University of Alaska Fairbanks
Collegiate Wind Competition 2014
Business Plan

Team Leads
Lead Wind Master: Patrick Wade
Engineering Lead: Pryce Brown
Business Lead: Donna Hill

Team Members:
Electrical Engineering Team: Chic O'Dell, Bruce Lee
Mechanism Team: Ed Greene, Mark Skya, Shanann Hoyos, Lance Gatter
Blade Design Team: Matt Staley, Milaud Baumgartner, Pryce Brown
Business Team: Shanann Hoyos, Donna Hill, Patrick Wade

Faculty Advisors
Faculty Advisor: Rorik Peterson
Co-Advisor: Xiaoqi Han

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Executive Summary

Company Name: Fairbanks Wind LLC.

Team Name: Breaking Wind

Our Team consists of eight Mechanical Engineers, two Electrical Engineers, one Business Major, and a PHD candidate as an advisor. Our team is shown in Figure 1.

Figure 1: Our team, from left to right in the back row: Shanann Hoyos, Mark Skya, Nick Janssen, Bruce Lee, Pryce Brown, Mathew Staley, Patrick Wade, Donna Hill. In the front row, from left to right, Lance Gatter, Ed Greene, Milaud Baumgartner, and Chic J. O'Dell.

We are based in the interior of Alaska and have extensive back-country and cold climate experience.

Our business overview: Fairbanks Wind LLC. develops micro-scale wind turbines, which produce 10-20W of power when the wind is blowing at 15-25 mph respectively. Our turbines seek to capture the energy in the wind, and convert this power to electricity that can be used to power such items as phones and tablets. We wish to bring the environment and our customers closer together, in a safe manner. Our vision is that we will be a model of sustainable stewardship while bringing people and their environment together.

Our web address: https://sites.google.com/a/alaska.edu/uaf-wind-competition/

Our three main **customer segments** are Off-Grid, Residential, and Educational.

- Off-Grid: Cost: $350, Materials: The blades are Carbon Fiber with a plastic core, plastic nacelle and nose cone, and a metal hub and braking system. The stand and fold out base are metal as well. The electricity is gathered by the user from a battery storage unit.
- Residential: Cost: $150. Same materials as the Off-Grid model, but with plastic blades, to reduce cost. Stationary model, no fold out bottom.
- Educational: Cost: $150. All plastic, simple designs, and not intended for power production. Used as an educational tool in schools and homes. Different blade designs offered to teach about the effect different designs have on power output.

We will be forming our business in Fairbanks, Alaska. We have identified that our best markets are in the farthest north and south latitudes for our off-grid users.

Our turbine has been prototyped and tested and a rendering is shown Figure 2: Rendering of our turbine. The blades are built from carbon fiber over plastic.

Figure 2: Rendering of our turbine.

Business Overview

Fairbanks Wind LLC. develops micro-scale wind turbines, which produce 10-20W of power when the wind is blowing at 15-25 mph respectively. Our turbines seek to capture the energy in the wind, and convert this power to electricity that can be used to power such items as phones and tablets. We wish to bring the environment and our customers closer together, in a safe manner, and that is why each turbine has been outfitted with a proven braking system. Our vision is that we will be a model of sustainable stewardship while bringing people and their environment together.

We have conducted market research in order to identify our customers and their needs. By surveying individuals across many industries, we have identified three main customer segments for our turbines. These customer segments have been separated due to the need to create wind turbines that operate under unique conditions, require different manufacturing methods, and have different price points.

