%, 3.333%, 3.333%, 3.333%
	3.333%, 3.333%, 3.333%, 3.333%, 3.333%, 3.333%, 3.333%
	3.333%, 3.333%, 3.333%, 3.333%, 3.333%, 3.333%, 3.333%, etc.
Debt Repayment #1	3.000%, 4.000%, 6.000%, 8.000%, 9.000%, 10.000%, 11.000%
	11.000%, 11.000%, 11.000%, 8.000%, 8.000%, 0.000%, 0.000%
Equity Amortiz-intang:	50% @ 5 years, 30% @ 1 year, and 20% @ no write-off

Sources of Funds

53.92%	Debt	53,220	at 9.00%	for 12 years	customized principal repayment
10.13%	Jr Debt/Grant	10,000	at 0.00%	for 12 years	level principal pmt.
35.95%	Equity	35,480			
100.00%		98,700			

Looking only at lower cost, AFTER the Grant,
Debt is 53,220 of 88,700 , which is 60.00%

Taxes

		year 1-14	year 15-20	
Marginal Tax Rate:	Federal	7.50%	7.50%	corporate federal rate is 7.5%,
	Local	2.00%	2.00%	corporate local rate is 2%,
	State	0.00%	14.50%	corporate state rate is 14.5%
	Combined	9.50%	24.00%	State rate is zero for
Investment Tax Credit			0.00%	payback + 2 years.
Capital Gains Tax on Sale			20.00%	14 years

Depreciation *Select 3, 5, 7, 10, 15, or 20 years; using straight-line deprec.*

Depreciation Class Life #1	20	years; Percent at Life #1	100.00%	ok
Depreciation Class Life #2	30	years; Percent at Life #2	0.00%	ok
Amortization-intangible for Equity Finc'g Fees		50.00% 30.00%	20.00%	(See B227 on Sheet2.)

Tax Treatment

*	Sum of Depreciable Items		84,830	(8,595)	76,235 = aftr grant
	Primary System Depreciable Base			76,235	20 years
	less Tax Credit Adjustment	50.00%	0		
	Primary System Depreciable Base		76,235		
	Other Depreciable Base			0	30 years
	Amortization-intangible over Sr Debt's Life			1,069	12 years
	Amortization-intangible over Second Debt's Life			201	12 years
	5 years' Amortization-intangible			710	
	1 years' Amortization-intangible			426	
	No Write-Off			284	
	Land			0	
	Input VAT (offset to output VAT on power sales)			6,060	<{ count with primary dpr base
	First Year Start-Up (expensed in yr 1)			0	{ for insur, but NOT prop tax
	Reserve Funds			5,120	
				98,700	ok

Revenues

Energy (rubl)	$0.0000 /kWh at	0.00%	/year beginning in year	1
Energy (US$)	$0.0950 /kWh at	0.00%	/year beginning in year	1
Energy (rubl)	$0.0000 /kWh at	0.00%	/year beginning in year	13
Energy (US$)	$0.0520 /kWh at	0.00%	/year beginning in year	13
Capacity (US$)	$0.0000 /kWh at	0.00%	/year	

Earnings

75 MW Leningrad Wind Plant **12/08/02** **7:54 PM**

All figures in $thousands.

	0	1	2	3	4	5	6	7	8	9	10
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Revenues											
Energy Payment (roubles)		0	0	0	0	0	0	0	0	0	0
Energy Payment (US$)		15,604	15,604	15,604	15,604	15,604	15,604	15,604	15,604	15,604	15,604
Capacity Payment		0	0	0	0	0	0	0	0	0	0
Interest on Reserves		112	112	112	112	112	112	112	112	112	112
Total Revenues		15,715	15,715	15,715	15,715	15,715	15,715	15,715	15,715	15,715	15,715
Operating Costs											
Major Overhauls (rubles)		45	45	46	46	125	126	127	129	130	131
Major Overhauls (US$)		105	106	107	108	31	32	32	32	32	33
Operations & Maint. (rubles)		394	398	402	406	1,094	1,105	1,116	1,127	1,138	1,150
Operations & Maint. (US$)		920	929	938	948	273	276	279	282	285	287
Site Owner Royalty (land, rubles)		2	2	2	2	2	2	2	2	2	2
Property Tax (rubles)		0	0	0	0	0	0	0	0	0	0
Other (rubles)		0	0	0	0	0	0	0	0	0	0
Insurance (US$)		1,818	1,845	1,873	1,901	1,929	1,958	1,988	2,017	2,048	2,078
Other (US$)		0	0	0	0	0	0	0	0	0	0
Total Operating Costs		3,284	3,326	3,369	3,412	3,455	3,499	3,544	3,589	3,635	3,682
Operating Income		12,431	12,389	12,347	12,304	12,260	12,216	12,171	12,126	12,080	12,033
Other Expenses											
Interest on Loan #1		4,790	4,646	4,455	4,167	3,784	3,353	2,874	2,347	1,820	1,293
Interest Withholding Tax		0	0	0	0	0	0	0	0	0	0
Interest on Loan #2		0	0	0	0	0	0	0	0	0	0
Loan Guarantee Fee		0	0	0	0	0	0	0	0	0	0
Depreciation		3,812	3,812	3,812	3,812	3,812	3,812	3,812	3,812	3,812	3,812
Repair Depreciation											
Amortization-intangible		674	248	248	248	248	106	106	106	106	106
Total Other Expenses		9,275	8,706	8,514	8,227	7,844	7,270	6,791	6,265	5,738	5,211
Before-Tax Profits		3,156	3,684	3,833	4,077	4,417	4,946	5,380	5,861	6,342	6,823
Income Tax Paid (Benefit Rec'd)		300	350	364	387	420	470	511	557	603	648
Investment Tax Credit Received		0	0								
GEF/Other Credit Received		1,643	1,643	1,643	1,643	1,643	1,643	1,643	1,643	1,643	1,643
Production Tax/Carbon Credits Received		246	246	246	246	246	246	246	246	246	246
After-Tax Profits		4,745	5,223	5,357	5,579	5,886	6,365	6,758	7,193	7,629	8,063

