The Fox Islands Wind Project (A)

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PJM 6005 21637 Project Scope Management

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Project Description

According to the case study "The Fox Islands Wind Project (A)" by Lassiter et al (2011), Fox Island is part of an island community off the coast of Maine that is separate from the mainland. The electrical market on Maine's Fox Islands of North Haven and Vinalhaven is unusual and expensive for residents. Due to the high cost of importing power by sea cable and maintaining the distribution network on the islands, electricity costs on the islands were three times the national average. Costs have always been volatile, more than tripling during peak consumption months in the summer, when the islands' populations swell significantly. To reduce power costs and promote community sustainability, the community must address its electrical challenges. Fox Islands Electric Cooperative (FIEC) has chosen to establish an alternate energy source to address this issue.

George Baker, a Harvard Business School professor, wanted to reduce the island's energy costs by utilizing wind power, and he became the CEO of FIEC. FIEC began researching wind power options on the islands in 2001, mostly to stabilize and lower energy prices, but also to reduce carbon emissions. The project began in 2008, after several years of feasibility studies, with the groundbreaking on a plot of donated property on Vinalhaven. In 2009, three 1.5-megawatt wind turbines on Vinalhaven started producing sustainable energy in the form of wind energy.

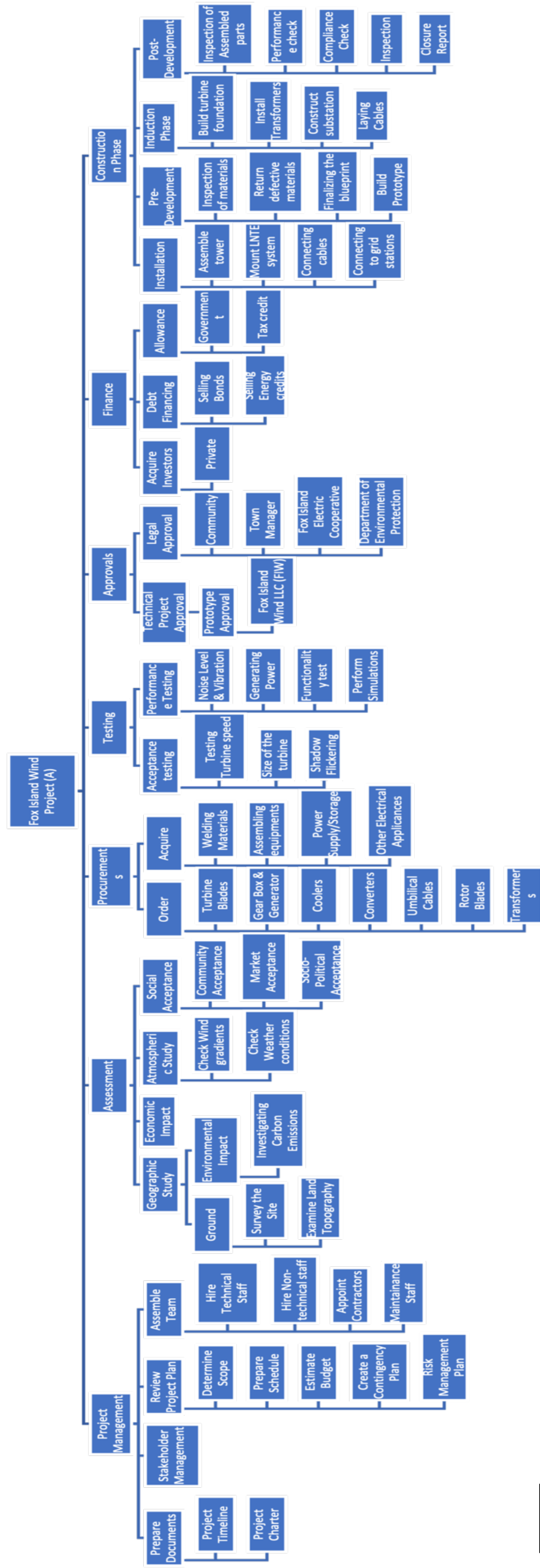
Despite the fact that the project was completed successfully, there were numerous extensibility concerns such as equipment, site selection, community participation, noise objections, and financing. The important components for the success of the Fox Island project were financing and community support.

Project Objectives

- Project aims to develop a wind power plant in Fox islands within one year which should be capable of generating 4.5 MW energy through three 1.5 MW wind turbines.
- To reduce the import of energy to 600-800 kWh to be consumed from June to August because of the high electricity consumption in summer months.
- To distribute the energy generated by the power plant throughout the year, to the residents, to lower the prices of electricity by 15-20% and promote the model of renewable energy.