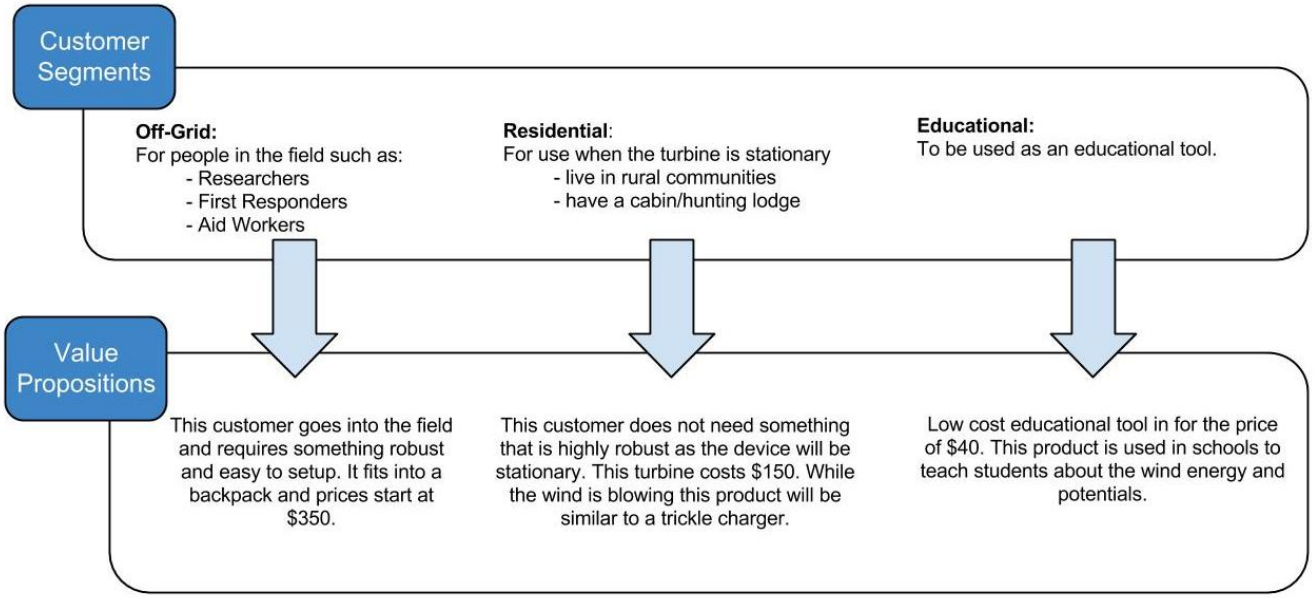

Figure 3: Customer segments and Value Propositions flow chart.

Purchasing a Wind Turbine

Our clients will primarily use our online store to purchase or learn more about our products. This graphic shows the process through which customers will go through during purchasing.

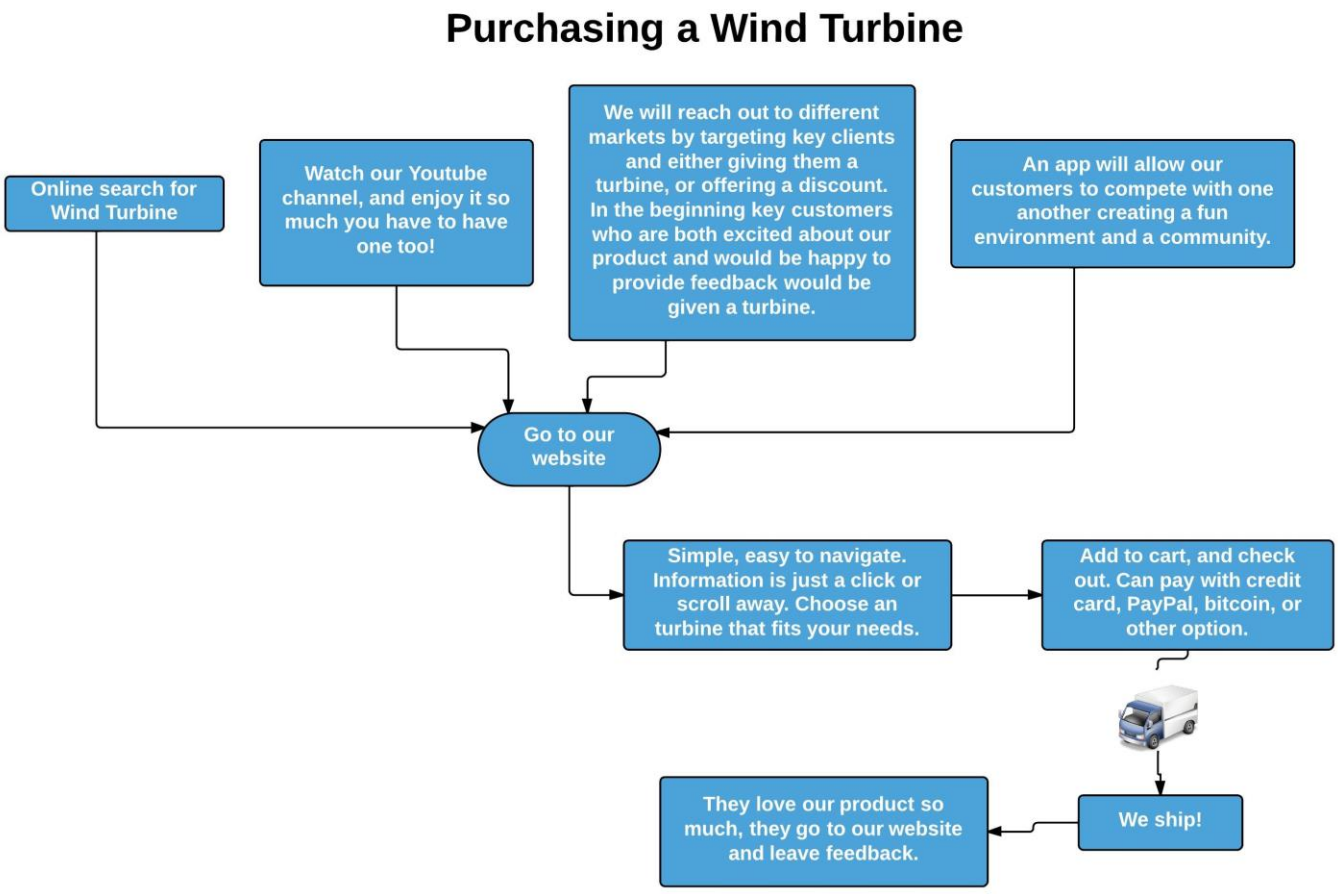

Figure 4: Flow chart showing the process of purchasing and receiving a wind turbine.