Earnings

75 MW Leningrad Wind Plant **12/08/02** **7:54 PM**

All figures in $thousands.

	11	12	13	14	15	16	17	18	19	20	21
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Revenues											
Energy Payment (roubles)	0	0	0	0	0	0	0	0	0	0	0
Energy Payment (US$)	15,604	15,604	8,541	8,541	8,541	8,541	8,541	8,541	8,541	8,541	0
Capacity Payment	0	0	0	0	0	0	0	0	0	0	0
Interest on Reserves	112	112	0	0	0	0	0	0	0	0	0
Total Revenues	15,715	15,715	8,541	8,541	8,541	8,541	8,541	8,541	8,541	8,541	0
Operating Costs											
Major Overhauls (rubles)	133	134	135	137	138	139	141	142	144	145	0
Major Overhauls (US$)	33	33	34	34	34	35	35	36	36	36	0
Operations & Maint. (rubles)	1,161	1,173	1,185	1,196	1,208	1,220	1,233	1,245	1,257	1,270	0
Operations & Maint. (US$)	290	293	296	299	302	305	308	311	314	317	0
Site Owner Royalty (land, rubles)	2	2	2	2	2	2	2	2	2	2	0
Property Tax (rubles)	0	0	0	0	495	410	325	240	155	70	0
Other (rubles)	0	0	0	0	0	0	0	0	0	0	0
Insurance (US$)	2,110	2,141	543	551	560	568	577	585	594	603	0
Other (US$)	0	0	0	0	0	0	0	0	0	0	0
Total Operating Costs	3,729	3,777	2,195	2,220	2,739	2,679	2,620	2,561	2,502	2,444	0
Operating Income	11,986	11,938	6,346	6,321	5,802	5,862	5,921	5,980	6,039	6,097	0
Other Expenses											
Interest on Loan #1	766	383	0	0	0	0	0	0	0	0	0
Interest Withholding Tax	0	0	0	0	0	0	0	0	0	0	0
Interest on Loan #2	0	0	0	0	0	0	0	0	0	0	0
Loan Guarantee Fee	0	0	0	0	0	0	0	0	0	0	0
Depreciation	3,812	3,812	3,812	3,812	3,812	3,812	3,812	3,812	3,812	3,812	0
Repair Depreciation											
Amortization-intangible	106	106	0	0	0	0	0	0	0	0	0
Total Other Expenses	4,684	4,301	3,812	3,812	3,812	3,812	3,812	3,812	3,812	3,812	0
Before-Tax Profits	7,302	7,638	2,534	2,510	1,990	2,050	2,109	2,168	2,227	2,285	0
Income Tax Paid (Benefit Rec'd)	694	726	241	238	478	492	506	520	534	548	0
Investment Tax Credit Received											
GEF/Other Credit Received	0	0	0	0	0	0	0	0	0	0	0
Production Tax/Carbon Credits Received	246	246	246	246	246	246	246	246	246	246	0
After-Tax Profits	6,855	7,158	2,540	2,518	1,759	1,804	1,849	1,894	1,939	1,983	0