Work Breakdown Structure

The WBS is based on the case study “The Fox Islands Wind Project (A)” prepared by Joseph B. Lassiter, James Corcoran, Max Gazor, Dylan Hogarty, & Alexander H. Somers Jr. This WBS is constructed by breaking down each deliverable into sub-deliverables and work packages that outline each project objective from start to finish. Every phase is broken down into logical work packages that are required to achieve the project's goal. The WBS dictionary describes all deliverables, sub-deliverables, and work packages in detail.



(Lassiter et al, 2011)

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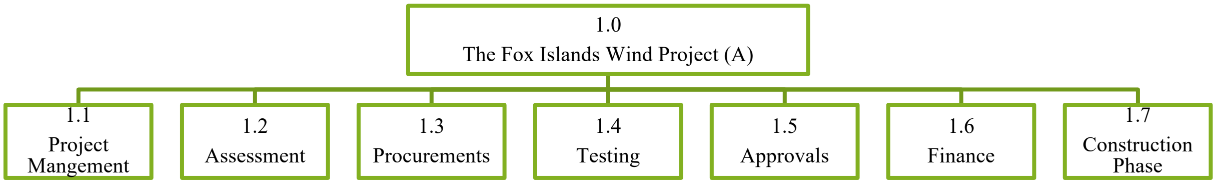

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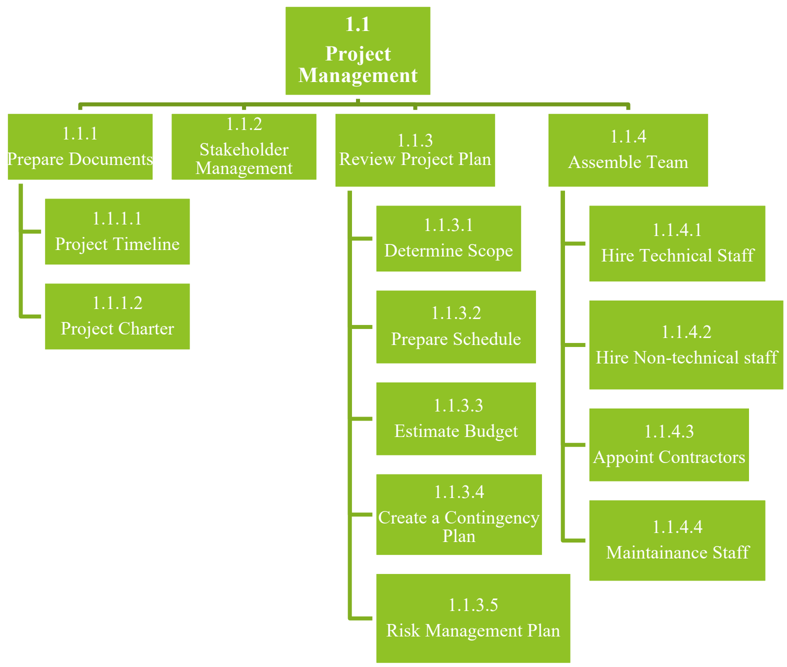