Customer service is a large part of our ability to grow as a company.

The turbines that we offer with a microcontroller will be capable of reading power output from the turbine, and relaying this information in the form of an app to our customer. This information can then be used in a competition style scoreboard, where different customers can compete to see who has the highest power output. Incentives may also be offered to the customer with the most power over a period of time. This feature is two-fold, as it will also give us valuable information. By knowing the

rotational rate of the turbine at various wind speeds we will be able to determine the environment that our customers find themselves in most often, and can shift our product design in that direction.

Triple Bottom Line

Profit: Our company sells through the online marketplace, because of that there is less startup and keep up costs. The profits we make allow us to invest in the other two P's, continuing the cycle.

People: We believe not only in taking care of our company, but our customers. Our company works with schools in outreach projects, and towards the education of the youth whose ideas will soon fuel our future.

Planet: We have worked towards developing our product in a way that reduces our impact on the environment. We are environmentally friendly not only because our product reduces CO2 emissions, but with the reduction on shipping packaging, and the use of recycled material.

Outreach

Outreach is an important part of our business, and our people. We wish to help enrich the lives of others. That is why we will actively seek out ways of volunteering our hours, and when we break even, grants for wind programs, and scholarships to students in need.

Market Opportunity

Our main competitor is solar power. Companies such as Goal Zero bring affordable, and robust solutions to rural communities as there are no moving parts. Their products have two main components: the solar panel, and the charge device. Our plan is to partner with a company such as goal zero and use their charging device. Our turbines however will be competing with their 15W Solar Panel that retails for $124.99.

For our off-grid use customers, the turbine will be able to withstand abuse, as the turbine will be intended to be tossed into a backpack and taken out into the backcountry. For our stationary customers the turbine will not be built as tough, and can be easily mounted to a roof. For our educational users, the components will be built cheap

In order to get a better understanding we performed a market opportunity analysis to see where there are currently turbines producing power shown in Figure 5.

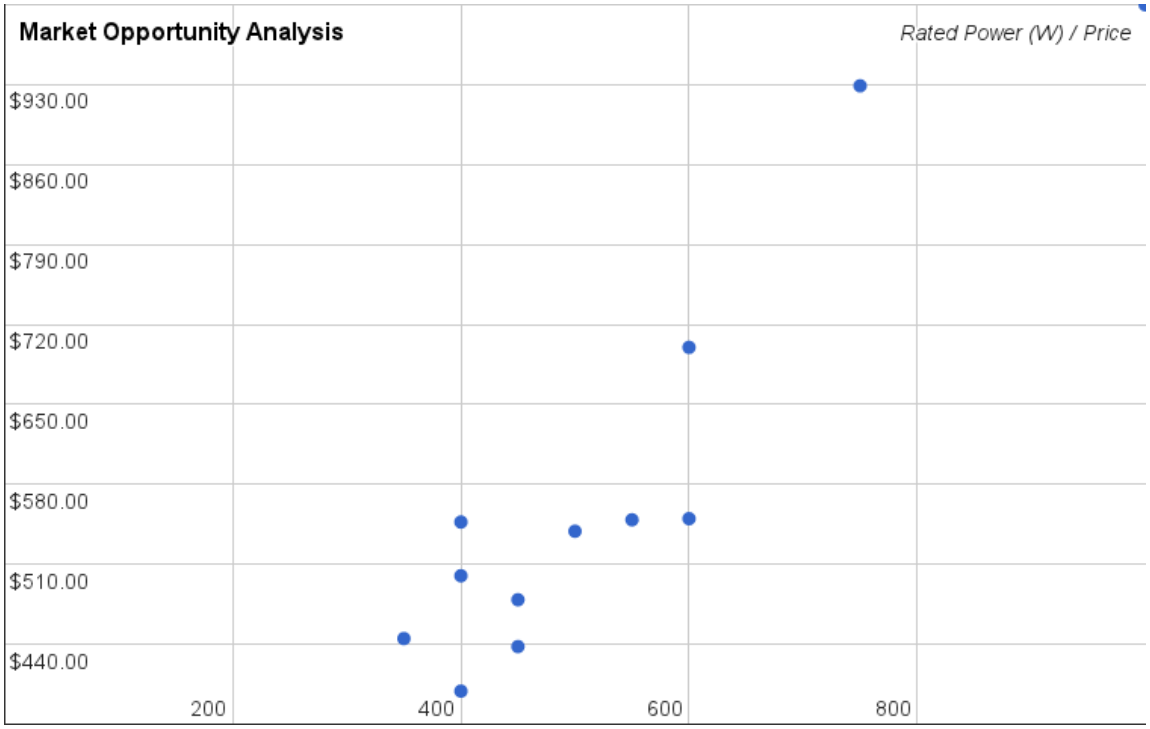

Figure 5: Market opportunity analysis.

From Figure 5 we can see that the main market for turbines that produce power under 1 kW is in the 400-600W range and for the cost of $440 - $580. Our turbine will produce 10 – 20W and will have a cost in the range of $150-$350.

