Madison Wind Solutions, LLC (MWS)

James Madison University

National Collegiate Wind Competition

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Sponsors:

Department of Energy

Virginia State Energy Office

Virginia Center for Wind Energy

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I. Executive Summary

Madison Wind is the name of James Madison University's team for the Department of Energy's Collegiate Wind Competition. The team consists of 30 students from the College of Business, Engineering, and Integrated Science and Technology departments. The students were divided into five sub teams: the rotor team, the electronics and gearing team, the business plan team, the market issues team, and the support team. Together, students along with faculty advisors worked toward the April 18th portfolio delivery deadline and the May 5-8 presentation component. The non-profit, Madison Wind Solutions, LLC spawned as a result of the business team's efforts to create a proposal to distribute the prototype wind turbine to those living in energy poverty.

Madison Wind Solutions, LLC exists as a non-profit to bring clean, sustainable energy to communities which currently lack a reliable electricity source. This is accomplished by selling wind turbines to local communities and entrepreneurs who can use the turbines to provide power to cell phone charging stations, light fixtures, radios, cooling units and other small electronics that require small amounts of power. This non-profit is designed as a startup that carries out the design, assembly and distribution of portable, small-scale wind turbines throughout rural sections of Kenya. Energy poverty remains a

significant problem across Kenya, even though individuals own various electric technologies such as lighting, cell phones and cooling systems, but lack the necessary electrical power to consistently and reliably power such items.[i] Due to the lack of a developed electric grid across much of the country, small-scale renewable energy will succeed by providing energy relief to meet the needs of millions of individuals.[ii]

II. Business Overview

Madison Wind Solutions' non-profit business model is a solution to the problem of energy poverty in underdeveloped countries. Our primary activities are research, design, assembly, and distribution of small wind turbine technology in departments worldwide. The Unites States headquarters will house the engineering department, which will continue to innovate and develop cost efficient strategies. The wind turbine components will be manufactured in India. The Kenya branch will assemble the turbines at the distribution location under the supervision of the sales representative and Kenyan distributor, and handle all customer service, before and after the transaction. The vision of Madison Wind Solutions is to increase the standard of living of individuals living in energy-impoverished communities by promoting sustainable and economically-feasible wind energy resources. The value of Madison Wind Solutions is derived from the social benefits of community building and increased standard of living. Madison Wind Solutions intends to meet triple bottom line objectives by improving the quality of life for people in rural Kenya through providing sustainable energy solutions that are available and affordable to those in need.

III. Market Opportunity

Madison Wind Solutions, LLC aims to relieve energy poverty. The World Energy Outlook 2013 estimates that 1.3 million people are without energy globally, and 2.6 million are restricted to biomass.[iii] Rural communities in Kenya primarily use biomass for electricity, which is highly inefficient and degrades the environment with harmful emissions and deforestation.[iv] The objective is to provide product that will

decrease the number of Kenyan citizens living in energy poverty by providing an affordable, clean, renewable, and long term source of energy.

Kenya also has poor electrical grid infrastructure. With 70% of the population living in rural areas, the strong majority are without reliable grid access.[v] The primary demand for energy is from devices that have a low energy output.[vi] The wind turbine, classified as "small" electricity output unit, will be able to help alleviate the shortage in supply of rural electricity generation. Specifically, research suggests a high demand for energy for the purposes of cell-phone charging and efficient lighting apparatuses. Furthermore, charged phones provide an opportunity for emergency medical assistance. Madison Wind Solutions, LLC aims to provide wind turbines that will meet this demand.[vii] survey in 2009 showed that four million mobile phone subscribers existed in Kenya from a population of 6.7 million people. The survey also conveys how rural household subscriptions outweigh the electricity supply, indicating that this market is ripe for penetration. The same survey illustrates that usage in rural areas closely resembled usage in urban areas, comprising roughly 50% of the market.[viii] In Kenya, the use of mobile phones has been supported by the growth of the mobile banking industry. Companies, like M-Pesa, allow Kenyans to make monetary transactions directly from their phones. The industry experienced substantial growth in the past five years, with 43% of Kenya's gross domestic product being transferred through this network.[ix] Unfortunately, economic growth is countered by energy deficiency inherent to the region. The turbine has the potential ability to power a cell phone charging station, such as power strip, facilitating financial transactions.