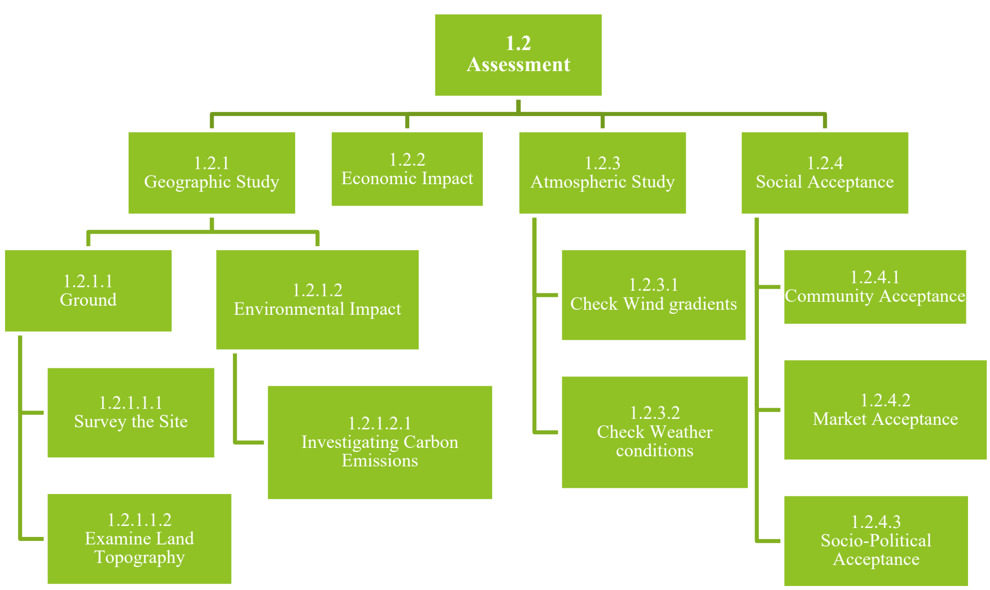

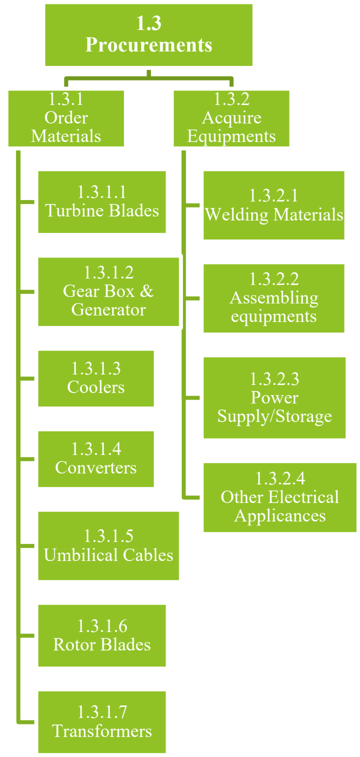
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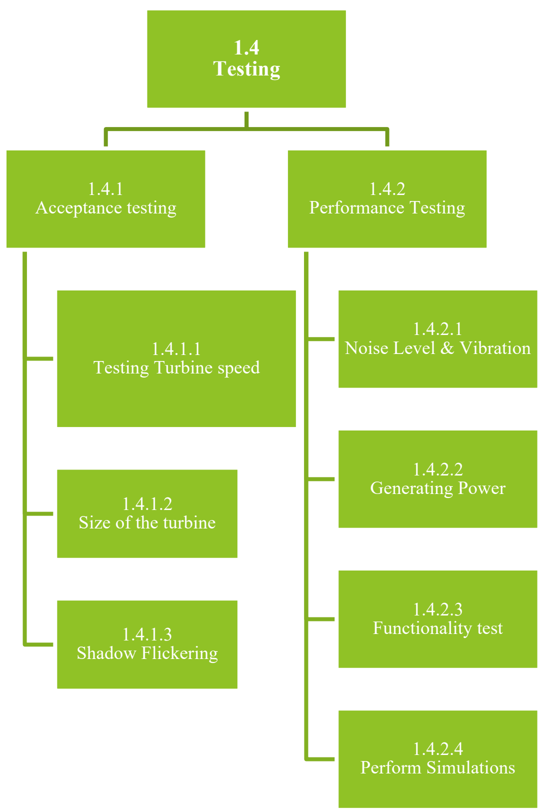
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