Table 1 shows our computed market forecast analysis. This table shows that we can expect a total market growth for our products of 9%.

Table 1: Market forecast analysis, showing growth in the market for a 5 year period.

Total Market Forecast		Values in kW					
Customer Segments	**Growth**	**2015**	**2016**	**2017**	**2018**	**2019**	**CAGR**
Backcountry	8%	6,275	6,777	7,319	7,905	8,537	8%
Residential	11%	14,000	15,540	17,249	19,147	21,253	11%
Educational	6%	7,000	7,420	7,865	8,337	8,837	6%
Total	9%	27,275	29,737	32,434	35,389	38,627	**9%**

By comparing Figure 7 and Figure 8 we can compare the areas where the sun doesn't shine, but the wind blows. Using Figure 9 we can determine the countries where we will have an easier time penetrating the off-grid, personal energy device market. Most of these countries are in the northern-most and southern-most latitudes.

Our turbine meets the needs of the backcountry user by being small and portable, and being fabricated from strong lightweight materials such as carbon fiber and plastics. These users also benefit from having a turbine that can operate in cold temperatures (i.e. -40F) without brittle fracture.

For our educational users we bring simple parts and an array of learning products. We offer different blade designs so that students can see how blade design affects the characteristics of the power output.

Management Team

Team lead Patrick left his home state of California after high school to explore and find many new people places and experiences in the world. After traveling for a few years he found Mechanical Engineering. At the University of Alaska Fairbanks he has grown his repertoire of skills which include machining, computer automated design, rapid prototyping and fabrication with composite materials. He is the current president of the American Society of Mechanical Engineers, and has been working as a Mechanical Systems Engineer for the Alaska Space Grant Program since his freshman year. He has

formed solid relationships with his peers and they have chosen him to be this team's lead. He was chosen to bring down the axe, and get things done.

Engineering team lead Pryce has been in the UAF Mechanical Engineering program since 2010, and brings a spectrum of skills to the team. His extensive history of backcountry travel and remote field work outfits the team with knowledge of a customer base in Alaska and the rigors that a turbine would have to endure while deployed in the harsh environments found around the state. He has worked with commercial 3-phase wind energy on a 12MW installation in the foothills of the Alaska Range and has an in depth understanding of wind energy concepts and the business environment surrounding renewables. Pryce has taken the role of Design Team Lead and oversees all aspects of our specialized blade design and hub fabrication.

Business Team Lead Donna has been involved in business since high school, when she worked in her family's grocery store and started taking college business classes to get a head start. She wasn't too sure which college she would go to when she graduated high school, until she was chosen to participate with Rural Alaska Honors Institute for summer courses at the University of Alaska Fairbanks. Since then she has gained not only business knowledge from her UAF courses, but also work experience with various student jobs and internships around Fairbanks. Donna is also a member of Native Alaskan Business Leaders. With her experience Donna has helped with all the business aspects of the project.

Product Development

Research and Development

As part of our company's organization, engineers are on staff. The engineers and marketing team work in conjunction to design a device that suits the company's image, and the customer's needs. 3D Computer Automated Design software is utilized to produce models of our product. These models are then used in a 3D printer to create prototypes and testing models. We will build a wind tunnel

optimized to operate up to 40 mph. We will design, build and test our models. Higher speed testing procedures for safety considerations and destructive tests will be conducted with a vehicle in a safe area.

Manufacturing

For the off-grid device, the manufacturing of the plastic pieces will be injection molded, and the metal components will be machined. All components not made in-house will be purchased. Assembly will be done by a team at our warehouse.

Sourcing/supply chain

- Plastics will be purchased from Calsak Plastics.
- Generators and gearboxes will be purchased from ElectriFly.
- Metal will be purchased locally from Alaska Steel.
- Office supplies will be purchased locally as well.
- Our HAAS CNC will be purchased from the manufacturer.
- Manual mills and lathes will be purchased locally.

Operations

Governance

Not knowing more about our clients and our potential, our business has been designed to be scalable. To achieve this, our company structure has been designed with three main segments. In the beginning each segment can be operated by one or two people, allowing for a minimum of three to four people. As the business grows, responsibilities within each segment grow, and positions for individual tasks can be obtained. Our business is organized differently than the classical top down structure. Our "org chart" is shown here in Figure 6 as a Venn diagram.