Cash Flow & COE

75 MW Leningrad Wind Plant — **12/08/02** — **7:54 PM**

	All figures in $thousands.		0 2003	1 2004	2 2005	3 2006	4 2007	5 2008	6 2009	7 2010	8 2011	9 2012	10 2013
	Before-Tax Profits			3,156	3,684	3,833	4,077	4,417	4,946	5,380	5,861	6,342	6,823
	Add Back:												
	Year 1 Cash from Financing			0									
	Depreciation & Repair Deprec.			3,812	3,812	3,812	3,812	3,812	3,812	3,812	3,812	3,812	3,812
	Amortization-intangible			674	248	248	248	248	106	106	106	106	106
	VAT Offset from Construction			3,121	2,939	0	0	0	0	0	0	0	0
	Released from Reserve			0	0	0	0	0	0	0	0	0	0
	Total Additions			7,606	6,999	4,060	4,060	4,060	3,918	3,918	3,918	3,918	3,918
	Subtract Off:												
	Loan #1 Principal			1,597	2,129	3,193	4,258	4,790	5,322	5,854	5,854	5,854	5,854
	Loan #2 Principal			0	0	0	0	0	0	0	0	0	0
	Other (e.g., Reserve Deposit)												
	Total Subtractions			1,597	2,129	3,193	4,258	4,790	5,322	5,854	5,854	5,854	5,854
	Project Sales Price			0	0	0	0	0	0	0	0	0	0
	Before-Tax Cash			9,166	8,554	4,699	3,879	3,686	3,541	3,443	3,925	4,406	4,886
	Taxes Payable (Benefit Received)			300	350	364	387	420	470	511	557	603	648
	Equity Cash Withholding Tax			0	0	0	0	0	0	0	0	0	0
780	Repay TDA Study Loan			78	78	78	78	78	78	78	78	78	78
	Investment Tax Credit			0	0								
	GEF/Other Credit			1,643	1,643	1,643	1,643	1,643	1,643	1,643	1,643	1,643	1,643
	Production Tax/Carbon Credit			246	246	246	246	246	246	246	246	246	246
	Tax on Sale of Project			0	0	0	0	0	0	0	0	0	0
	After-Tax Cash		(35,480)	10,677	10,015	6,146	5,303	5,078	4,882	4,743	5,179	5,614	6,049
			After-tax IRR		19.576%								
			using starting estimate of			20.000%	.						
			Net Present Value		712	, using	19.00%	as discount rate for developer					
			Payback	5		excluding return on equity							
				1	1	1	1	1	0	0	0	0	0
	COST OF ENERGY	Cal fraction		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Electric Revenues:	Energy		15,604	15,604	15,604	15,604	15,604	15,604	15,604	15,604	15,604	15,604
		Capacity		0	0	0	0	0	0	0	0	0	0
	Total (thousands)			15,604	15,604	15,604	15,604	15,604	15,604	15,604	15,604	15,604	15,604
	NPV (thousands)			14,381	13,255	12,216	11,259	10,377	9,564	8,815	8,124	7,488	6,901

Net Present Value 132,700 , using 8.500% <--- SET THIS! Before-tax rate, from utility's cost of capital
Check (Sum of NPV) 132,700 ok!!
>> >> Current $ Levelized 14,023 as Rate * NPV/(1-(1+Rate)^(-n)) (e.g., 8.50% for IOU in US w/ 3% inflation; 15.0% w/ 10% inflation)
lev COE/kWh $0.0854 in nominal terms of 2004 note: NPV boosts year 1 to 100% and
1st-yr Cost $0.0950 cuts any N+1 last year to zero.

Net Present Value 132,700 , as nominal value (because nominal NPV is needed even though will calculate constant$ levelized COE).
>> >> Constant $ levelized 11,432 , using 5.854% = (1 + 0.085)/(1 + 0.025) - 1
lev COE/kWh $0.0696 in constant terms of 2004 (excluding inflation).

Cash Flow & COE

75 MW Leningrad Wind Plant **12/08/02** **7:54 PM**

	All figures in $thousands.		11 2014	12 2015	13 2016	14 2017	15 2018	16 2019	17 2020	18 2021	19 2022	20 2023	21 2024
	Before-Tax Profits		7,302	7,638	2,534	2,510	1,990	2,050	2,109	2,168	2,227	2,285	0
	Add Back:												
	Year 1 Cash from Financing												
	Depreciation & Repair Deprec.		3,812	3,812	3,812	3,812	3,812	3,812	3,812	3,812	3,812	3,812	0
	Amortization-intangible		106	106	0	0	0	0	0	0	0	0	0
	VAT Offset from Construction		0	0	0	0	0	0	0	0	0	0	0
	Released from Reserve		0	3,720	0	0	0	0	0	0	0	1,400	0
	Total Additions		3,918	7,638	3,812	3,812	3,812	3,812	3,812	3,812	3,812	5,212	0
	Subtract Off:												
	Loan #1 Principal		4,258	4,258	0	0	0	0	0	0	0	0	0
	Loan #2 Principal		0	0	0	0	0	0	0	0	0	0	0
	Other (e.g., Reserve Deposit)												
	Total Subtractions		4,258	4,258	0	0	0	0	0	0	0	0	0
	Project Sales Price		0	0	0	0	0	0	0	0	0	0	1
	Before-Tax Cash		6,962	11,018	6,346	6,321	5,802	5,862	5,921	5,980	6,039	7,497	1
	Taxes Payable (Benefit Received)		694	726	241	238	478	492	506	520	534	548	0
	Equity Cash Withholding Tax		0	0	0	0	0	0	0	0	0	0	0
780	Repay TDA Study Loan		0	0	0	0	0	0	0	0	0	0	0
	Investment Tax Credit												
	GEF/Other Credit		0	0	0	0	0	0	0	0	0	0	0
	Production Tax/Carbon Credit		246	246	246	246	246	246	246	246	246	246	0
	Tax on Sale of Project		0	0	0	0	0	0	0	0	0	0	0
	After-Tax Cash		6,515	10,538	6,352	6,329	5,571	5,616	5,661	5,706	5,750	7,195	1
			0	0	0	0	0	0	0	0	0	0	0
	COST OF ENERGY	Cal fraction	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%
	Electric Revenues:	Energy	15,604	15,604	8,541	8,541	8,541	8,541	8,541	8,541	8,541	8,541	0
		Capacity	0	0	0	0	0	0	0	0	0	0	0
	Total (thousands)		15,604	15,604	8,541	8,541	8,541	8,541	8,541	8,541	8,541	8,541	0
	NPV (thousands)		6,361	5,862	2,957	2,726	2,512	2,315	2,134	1,967	1,813	1,671	0

>> >>

>> >>

PRELIMINARY

Debt Redemption

75 MW Leningrad Wind Plant **12/08/02** **7:54 PM**

All figures in $thousands.