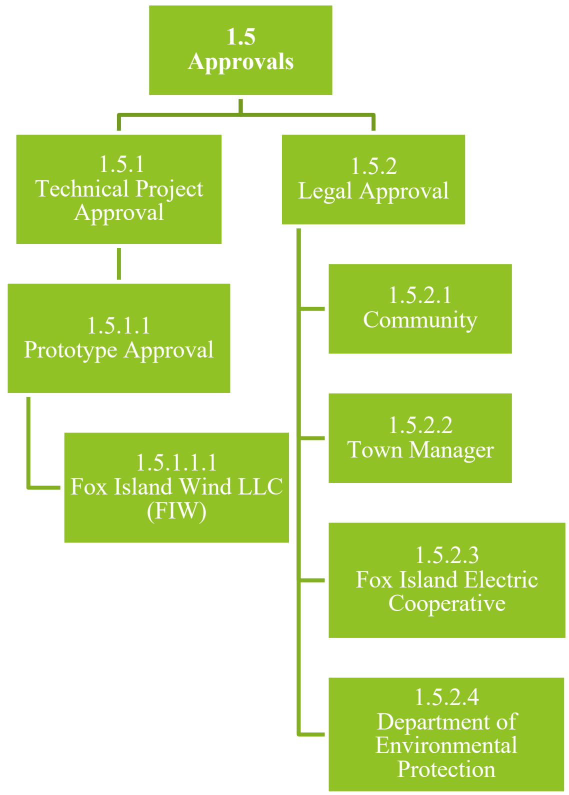
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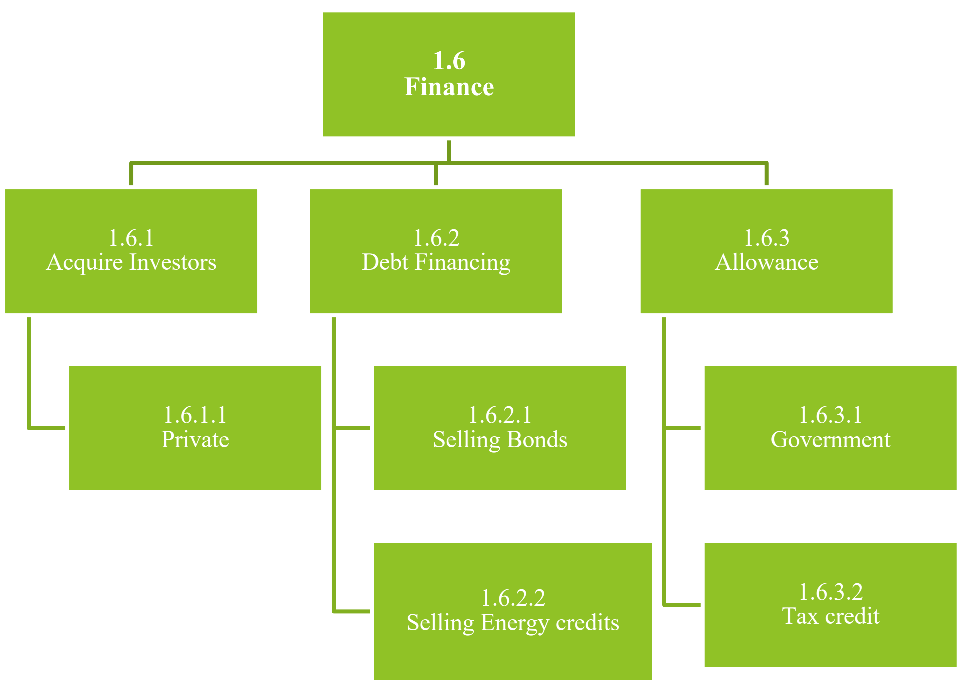
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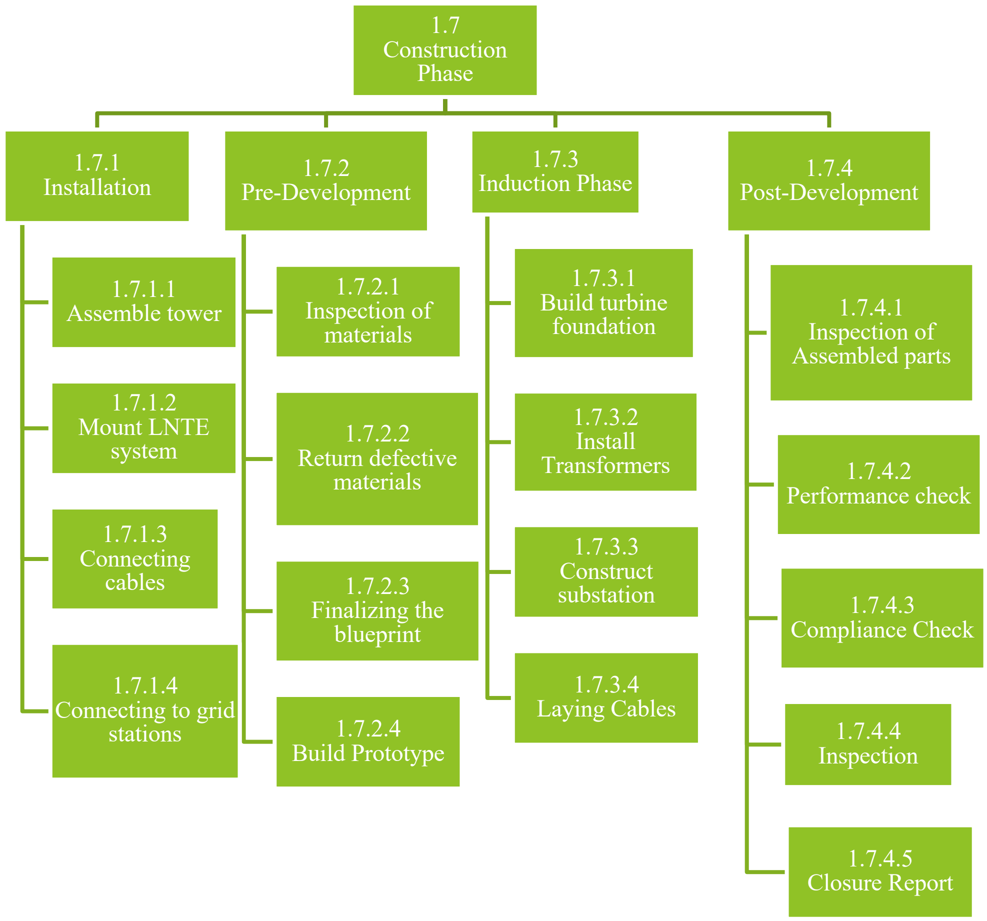