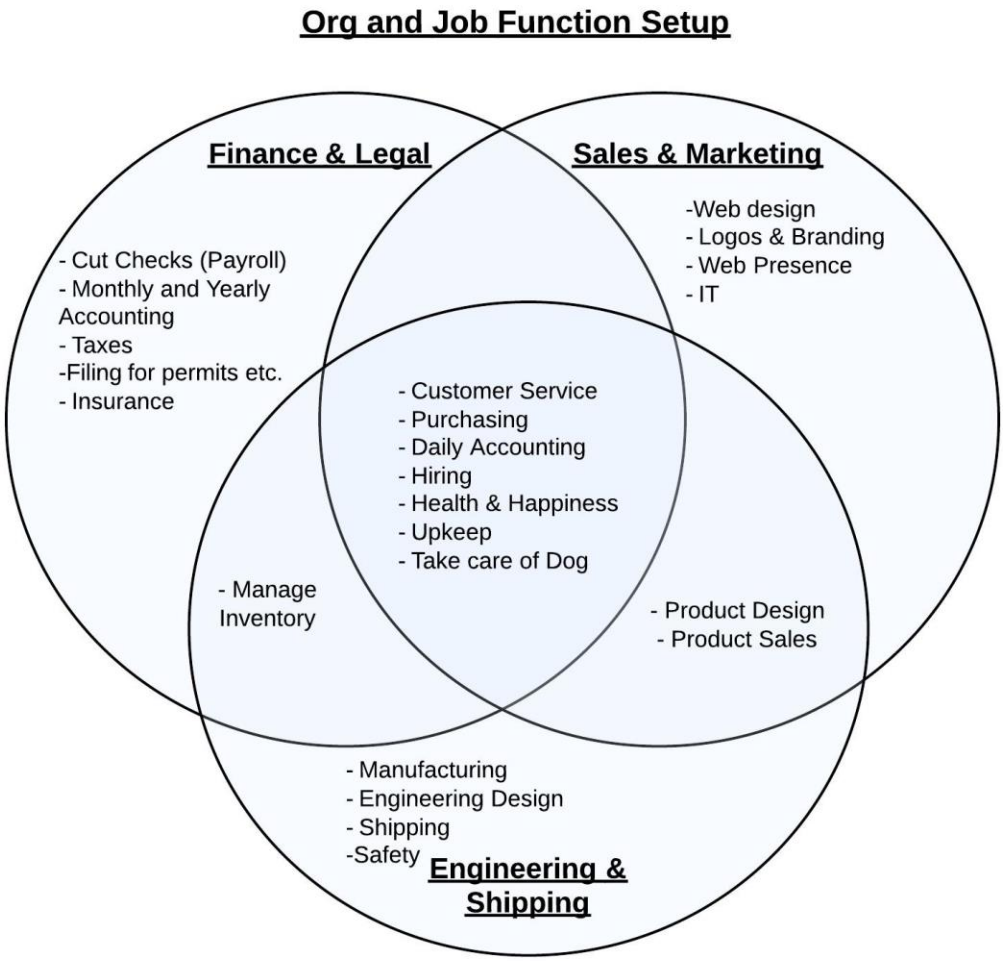

Figure 6: Org chart Venn Diagram.

The first and most important part of our business is our customer, and that is why they have been put in the center of the org chart. This model allows for each org to do what they are best at, engineers engineering, marketers marketing, but everybody needs to speak with the customer, because they are the bottom line. This model also helps keep everyone working together, and attempts to eliminate barriers of communication. An example of this is the section of the Venn diagram where Engineering and Marketing intersect, and product design is shared equally by both orgs.

In order to give individuals in the company power, keep costs low, and raise accountability each org is responsible for purchasing the things they need and keeping daily totals on their purchases. The overall accounting done in the business is handled on a monthly and yearly basis by the finance team, but the daily accounting keeps the thought of costs on everybody's mind.

Hiring and workplace practices

Our company will be an equal opportunity employer. We will not discriminate against race, national origin, color, religion, sex, disability, or sex-stereotyping of gays, lesbian, and bisexuals.
To ensure our employees are happy and informed we will practice great communication and a positive management approach. All our employees have the right to voice their opinion, and we will be sure to give the opportunity to do so in one on one and/or weekly group meetings. Our company will run with honesty, respect, and we expect our employees to follows those guidelines.

Financial Analysis

From our financial analysis, we have determined that we will need $153k for startup costs.

Our Balance Sheet is in Table 3, income statement in Table 4, and our cash flow statement in Table 2, in the appendix.