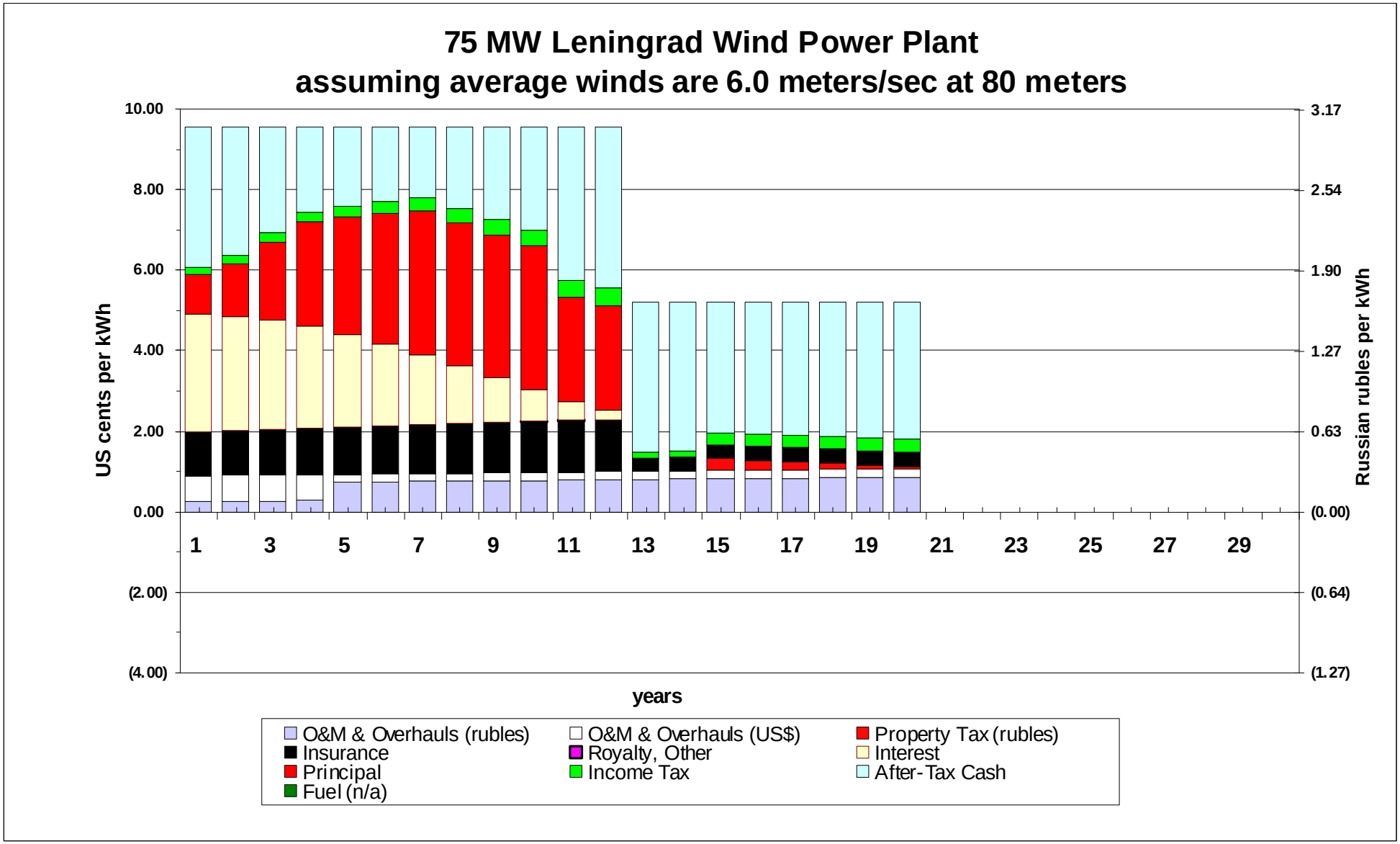
		0	1	2	3	4	5	6	7	8	9	10
		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Loan #1		53,220	at 9.00%	for 12 years	customized principal repayment -- with ONE payment/year							
Beginning Balance			53,220	51,623	49,495	46,301	42,044	37,254	31,932	26,078	20,224	14,369
Interest			4,790	4,646	4,455	4,167	3,784	3,353	2,874	2,347	1,820	1,293
Loan Guarantee Fees	0.00%		0	0	0	0	0	0	0	0	0	0
Principal			1,597	2,129	3,193	4,258	4,790	5,322	5,854	5,854	5,854	5,854
Total			6,386	6,775	7,648	8,425	8,574	8,675	8,728	8,201	7,674	7,147
Available Cash: Operating Income			14,320	14,278	14,236	14,193	14,149	14,105	14,060	14,015	13,969	13,922
Total Debt Service			6,386	6,775	7,648	8,425	8,574	8,675	8,728	8,201	7,674	7,147
Debt Coverage Ratio			2.242	2.108	1.861	1.685	1.650	1.626	1.611	1.709	1.820	1.948
Average Ratio	1.943		not counting last partial year									
Minimum Ratio	1.611											

Debt Redemption

75 MW Leningrad Wind Plant **12/08/02** **7:54 PM**

All figures in $thousands.