(Lassiter et al, 2011)

Work Breakdown Structure Dictionary (WBSD)

WBS Level	WBS Code	Elements	Description	Team Responsible
1	1.0	Fox Islands Wind Project (A)	Three 1.5 MW, wind turbines which will generate 4.5 MW electricity.	
2	1.1	Project Management	Develop business plan, project scope, assessment reports, Work Breakdown Structure, Risk management, Team Acquisition and Management.	Project Management team
2	1.2	Assessment	Collect and study the Weather, Geographical, Social, Economic impact of the project undertaken.	Project Management team & Field Experts
2	1.3	Procurement	Acquire all materials required for the construction of the Power Plant.	Manager
2	1.4	Testing	Post construction, test all the components of the power plant for performance and durability.	Technical Engineering team
2	1.5	Approvals	Procure all required permits and certifications for the construction to start.	Project Manager & FIW
2	1.6	Finance	Securing total estimated funds for the project through various sources.	FIW & Project Management team
2	1.7	Construction Phase	Activities include but are not limited to constructing turbines, laying foundations, inspect all acquired materials, inspecting the project post development.	Contractors, Technical and Non-Technical Engineers
3	1.1.1	Prepare Documents	Prepare Project Timeline, Charter, Scope document and other required documents.	Project Management Team

3	1.1.2	Stakeholder Management	Identify and communicate with the project stakeholders to determine quality and acceptance criteria.	Project Management team
3	1.1.3	Review Project Plan	Review the final project plan with the stakeholders and sponsors, and managers for any final changes.	Stakeholders & Sponsors
3	1.1.4	Assemble Team	Estimate the resource requirements and hire personnel.	Project Management team
3	1.2.1	Geographic Study	Performing land survey to check whether surface condition and soil strength are viable for the project. Investigate carbon emissions and its effects on the residents, and wildlife.	Field Experts
3	1.2.2	Economic Impact	Investigate if the project is economically beneficial for Fox Islands.	Financial managers
3	1.2.3	Atmospheric Study	Investigate and locate most suitable sites, where the long - term weather conditions and wind gradients will be favorable.	Field experts
3	1.2.4	Social Acceptance	Perform public surveys, market research and political factors for the project.	Town council
3	1.3.1	Order Materials	Order all materials required for power plant construction.	Project Management & Technical team
3	1.3.2	Acquire Equipment	Acquire equipment needed for setting up the power plant.	Project Management team
3	1.4.1	Acceptance Testing	Test if the project satisfies the given acceptance criteria, and standard regulations.	Technical Engineers
3	1.4.2	Performance Testing	Test the function of all mechanical and technical parts of the power plant, through simulations.	Technical Team

3	1.5.1	Technical Project Approval	Review of the prototypes by engineers and experts.	Technical Team, Project Managers & Sponsors
3	1.5.2	Legal approvals	Obtain approval by the government, community and concerned authorities.	Project Management team & Sponsors
3	1.6.1	Acquire Investors	To secure funds through private investors.	Project Management team
3	1.6.2	Debt Financing	Securing funds through bank loans by selling bonds and energy credits.	Financial Managers
3	1.6.3	Allowance	Identify government allowance schemes for the project.	Town Manager
3	1.7.1	Installation	Activities involved in building the turbines.	Project Management team
3	1.7.2	Pre-Development	Activities that need to be performed and checked before building the turbines.	Project Management team
3	1.7.3	Induction Phase	The on-going construction phase of the project.	Engineers & Contractors
3	1.7.4	Post development	Activities that need to be performed and checked after building the turbines.	Technical Engineers
4	1.1.1.1	Project Timeline	Prepare list of all tasks and deliverables in chronological order.	Project Management Team
4	1.1.1.2	Project Charter	Identify project scope, objectives and all the resources	
4	1.1.3.1	Determine scope	To determine all project related needs, objectives, constraints, client and stakeholder expectations	
4	1.1.3.2	Prepare Schedule	Prepare a time chart that organizes tasks and resources.	
4	1.1.3.3	Estimate Budget	Calculate required budget for the overall project	