Appendix

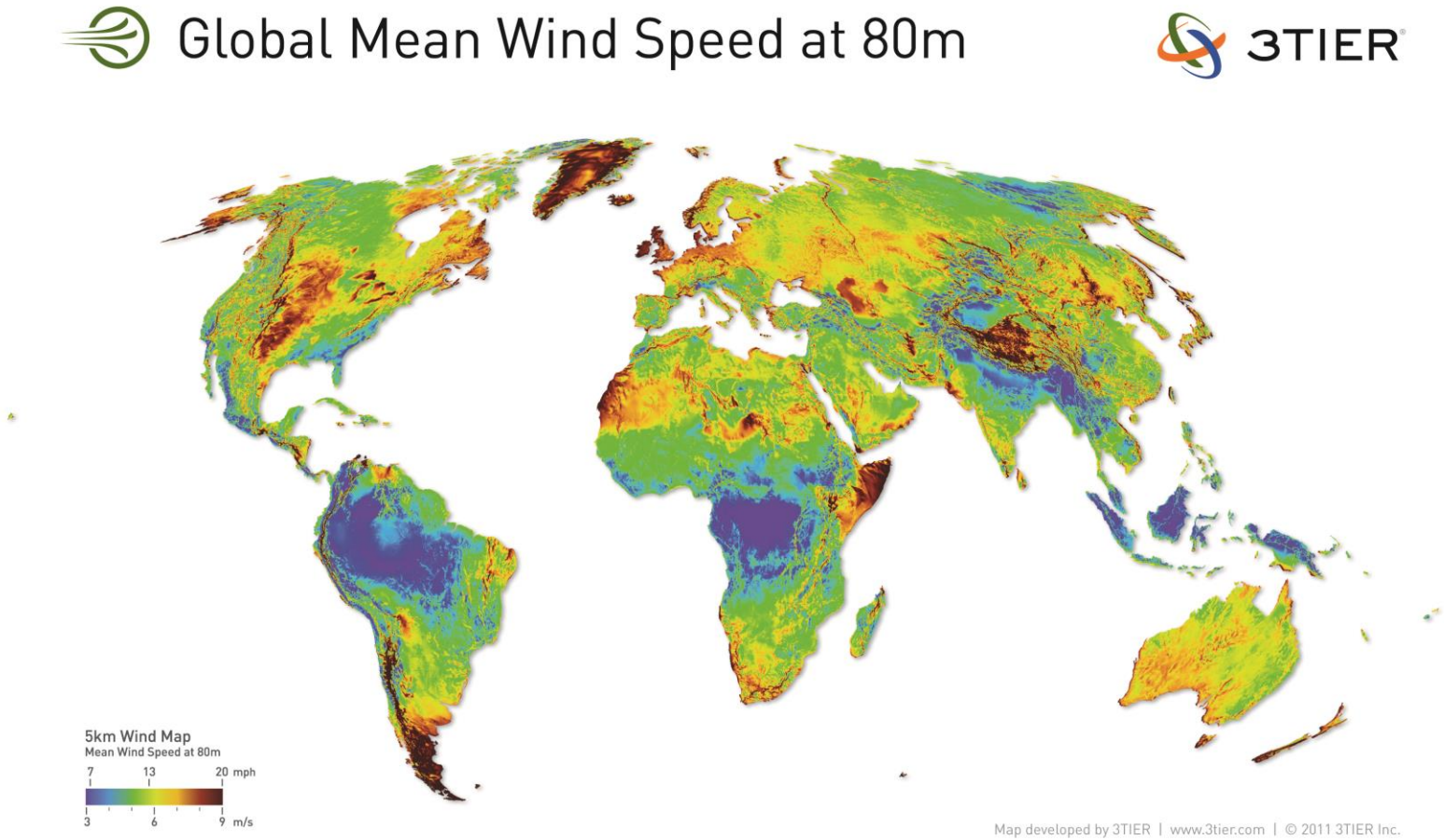

Figure 7: A map of the world showing where the wind is the strongest. The more red the color, the higher the wind.