		11 2014	12 2015	13 2016	14 2017	15 2018	16 2019	17 2020	18 2021	19 2022	20 2023	21 2024
Loan #1												
Beginning Balance		8,515	4,258	0	0	0	0	0	0	0	0	0
Interest		766	383	0	0	0	0	0	0	0	0	0
Loan Guarantee Fees	0.00%	0	0	0	0	0	0	0	0	0	0	0
Principal		4,258	4,258	0	0	0	0	0	0	0	0	0
Total		5,024	4,641	0	0	0	0	0	0	0	0	0
Available Cash: Operating Income		12,233	12,185	6,592	6,568	6,048	6,108	6,167	6,226	6,285	6,343	0
Total Debt Service		5,024	4,641	0	0	0	0	0	0	0	0	0
Debt Coverage Ratio		2.435	2.626	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Average Ratio	1.943											
Minimum Ratio	1.611											



preliminary

APPENDIX 1.6:
ENVIRONMENTAL ASSESSMENT

Summary of New Russian Environmental Laws and Regulations

Terms of Reference for Conducting an Environmental Assessment

Russian Environmental Legislation

THE RUSSIAN FEDERATION LAW dated July 10, 2001 No. 93-03
"ON ITRODUCTION OF ADDENDA TO THE ARTICLE 50 OF THE RSFSR "ENVIRONMENTAL PROTECTION LAW"
(adapted by FS RF State Duma on June 6, 2001)

THE RUSSIAN FEDERATION LAW dated November 23, 1995 No. 174-03
(version dated April 15, 1998)
"ON ENVIRONMENTAL EXPERT REVIEW"
(adapted by FS RF State Duma on July 19, 1995)

THE RUSSIAN FEDERATION LAW dated April 24, 1995 No. 52-03
"ON ANIMAL KINGDOM"
(adapted by FS RF State Duma on March 22, 1995)

THE RUSSIAN FEDERATION LAW dated March 14, 1995 No. 33-03
"ON SPECIALLY PROTECTED NATURAL TERRITORIES"
(adapted by FS RF State Duma on February 15, 1995)

THE RUSSIAN FEDERATION LAW dated December 21, 1994 No. 68-03
"ON POPULATION AND TERRITORIES PROTECTION FROM NATURAL AND TECHNOLOGICAL DISASTERS"
(adapted by FS RF State Duma on November 11, 1994)

THE RUSSIAN FEDERATION LAW dated June 2, 1993 No. 5076-1
(version dated March 30, 1999)
"ON ITRODUCTION OF CHANGES AND ADDENDA TO THE RSFSR LAW "ON THE SANITARY AND EPIDEMIOLOGICAL WELL-BEING OF THE PUBLIC", THE RSFSR LAW "ON THE CONSUMER RIGHTS PROTECTION", AND THE RSFSR ENVIRONMENTAL PROTECTION LAW"

THE RUSSIAN FEDERATION LAW dated December 19, 1991 No. 2060-1
(version dated July 10, 2001)
THE ENVIRONMENTAL PROTECTION LAW

THE RUSSIAN FEDERATION LAW dated July 19, 1998 No. 113-03
"ON HYDREMETEOROLOGICAL SERVICE"
(adapted by FS RF State Duma on July 3, 1998)

LITERATURE REVIEW

Databases Searched

Ornithological Books Online http://hem.fyristorg.com/takern/ornlit.html

This is an on-line compedium of about 275 books, pamphlets and technical reports, including several useful Avian Surveys, Censuses, and Atlases. Mostly English-language books. Relevent to the current project are the following:

Anderson, Richard et al. 1999. *Studying Wind Energy/Bird Interactions: A Guidance Document for Determining or Monitoring Potential Impacts on Birds at Existing and Proposed Wind Energy Sites*. Avian Subcommittee, NWCC, 94 pp.

Delany S., et al. 1999. *Results from the International Waterbird Census in the Western Paleoarctic and Southwest Asia 1995 and 1996*. 178 pp.

Fischer Rasmussen, Jan. 1999. *Birds of the Danish SPAs—Trends in Occurrence*. Miljo-og Energiministeriet, Skov-og Naturstyrelsen. 114 pp.

Guillemette, M. et al. 1999. *Assessing the Impact of the Tuno Knob Wind Park on Sea Ducks. The Influence of Food Resources*. Faglig rapport fra DMU, Nr. 263. 20pp.

-------. 1998. *Impact Assessment of an Off-Shore Wind Park of Sea Ducks*. Faglig rapport fra DMU, Nr. 227. 61 pp.

Madsen, J. et al. 1997. *Spring Migration Strategies and Stopover Ecology of Pink-Footed Geese: Results of Field Work in Norway, 1996*. Faglig rapport fra DMU, Nr. 204 29 pp.

Milko, Robert, 1998. *Environmental Assessment Guidelines for Forest Habitat of Migratory Birds*. Biodiversity Protection Branch, Canadian Wildlife Service, Environment Canada.

Morrison, Michael et al. 1998. *Development of a Practical Modeling Framework for Estimating the Impact of Wind Technology on Bird Populations*, NREL/SR-440-23088. 42 pp.

Pihl, S. et al. 1995. *Waterbird Numbers in the Baltic Sea, Winter 1993*. Faglig rapport fra DMU Nr. 145. 60 pp.