4	1.1.3.4	Create a contingency Plan	Prepare a secondary plan in case of changes in project.	
4	1.1.3.5	Risk Management Plan	Identify all the risks, impacts and mitigation techniques.	Risk Manager
4	1.1.4.1	Hire Technical Staff	Hire electrical, mechanical engineers and industry experts.	Project Manager
4	1.1.4.2	Hire Non-Technical Staff	Hire laborers and other staff.	Project Manager
4	1.1.4.3	Appoint Contractors	Selecting licensed contractors to build the wind project.	
4	1.1.4.4	Maintenance Staff	Hire staff for maintenance of mechanical and electrical equipment.	
4	1.2.1.1	Ground	Examine Land Terrain and soil strength.	Field Experts
4	1.2.1.1.1	Survey the Site	Inspection of the area and to determine the suitable construction location.	Project Managers
4	1.2.1.1.2	Examine Land Topography	Study the surface features of the site.	Field Experts
4	1.2.1.2	Environmental Impact	Examine the impact of the proposed power plant on the nearby areas.	
4	1.2.1.2.1	Investigating Carbon Emissions	Determine the possible amount of carbon emission from the power plant.	
4	1.2.3.1	Check Wind Gradients	Select suitable locations for the power plant by examining the wind conditions, strength and direction throughout the year.	
4	1.2.3.2	Check Weather Conditions	Record the climate conditions and its probable positive and negative impacts on the power plant.	
4	1.2.4.1	Community Acceptance	Engage with residents and address their concerns to gain support for the project.	Project Manager & Town Council

4	1.2.4.2	Market Acceptance	Perform market research to identify potential sponsors.	Project Manager
4	1.2.4.3	Socio-Political Acceptance	Determine the project acceptance through polls, opinion leaders and media.	
4	1.3.1.1	Turbine Blades	To be orders from General Electric	Technical Engineers & Project Managers
4	1.3.1.2	Gear Box and Generator	To be orders from General Electric.	
4	1.3.1.3	Coolers	To be orders from General Electric.	
4	1.3.1.4	Converters	To be orders from General Electric.	
4	1.3.1.5	Umbilical Cables	Order to be placed.	
4	1.3.1.6	Rotor Blades	To be orders from General Electric.	
4	1.3.1.7	Transformers	To be declared by grid station.	
4	1.3.2.1	Welding Materials	Acquire mechanical and electrical equipment required to build the turbines.	
4	1.3.2.2	Assembling Equipment		
4	1.3.2.3	Power Supply/Storage		
4	1.3.2.4	Other Electrical Appliances		
4	1.4.1.1	Testing Turbine Speed	After the construction, in trial phase, each element needs to be tested in working condition.	Technical Engineers
4	1.4.1.2	Size of the Turbines		
4	1.4.1.3	Shadow Flickering		
4	1.4.2.1	Noise Level and Vibrations		
4	1.4.2.2	Generating Power		
4	1.4.2.3	Functionality Test	Test if the power plant fulfils the functional requirements.	
4	1.4.2.4	Perform Simulations	Run simulations to test the power plant in normal, best, and worst scenarios.	

4	1.5.1.1	Prototype Approval	Get approval from technical engineers and FIW.	Project managers & Sponsors
4	1.5.1.1.1	Fox Island Wind LLC(FIW)	Get approval from FIW.	Project Managers
4	1.5.2.1	Community	Get approval from Community.	
4	1.5.2.2	Town Manager	Get approval from town manager.	
4	1.5.2.3	Fox Island Electric Cooperative	Get approval from FIEC.	
4	1.5.2.4	Department of Environmental Protection	Get approval from DEP.	
4	1.6.1.1	Private	Identify and acquire funding from private investors.	Financial managers & FIW & Project Managers
4	1.6.2.1	Selling Bonds	Acquire funds from selling bonds.	
4	1.6.2.2	Selling Energy credits	Get funds from selling renewable energy credit (REC)	
4	1.6.3.1	Government	Obtain grants and allowances from government	
4	1.6.3.2	Tax credit	Obtain tax credits from green investors.	
4	1.7.1.1	Assemble tower	Build tower and join the rotor blades.	Project Engineers
4	1.7.1.2	Mount LNTE system	To be mounted on all rotor blades.	
4	1.7.1.3	Connecting cables	Connect cables with substation to turbines	
4	1.7.1.4	Connecting to grid stations	Power plant to be connected with nearby grid stations	Technical Engineers
4	1.7.2.1	Inspection of materials	Check all delivered materials which meet quality standards.	Project Manager
4	1.7.2.2	Return defective materials	Check all the materials ordered and return any faulty materials.	

4	1.7.2.3	Finalizing the blueprint	Make a final layout blueprint for the construction of the power plant.	FIW
4	1.7.2.4	Build Prototype	Develop prototype of power plant.	Technical Engineer, Contractor, Project Management team, & non-technical team
4	1.7.3.1	Build turbine foundation	Construction the base layer for turbines to be mounted.	
4	1.7.3.2	Install transformers	Transformers to relate to the power plant and the grid stations.	
4	1.7.3.3	Construct substation	Build substation to help lower the voltage electricity to easily be supplied to homes through distribution lines.	
4	1.7.3.4	Laying cables	Lay high tension cables connecting to grid system and power plant.	
4	1.7.4.1	Inspection of assembled parts	Post development check whether all the parts are assembled correctly.	Technical Engineer
4	1.7.4.2	Performance check	To check the working of the turbines.	Testing Engineers, Stakeholders
4	1.7.4.3	Compliance check	To check whether all the needs and requirements have been met according to the standards.	
4	1.7.4.4	Inspection	Timely inspection to be done of the construction sites.	Project Manager, FIW
4	1.7.4.5	Closure report	Prepare project closure report.	Project Manager & Stakeholder