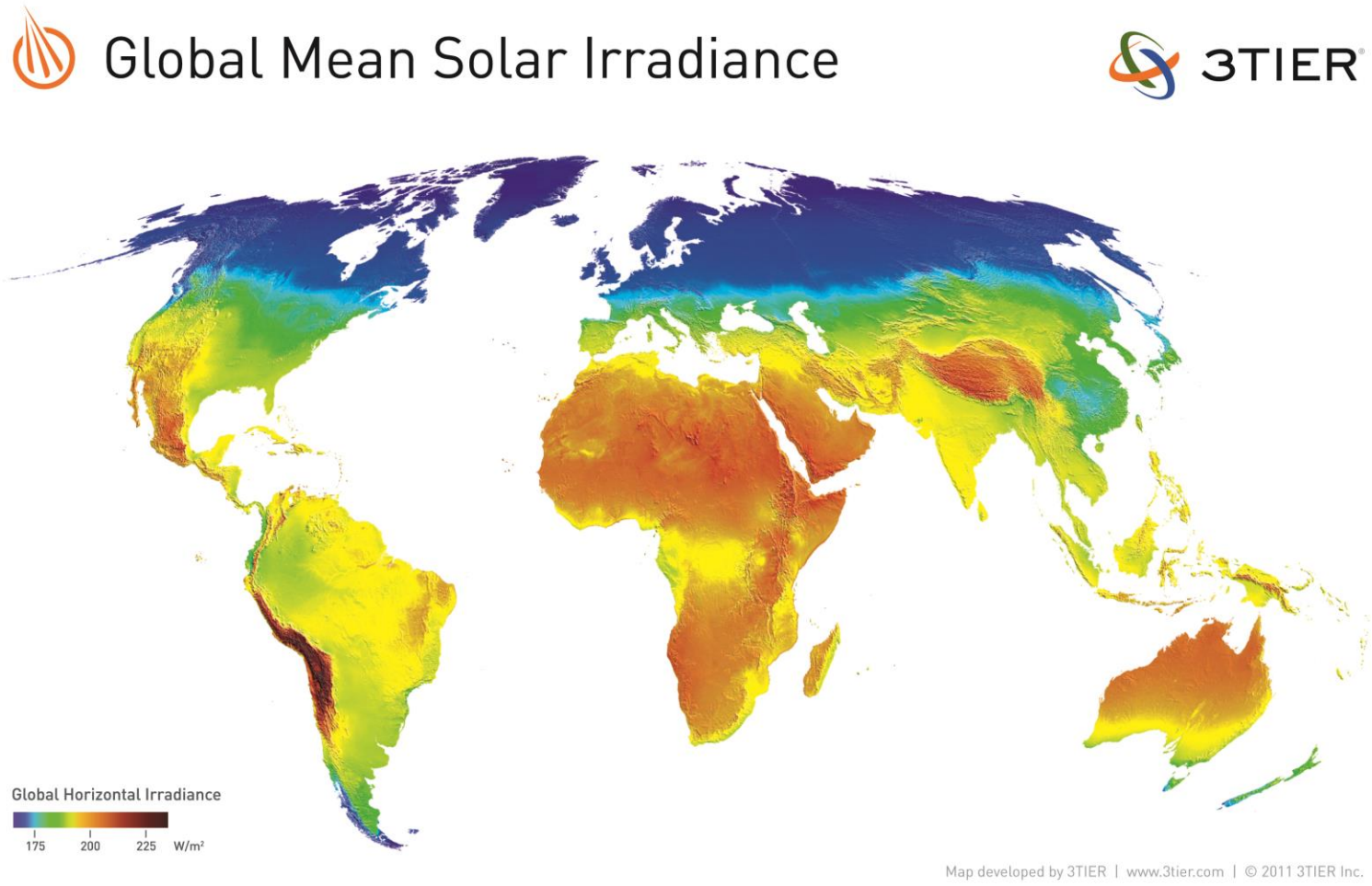

Figure 8: Global map showing where the sun shines most. The more red the color, the more sunlight that shines in those areas.

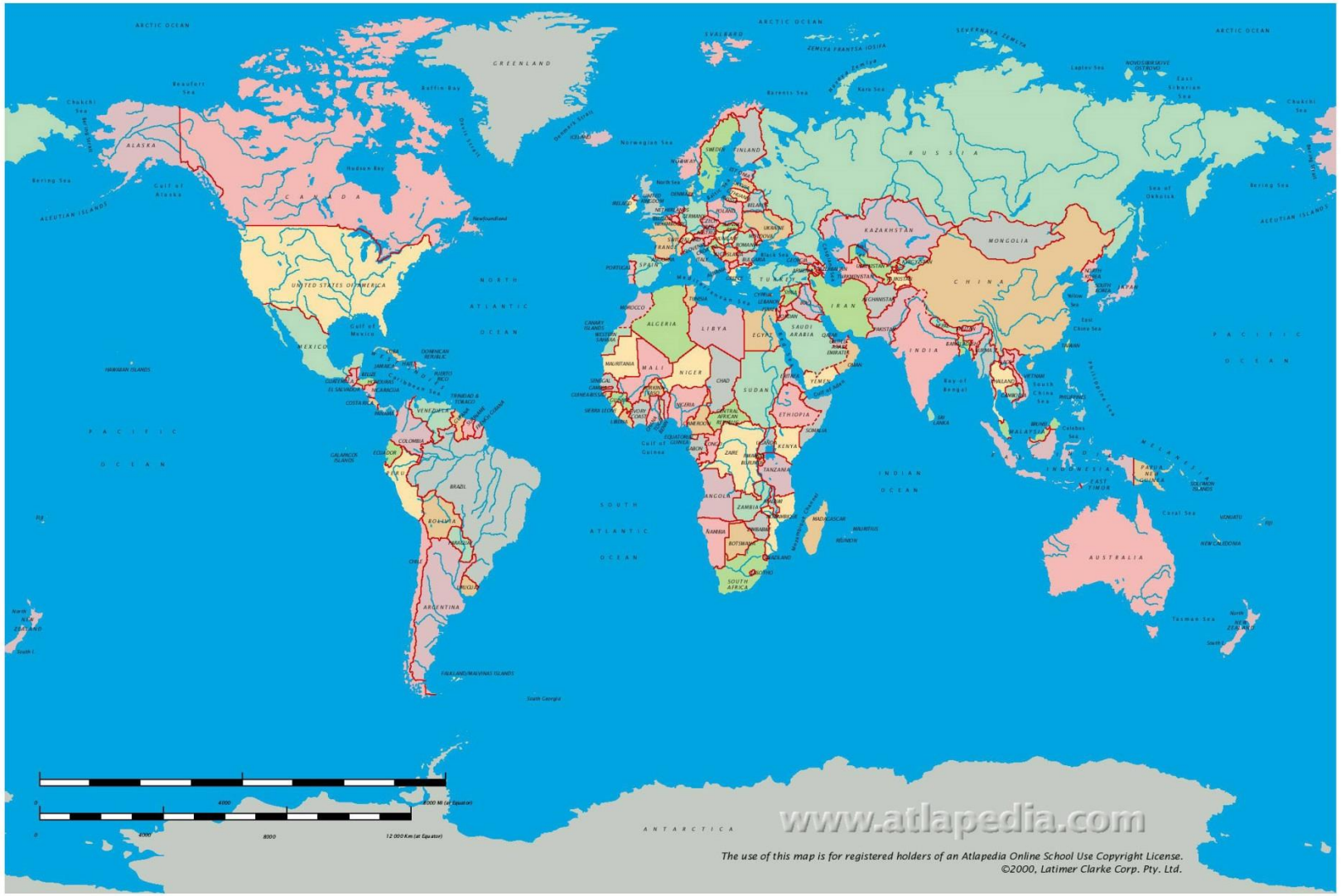

Figure 9: Global political map.