In order for success, an obvious and essential element must be present: wind. The majority of Africa is without wind energy production due to poor wind availability inland. Thankfully, Kenya is located on the coast, which enables relatively consistent and sufficient wind speeds for a small scale turbine. Wind resources are greatest around the North Kenyan rural community of Marsabit, which will be the initial location. Data reveals that wind speeds are, on average, higher during the summer dry season, when

hydro is o the downswing, cloud cover, and nighttime hours, when solar panels are no longer generating energy from the sun; these characteristics of Kenya's climate gives MWS a competitive advantage.[x] Turbine installation will provide complimentary electricity to offset the intermittence of current alternative energy production. Another advantage to the market regards Kenya's government actively seeking renewable energy infrastructure to replace poor electricity sources such as biomass.[xi] Hopefully the Kenyan government will see the parallel between the product and the country's goals, leading to legal and financial support through possible grants and subsidies. It should also be noted that Kenya has very lenient laws regarding foreign investment.[xii] This open economy is intended to stimulate growth in order for Kenya to achieve the plans set out in their Vision 2030 long-term plan.

The presence of energy poverty in Kenya is two sided coin. On one side, there is a strong market opportunity for a small, portable turbine. On the other side, there is little wealth within the community to afford such a device.[xiii] In order to ensure the target market is able to acquire our product, a financing structure must be put in place. Several barriers exist that must be addressed. First and foremost, the average citizen living in the rural areas of Kenya cannot afford to buy $20 turbine. This is due to both the difference in scale between Kenyan and U.S. economies and the non-monetary nature of rural Kenya's economy. To solve this problem, we will charge a price for the product that is below the cost of production.

First, Madison Wind Solutions will apply for non-profit status. This will be advantageous in that it will allow the acquisition of grants to fund operations. With the help of charitable grants, turbines will be sold to the public below production cost.[xiv] The target price per turbine will be $20 or about Kenyan Shilling 17000.

Even with this subsidized price, the non-monetary nature of the rural Kenya economy will need to be addressed. Currently, many communities have Community Based Organizations, or CBOs, that oversee lending operations of this type.[xv] Purchasers of our turbines will be required to make an initial down

payment which will be a designated portion of the total turbine cost. The customer will then be required to make installments over a period of time that are a fair percentage of the turbines cost. The reason for the variability in payments is due to the fact that many Kenyans living in rural areas practice subsistence farming and sell what produce is left after their own consumption needs are met. In fact, the agriculture industry employs seventy-five percent of the population.[xvi] This uncertain source of income combined with the seasonality of crops will cause the cash flow from our borrowers to be unstable. At some points of the year, such as during the coffee harvest in October through December, cash flows will be greater than in months with less crop activity.[xvii] In the end, with the help of the CBOs' supervision and the relationship of our sales representatives with the client, we will rely on the individual desire of the client to repay their loan. This structure was decided to be the best method after speaking with Dr. Justin Henriques, who has implemented similar project in Kenya with solar panels successfully.

Some charitable grants may come from federal and state government sources, in order to make up the difference between our operating costs and program revenues.

IIIa. Customer Relationships

The turbine will reach two kinds of users: (1) an entrepreneur using the wind turbine to charge small electronic devices like cell phones and LEDs for fee and (2) communities who will be the end user. Utilizing an entire community to pool funds, multiple people can benefit from a decreased selling price to afford immediate access to a turbine and the various electronic powering function.

Madison Wind Solutions hopes to build long term relationships with the customers to ensure prosperity and expansion of operations. By employing native Kenyans as the sales representatives, there is an effort to establish stronger, more direct links with end consumers through networking. Ideally, the entrepreneurs investing in the product will develop innovative purposes for the turbines and share these ideas with the company to allow stronger marketing across various industries. These individuals

will also be more inclined to purchase future products, or recommend the products to others through word-of-mouth marketing. This enhances the need for strong relationship as Madison Wind Solutions, LLC looks to grow rapidly in the early stages. These entrepreneurs will be a key part of the overall marketing plan, consisting of direct selling, word of mouth, and a small advertising campaign in places we think there are potentially untapped markets.

IV. Management Team

Madison Wind solutions will team up with the Virginia Center for Wind Energy to help the U.S. based operations, especially early o in the operation. Due to our connections with JMU and the Center for Wind Energy, we will be able to use their space for general operations and logistics as well as the high bay for research and development purposes. There are many reputable people with extensive knowledge on the subject of wind energy who will be able to help us as we move forward and begin to develop more brand offerings and expand into new geographic markets.