Rough Order of Magnitude (ROM)

Cost and Time Estimate

The Fox Islands Wind Project (A)						
1.7.3 Induction Phase						
WBS ID	Activity	Resources	Labor		Total Cost Estimate	Total Time Estimate
			Hours	Rate/hr		
1.7.3.1	Build Turbine Foundations	Technical Engineer, Contractor, Project Management team, & Project Manager	200	$100	$20,000	5 weeks
1.7.3.2	Install Transformers		40	$90	$3,600	1 weeks
1.7.3.3	Construct Substations		160	$80	$12,800	4 weeks
1.7.3.4	Laying Cables		80	$75	$6000	2 weeks

The Fox Islands Wind Project (A)						
1.7.4 Post Development						
WBS ID	Activity	Resources	Labor		Total Cost Estimate	Total Time Estimate
			Hours	Rate		
1.7.4.1	Inspection of assembled parts	Technical Engineer	40	$100	$4000	1 week
1.7.4.2	Performance check	Technical Engineer	40	$100	$4000	1 week
1.7.4.3	Compliance check	Technical Engineer	64	$100	$6400	1.5 weeks
1.7.4.4	Inspection	Technical Engineer, Project Manager	80	$130	$10,400	2 weeks
1.7.4.5	Closure Report	Project Manager	24	$150	$3600	0.5 week

<table>
<tr><th colspan="7">The Fox Islands Wind Project (A)</th></tr>
<tr><th colspan="7">1.4.1 Acceptance Testing</th></tr>
<tr><th rowspan="2">WBS ID</th><th rowspan="2">Activity</th><th rowspan="2">Resources</th><th colspan="2">Labor</th><th rowspan="2">Total Cost Estimate</th><th rowspan="2">Total Time Estimate</th></tr>
<tr><th>Hours</th><th>Rate</th></tr>
<tr><td>1.4.1.1</td><td>Testing Turbine Speed</td><td rowspan="3">Technical Engineer</td><td rowspan="3">150</td><td rowspan="3">$110</td><td rowspan="3">$16,500</td><td rowspan="3">4 weeks</td></tr>
<tr><td>1.4.1.2</td><td>Size of the Turbines</td></tr>
<tr><td>1.4.1.3</td><td>Shadow Flickering</td></tr>
<tr><th colspan="7">1.4.2 Performance Testing</th></tr>
<tr><td>1.4.2.1</td><td>Noise Level and Vibrations</td><td rowspan="4">Technical Engineer</td><td rowspan="3">120</td><td rowspan="3">$110</td><td rowspan="3">$13,200</td><td rowspan="3">3 weeks</td></tr>
<tr><td>1.4.2.2</td><td>Generating Power</td></tr>
<tr><td>1.4.2.3</td><td>Functionality Test</td></tr>
<tr><td>1.4.2.4</td><td>Perform Simulations</td><td>104</td><td>$110</td><td>$11,440</td><td>2.5 weeks</td></tr>
</table>

WBS Dictionary Assessment

A WBS dictionary is an add-on to your WBS that provides specific information about each component. It is one of three pillars that enable project scope management in your project, along with a work breakdown structure (WBS) and a project scope statement. The work breakdown structure dictionary is made up of tasks, activities, and deliverables. It also provides certain key dates, costs, timelines, resources, and quantities. The WBS dictionary aids in ensuring that the project complies with any regulatory or compliance problems that govern the task. It also assists in ensuring that the deliverables match the quality requirements of the project stakeholders.

In the instance of the Fox Island Wind project, we established a WBS dictionary to ensure that both the production and installation of the turbines go well. For example, considering the Construction phase in the WBS dictionary, which is the most important work package in this project, it will assist the project managers and technical engineers in planning the installation and construction of the Wind turbines.

The WBS dictionary is a derivative of an already verified WBS standard. The project managers validate the collected WBS dictionary, and then further analysis is performed for revisions and ideas made by stakeholders and sponsors in order to obtain a valid result. Residents of the Fox Islands of North Haven and Vinalhaven are expected to benefit from this research. This wind power project's WBS Dictionary is also projected to provide a solution to the island's people' difficulties with excessive electricity rates.