Scott, Derek A. 1998. *Global Overview of Arctic Migratory Breeding Birds Outside the Arctic*. CAFF Technical Report No. 4.

Baltic Marine Environment Bibliography http://www.baltic.vtt.fi/

This searchable on-line resource covers bibliographic information on the Baltic Sea, including the Gulf of Finland. There are approximately 11,000 references in the database, dating from 1970, including journal articles, books, conference proceedings, and dissertations. Most useful for data on shorebirds and other pelagic species.

The bibliography was compiled under the auspices of the Baltic Marine Environment Protection Commission (HELCOM, Helsinki Commission). The main languages are English (48%), Swedish (14%), Russian (9%), and German (9%). Not as useful as on-line books, since once an relevant reference is identified, the actual document must be obtained by contacting a country representative.

The Baltic Marine Environment Bibliography contact for Russia is:
Mr. Nicolai D. Sorokin
Ministry of Protection of the Environment and Natural Resources
Committee on Ecology and Natural Resources for St. Petersburg and Leningrad
(Address and FAX no. available on website)

UNEP/WCMC World Database on Protected Areas http://www.unep-wcmc.org/protected_areas/data

UNEP's World Conservation Monitoring Centre maintains a database of designated protected areas throughout the world, including sites in the Russian Federation. The IUCN definition of a protected area is:

An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.

A search of this database revealed no IUCN Category I (the highest protected value) areas in the immediate area of candidate wind farm sites considered in this FS. The table below lists the closest (by lat/long) Category I protected sites:

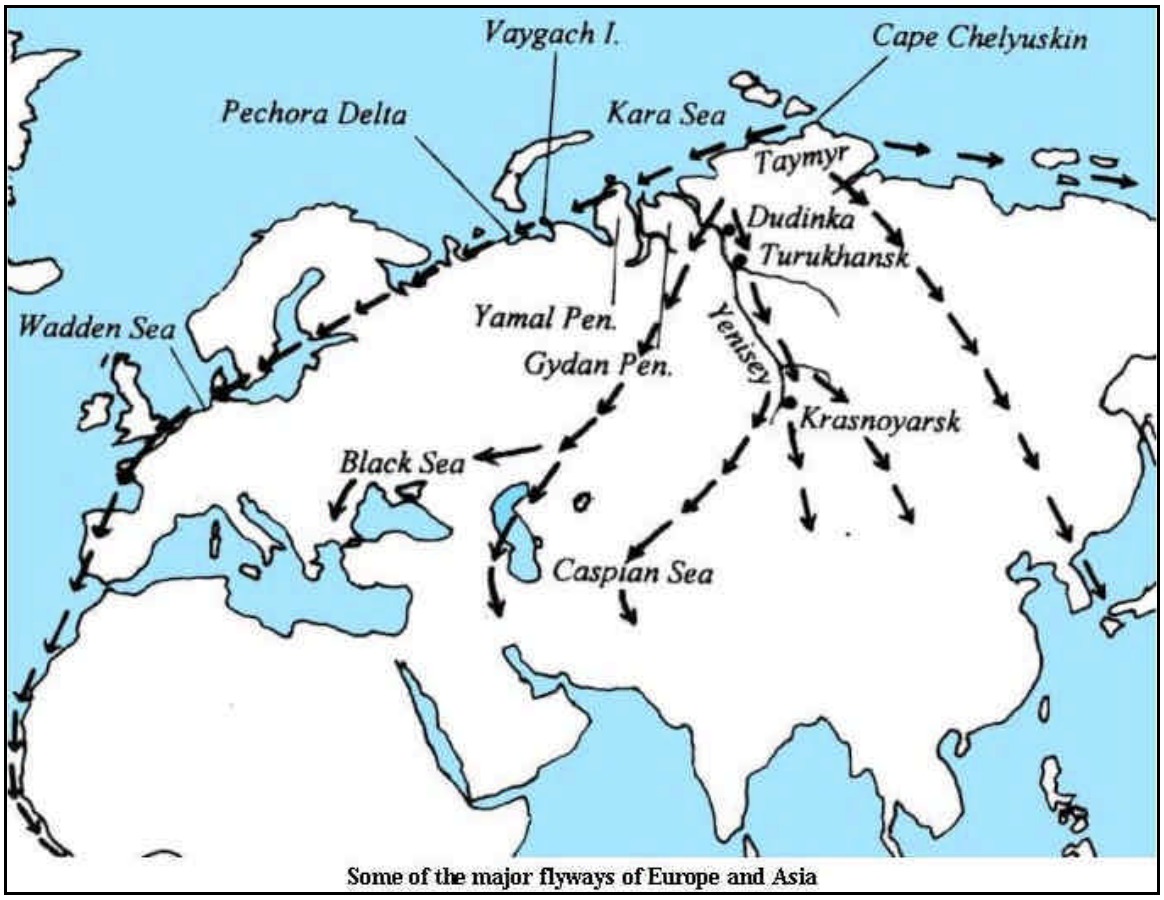
Name	IUCN Category	Type	Lat/Long	Description
Tsental'nolesnoy Zapovednik	I and IX	Strict Nature Reserve and Biosphere Reserve	56o30'N, 32o54'E	In Central Russian Kalinin Oblast
Laplandskiy Zapovednik	I and IX	Strict Nature Reserve and Biosphere Reserve	67o10'-68o05', 31o45'-32o45'	Western Kola peninsula, 120 km north of the Arctic Circle
Polistovsky Zapovednik	Ia	Strict Nature Reserve	57o09', 30o33'	In Udvardy ecoregion
Nyzhnesvirsky Zapovednik	Ia	Strict Nature Reserve	60o38', 33o03'	In Udvardy ecoregion
Kostomukshsky Zapovednik	Ia	Strict Nature Reserve	64o25', 30o21'	In Udvardy ecoregion

Coastal and Marine Protected Areas in the Baltic Sea http://www.iczm.lt/iba/pro-areas.html

This database shows coastal and offshore marine areas that have been designated under the Baltic Sea Protected Areas (BSPA) programme, pursuant to the 1992 Helsinki Convention recommendations. These represent areas of high seabird concentration and biodiversity.