Table 2: Cash Flow Statement.

Cash Flow Statement

Fiscal year begins: 1/5/2015	(Pre) Startup EST	JAN 05	FEB 05	MAR 05	APR 05	MAY 05	JUN 05	JUL 05	AUG 05	SEP 05	OCT 05	NOV 05	DEC 05	Total Item EST
Cash on Hand (beginning of month)	153000	98730	84202	80174	70746	64718	57660	68132	84104	81876	69148	58820	49592	49592
Cash Receipts														
Cash Sales		5500	16500	11000	16500	22000	44000	52800	22000	11000	9900	8800	14000	234000
Loan														0
Total	0	5500	16500	11000	16500	22000	44000	52800	22000	11000	9900	8800	14000	234000
Total Cash Available (before cash out)	153000	104230	100702	91174	87246	86718	101660	120932	106104	92876	79048	67620	63592	283592
Cash Paid Out														
Research & Development Purchases	800	800	800	800	800	800	800	500	500	500	500	800	800	9200
Manufacturing Purchases		4000	4000	4400	6000	8200	16000	20000	8000	8000	4000	2000	4000	88600
Gross wages (exact withdrawal)	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	78000
Payroll expenses (taxes, etc.)		138	138	138	138	138	138	138	138	138	138	138	138	1656
Supplies (office & oper.)	3200	20	20	20	20	50	20	20	20	20	20	20	20	3470
Repairs & maintenance	500	100	100	100	100	100	100	500	100	100	100	100	100	2100
Advertising	1500	200	200	200	200	2000	400	400	200	200	200	200	200	6100
Car, delivery & travel	10000	500	500	500	500	3500	1000	1000	500	500	500	500	500	20000
Accounting & legal	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	19500
Rent	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	39000
Telephone	220	220	220	220	220	220	220	220	220	220	220	220	220	2860
Utilities	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	18850
Insurance	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	26000
Miscellaneous	100	100	100	100	100	100	100	100	100	100	100	100	100	1300
Total	30270	20028	20028	20428	22028	29058	32728	36828	23728	23728	19728	18028	20028	316636
Cash Paid Out (Non P&L)														
Equipment purchase	24000						300							24300
Owners' withdrawal			500		500		500		500		500		1500	4000
Total	24000	0	500	0	500	0	800	0	500	0	500	0	1500	28300
Total Cash Paid Out	54270	20028	20528	20428	22528	29058	33528	36828	24228	23728	20228	18028	21528	344936
Cash Position (end of month)	98730	84202	80174	70746	64718	57660	68132	84104	81876	69148	58820	49592	42064	-61344

Table 3: Balance Sheet

Balance Sheet

	31-Dec-15
Current Assets	
Cash	40964
Inventories	400
Accounts receivable	1100
Pre-paid rent	3000
Other	500
Total	**45964**
Fixed Assets	
Equipment	24300
Equity and other investments	100000
Less accumulated depreciation (Negative Value)	-2600
Total	**121700**
Other Assets	
Deferred charges	0
Total	**0**
Total Assets	**167664**
Current Liabilities	
Accounts payable	480
Notes payable	300
Total	**780**
Long-term Liabilities	
Mortgage	N/A
Total	**0**
Owner Equity	
Investment capital	100000
Accumulated retained earnings	66884
Total	**166884**
Total Liabilities & Stockholder Equity	**167664**

Table 4: Income Statement.

Income Statement

Arctic Industries

[December 31, 2015]

Financial Statements in U.S. Dollars

Revenue			
Gross Sales		$145,400	
Less: Sales Returns and Allowances		$7,270	
Net Sales			138130
Cost of Goods Sold			
Beginning Inventory		$88,600	
Add:	Purchases	$360	
	Freight-in	$18,000	
	Direct Labor	$18,000	
	Indirect Expenses		
Inventory Available		124960	
Less: Ending Inventory		400	
Cost of Goods Sold			124560
Gross Profit (Loss)			13570
Expenses			
Advertising		6100	
Insurance		26000	
Legal and Accounting Fees		19500	
Licenses and Fees		325	
Miscellaneous		1300	
Office Expense		5010	
Payroll Taxes		1656	
Rent		39000	
Repairs and Maintenance		2100	
Supplies		95470	
Telephone		2860	
Travel		5000	
Utilities		18850	
Vehicle Expenses		15000	
Wages		78000	
Total Expenses			316171
Net Operating Income			(302601)
Other Income			
Gain (Loss) on Sale of Assets			
Interest Income			
Total Other Income			0
Net Income (Loss)			(302601)