Comment:

Q. Does your WBS adhere to the 100% rule by incorporating all work to be done for the project?"

Yes, our team believes that WBS is critical for any project's success, and that essential adjustment can be considered ahead of time to determine the project's overall activity, resources, and costs. Because of the importance of WBS and WBSD, The Fox Island wind project took over a decade to complete and Baker spent a lot of time researching the topic. In the end, the project successfully emerged as a model for green renewable energy on other isolated islands.

The work breakdown structure (WBS) is both a project management framework and a work measurement baseline instrument. The 100% rule is a crucial part of the work breakdown structure technique since its application and related concepts are critical in assuring its utility and validity.

Although it can be used to any field, the work breakdown structure approach is commonly used for planning and executing work in construction and research and development (R&D) projects. The top level of a work breakdown structure represents the totality of the project, according to the 100 percent Rule, and successive tiers in a top-down structure under the first level categorize greater detail. The manager can use the 100% Rule to ensure that all efforts in each area are captured where they belong and that no unrelated items are included in an element.

Prior to project scheduling, the work breakdown structure provides a planning framework of planned outputs. Scheduling cannot be completed until a task breakdown structure has been established. (Haugan,2002) the work breakdown structure explains all that needs to be done under the 100% Rule, regardless of work style or schedule changes, because it is outcome oriented. During the project, methodologies and activity schedules may change, but the work breakdown structure should not.

The use of the 100 percent Rule enables the specification of all outcomes prior to the start of schedule planning. Because desired goals must be specified before procedures and timetables can be addressed, the work breakdown structure is the beginning point in the planning process. If the outcomes are not clearly established, the project will fail. The 100 percent rule allows for and expresses a comprehensive knowledge of all required results.

Q. Why is leveraging the 100% rule an effective tool for managing project scope?

It is generally understood that if there are no project guidelines or methodology, the project will take longer and cost more money. For example, the Fox Island wind project cost nearly $15 million US dollars, which is a large sum, and without a proper commitment to the project's working structure, the project will fail to meet the expectations of the island community. The project will fail if the outcomes are not clearly specified. The 100% rule allows for and communicates complete awareness of all required results.

Using the leverage or benefits of the available tool will absolutely aid project success. Because the twenty-first century is dependent on technology, using any management tool to aid project success will undoubtedly aid in achieving 100% quality and risk-free project success. Furthermore, the amount of information provided by the work breakdown structure dictionary will be clearly understood by all project stakeholders, removing any uncertainty about roles and duties.

According to a poll done by the Practice Standard for Work Breakdown Structures–Second Edition team, 87% of respondents utilize the WBS as a planning tool for project management activities at least half of the time, and over 60% use it more frequently. They wanted to use the WBS to help with activity definition, resource planning, scope planning and definition, cost estimation, and risk management. The ability of the WBS to accomplish these objectives was rated as satisfied or very satisfied by 91% of respondents. These findings show that the WBS is widely accepted and used in project management today. (2006, Eric S. Shelly and Robert T. George)

Potential Project Tradeoffs

Cost

Finance was the key ingredient for this project's success. Since there were not any powerful parties involved in the project, securing required funds to start the project became very troublesome. Out of the three triple constraints, cost is the principal factor that can affect this project's scope, future expansion, and ideas. In this case we have kept some extra options for debt financing if necessary. Currently, the project cost is in the range of $15 million. Keeping the cost as a trade-off, we are rebuilding the wind project so that instead of 1.5MW, we may set up to 5 turbines of small capacities to satisfy the project budget and critical production as required.

Schedule

For the Fox Islands Wind project, Cost-Schedule could be the most suitable tradeoff. The client hasn't provided any strict criteria for project implementation, and cost being a fluctuating factor; we can effectively derive middle grounds. Scheduling all the deliverables and processes systematically and in an aligned manner, to achieve project outcomes and meet the standards, it is crucial for this project. We have been given an adequate period to deliver the final project, considering any unforeseen issues may or may not arrive, we can deliver the project a little early or we can buy more time if the issues persist.

Refined Scope

Our team believes that scope trade-off will not be feasible for the Fox Islands Wind project, thus it must be kept fixed. As the client has been promised that the scope of the project will be maintained until execution and conclusion. It is likely that any occurring changes in scope will result in scope change or scope creep in the project. Regular scope changes and overviews, as well as ongoing engagement with team members, will provide insight into whether the project is on track to meet the objectives set out at the outset.

WBS Approval

Approver (Position in Organization)	Role in Project	Approved (Signature = Approval)	Date of Approval
Director of the Project/ Vice President (George Baker)	Team Lead		
Energy Investment Banker (Matthew R. Simmons)	Investor		
State Representative (Hannah Pingree)	Opinion Leader		
Finance Team	Finance Manager		
Technical Team	Technical Manager		

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