In Russia, the Law of Specially Protected Areas provides federal and regional protection to designated marine and coastal protected areas. Three areas on the Russian Baltic Coast are designated as Ramsar sites. These represent protected underwater habitats for fish and other marine animal conservation. The three sites are within 50 km of two of the candidate wind farm sites, but since these sites protect underwater habitat, they would have no potential impact from a wind farm.

Four areas in the Gulf of Finland are proposed by the Russian regional governments as BSPAs. These sites are in the middle of the Gulf of Finland, and again, would be little affected by an inland or coastal wind farm.



Some of the major flyways of Europe and Asia

Documents Reviewed

Larsen, Jesper K. and Preben Clausen. *Potential Wind Park Impacts on Whooper Swans Cygnus Cygnus in Winter: the Risk of Collision*. (prepublication review, 2002)

- The study area, eastern Jutland (Denmark), while not in the Gulf of Finland, does offer some relevance with respect to species' migratory behavior and height preferences. The findind is that medium

Pettersson, Jan. 2000. *Bird Observation in Southern Kalmar Sound*. Prepared for Vindkompaniet AB and Enron Wind.

- This is an avian expert's report on the first stage of a long-term study whose aim is to assess to what extent the off-shore wind farms in Kalmar Sound, Sweden, might influence bird life, including assessment of the risk of collision, effect on bird migration, and effect on feeding, resting, and breeding in the shoal area where the windmills are constructed. While the detailed results are relevant only to this site, and to off-shore wind farms in general, there is interesting data being developed on the flight paths and migration height preferences of seabirds and others avian species that would be relevant to coastal Baltic windfarm sites in Russia.

Winkelman, J.E. 1994. *Bird/Wind Turbine Investigations in Europe*. National Wind-Avian Power Planing Meeting I.

- Overview of research carried out in Europe with emphasis on two key studies at Oosterbierum and Urk Wind Parks, Netherlands. Generally, research is a bit dated as the wind sites covered (14 in all) involve mostly small, solitary turbines. A more recent review is: Sjoerd Dirksen et al 1998 *, A Review of Recent Developments in Wind Energy and Bird Research in Western Europe*. National Avian-Wind Power Planning Meeting III.

TERMS OF REFERENCE
FOR ENVIRONMENTAL IMPACT ASSESSMENT REPORT

I. Overall Expectation

The purpose of this TOR is to outline specific requirements for a Project-Level Environmental Assessment Process and Report.

The main steps in such a process are:

- Project Definition: Define the project, physical setting, energy source, energy conversion technology, environmental issues associated with energy source and/or technology.
- Environmental Impacts: Estimate or measure, as part of the assessment process, a range of environmental impacts using appropriate assessment tools and methods. Once assessed, impacts are compared to applicable environmental standards and guidelines to determine significance.
- Assessment Methods and Tools: Methods and tools used in the assessment process can include mathematical and empirical models, software tools, guidelines, etc.
- Standards and Guidelines: Environmental impacts of the project must be compared with country-specific environmental standards and guidelines to see if mitigation measures are needed.
- Mitigation Measures: If, through the environmental assessment process, it is determined that mitigation measures are needed, then ensure that appropriate measures are integrated into the project design.

In addition, the environmental assessment process pursuant to this TOR must meet Russian Federation Environmental Protection Law No. 2060-1 (December 1991 and other dates) requirements, as delineated in reference guideline SP 11-101-95, titled "Environmental Impact Assessment During an Investment Study for Construction of Enterprises, Buildings, and Structures." The RSFSR requirements may include:

- State Environmental Expert Review and/or
- Public Environmental Expert Review.

It is the responsibility of TOR respondents to determine the applicability of RSFSR for the proposed project, and what level of expert review may be required.

In addition, the environmental assessment process pursuant to this TOR must be compatible with World Bank/International Finance Corporation Environmental, Health, and Safety Guidelines for Wind Energy Conversion Systems, dated July 1, 1998.

II. Specific Studies

The Environmental Assessment Process must include the following studies; other studies may be proposed, with the rationale for including them.

- Conduct spring and fall migrant studies with special attention to migratory patterns and feeding behavior of birds of prey and owls and migrants at the selected site.
- Conduct summer breeding bird survey at the selected site, with special attention to Kestel and Montagu's Harrier to make sure no rare or threatened species are nesting in vicinity of planned turbines.
- Identify all IUCN category protected areas within 25 km of proposed sites to ensure that no protected areas have the potential for impact.
- Conduct site surveys for presence of wetlands, rare or threatened flora and fauna, and other sensitive environment indicators, to ensure that site selection is considerate of these.
- Conduct a cultural resources survey that including delineates candidate sites' potential for archeological, historical, and visual impacts.
- Conduct a carbon displacement study to estimate the fossil fuel consumption that will be offset by wind energy production over the life of the project.

III. Considerations for Project Design

Document environmental considerations for project design, including but not limited to the following

- At a minimum, project should be designed to meet World Bank guidelines for noise abatement; or local/regional noise regulations, whichever are more protective.
- At a minimum, project should be designed to comply with industry standard practices for erosion and sediment control during and after construction.
- At a minimum, project should be designed to minimize electromagnetic interference via proper tower siting and/or shielding or filtering the wind turbine generators.
- At a minimum, project should be designed to comply with industry standard practices for management of waste material, wastewater (if any), and hazardous materials generated or stored on site.
- Mitigation measures for project design, as determined by the environmental assessment process. Measures may include, but are not limited to, setbacks for:
  - Wind access
  - Residences (safety and noise abatement)
  - Roads (safety)
  - Tower lighting requirements for aviation safety
  - Designated Protected Areas
  - Wetlands

IV. Environmental Impact Report

The report on the environmental assessment process should take the form of a statement that includes the following major topics:

- Introduction and Project Description
- Environmental Setting
- Favorable and Adverse Environmental Impacts of the Proposed Action

- Proposed Mitigation Measures
- Biological Resources
- Cultural Resources

Results of State or Public Expert Environmental Review (if applicable)

APPENDIX 1.7:
TECHNICAL PAPER ON "OPERATIONAL CONSTRAINTS AND ECONOMIC BENEFITS OF WIND-HYDOR INTEGRATION IN THE UNITED STATES AND RUSSIA"

To be presented at the European Wind Energy Conference in Madrid, Spain, 10-23 June 2003

Subject numbers - B4 / T6

Title – Operational Constraints and Economic Benefits of Wind-Hydro Hybrid Systems – Analysis of Systems in the U.S./Canada and Russia

Authors - Daniel F. Ancona, International Program Manager, Princeton Energy Resources International, 1700 Rockville Pike, Suite 550, Rockville, Maryland, USA 20852, Phone 1-301-468-8414, FAX 1-301-230-1232, dancona@perihq.com
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Pavel Bezrukikh, Head of Department of Science and Technology, Ministry of Energy, Russian Federation, Moscow, Russia (095) 220-6402 (voice) (095) 924-5174 bpp@mte.gov.ru

Objectives – 1.To define key technical limits and economic considerations in combined operation of these two renewable energy technologies in large-scale hybrid wind/hydro power plant applications.

2. To present the findings of recent studies assessing the impact of wind power on Vermont (USA) electricity system costs[1] and the potential value in areas of Russia.

3. To explain the accelerating development of wind-hydro hybrid applications in the United States, and

4. To demonstrate case studies of potential value of large-scale wind-hydro applications in cold climate regions.

Approach – Results and data from two recent studies on large-scale wind and hydropower applications in the United States and Russia will be combined along with a survey of studies conducted over the past 20 years in the United States to determine the technical and economic drivers and constraints for wind-hydro hybrid development. A study was recently completed to estimate the potential increase in value to a hypothetical windpower plants located in the State of Vermont, by operating the wind plants in conjunction with small local hydro plants and the largely hydro-based power system in Canada. An existing hydrothermal medium-term generation planning (MTGP) model was used for this analysis. In addition, interannual hydro-power operational and energy production data was collected on several large run-of-the-river hydro plants in northwest Russia. This data was used in the evaluation of potential commercial wind power plants in that region.

Scientific innovation and relevance – The paper will explain the accelerating growth of wind-hydro applications in the Northwestern United States where low cost electricity comes primarily from hydropower and to project the value and constraints for similar applications in other parts of the world. Further, it demonstrates conditions under which wind power can be valued higher than just the worth of its energy generation, and quantifies such value for a specific case study.

Results and conclusions -Major findings of analysis include:
1. It was determined in Vermont that there are no major electrical system integration constraints to preclude wind power from becoming a large share of the State's generation system with an addition of over 800 MW of a wind plants, without significant costs for T&D upgrades or reinforcements.

2. Wind energy output was found to have low correlation with either NEPOOL prices, or NEPOOL/Vermont loads and was too low to provide wind energy projects with annual revenues above pool prices without other incentives, thereby limiting projected growth.

3. Estimates of the additional cost to Vermont ratepayers for accepting 820 MW of wind capacity varied from below zero (i.e., savings) to over 1 cent/kWh depending on projected NEPOOL spot prices.

4. Hydro-Québec load and Vermont wind are well correlated. The value of wind was found to be up to 22% higher if it was exported during periods of peak demand in Quebec, than if it were sold only at NEPOOL spot prices.

5. The value of wind-hydro hybrids is projected to be highest in winter months due to water shortages combined with peak electricity demand, occurring in many parts of the world. Other operating constraints on hydroplants may diminish the value wind-hydro firming capability.

Notes: 1. G. Lafrance et. al., *Assessment of the impact of wind power penetration on the Vermont electricity grid: Technical Reference 1*, A contribution to U.S. DOE project DE-PS01-00EE10722, co-funded by Green Mountain Power Corporation, under management of Princeton Energy Resources International (PERI), December, 2002.