IVa. Staffing

In order to prosper as a competitor in the small wind energy market, Madison Wind Solutions will work with a Board of Advisors who meet in the Center for Wind Energy and assist in decision making. Thus, the company will need a president as well as an international operations manager. The president will be the point of contact for the communications between the Board of Advisors and the International Operations Manager. The ideal candidate for the presidential position will have relevant managerial experience, preferably within the renewable energy industry to contribute valuable ideas to expand operations.

The international operations manager will oversee the staff that operates overseas including but not limited to: the warehouse manager, sales staff, and a technician. All of these employees will answer directly to the international operations manager. The manager will then report to the president and provide status reports o business operations.

There is the potential for communication disconnects between the different divisions of this small international organization. Management plans to address this issue through careful employee selection and training, leading to clearly defined communication channels which will be sustainable between continents. The training will include technical development in Microsoft SharePoint or a similar product to make sure that documentation amongst divisions is organized and easily transferable.

Madison Wind Solutions will utilize a board of advisors who meets in the Center for Wind energy to ensure that operations are beneficial in every regard of the business. The board will comprise of individuals that provide advice from a professional and experienced background. The advisors will have experience with international, small-scale, renewable energy operations, in order to help guide the president's decisions to develop a strong presence in energy impoverished areas. Se organizational chart (Appendix 4).

V. Production Development and Operations

Madison Wind Solutions will conduct business overseas, manufacturing will take place in Mumbai, India. Assembly and distribution will take place in Nairobi, Kenya and marketing and installation will begin in Marsabit, Kenya. The US headquarters will host R&D because of their close proximity to resources and technical ability available in the Center for Wind Energy. The availability of this technical expertise will be crucial in developing new product offerings.

Manufacturing will be done through our partner Elite Tools and Equipments in India. See procurement process (Appendix 5). India offers a strategic location for our manufacturing to be outsourced because of its prominence as one of the world's most developed and least costly countries to manufacture in.[xviii] Additionally, India is located in a geographically beneficial area relative to both the current and potential end users. Shipping to Kenya will be handled by Tudor International Freight Limited who will deliver our products directly to Nairobi by cargo freight.[xix] The choice to ship by boat is not only cost effective, but also helps minimize the carbon footprint of our product. In India, the

manufacturing includes components such as turbine blades, nacelles, hubs, electronics, tails, and all other critical components. The actual assembly will be done in Kenya and then properly distributed amongst prospective buyers.

Assembly will occur at Madison Wind Solution's Nairobi office and warehouse. Turbines will be fully assembled, packaged, and sold as individual products along with accessories such as LED light strands and usb ports. The sales force will also be located in this office. Once assembly is completed by the technician, wind turbines are moved along to distribution. The distribution effort relies o native Kenyan sales representatives with contacts in urban, suburban, and rural areas. See sales diagram (Appendix 6).

Our most valuable partnership will be with the manufacturer of our parts. Their attention to quality standards will be essential in making the Stimangu product, therefore making the business successful. This partnership will have to be managed closely by the board of advisors to make sure that the transference of products and payments runs smoothly and does not give them a reason to dissolve the partnership.

It is important to note that the turbine being produced and sold for the purposes of the business plan, Stimangu, will be slightly different than the turbine actually produced by the engineering team. The current nacelle and gearbox are oversized for the size of the turbine blades. This enables the blades to be scaled u easily; allowing the turbine to be far more efficient when converting wind resources into electricity. The difference in cost is minor due to the blade materials being inexpensive.

The most significant risks associated with production and distribution of our products would be lack of quality from our suppliers as well as limited time for our sales representatives to make sales to communities. The issue of lacking in quality was assessed before we made our decision. We looked at quality control measures such as Six Sigma and other quality control standards, and decided o Elite Tools and Equipments because of their size and quality control measures. Although they do not follow

Six Sigma, Elite Tools and Equipment is reputable dealer who should be able to efficiently produce the parts we need for the turbines.

The second most pressing risk we face is limited time for Sales of our products by sales representatives. Sales representatives are limited in their time available to build relationships with customers. The time involved in one sale includes the time spent traveling to the communities, building relationships, making the sale, and finalizing any paperwork before the technician can come and install the actual turbine. Because our business is based around bettering communities, we hope to have many customers come to us, therefore greatly reducing the time required in making a sale. This was the case for Dr. Justin Henriques and his colleagues in their objective to reduce energy poverty through the distribution and sales of small scale solar panels.

The technical specifications describe five-bladed rotor with a diameter of 40 centimeters. It is an upwind, horizontal-axis turbine (HAWT) with easily replaceable components. The five-blade design was selected due to use of a 50:1 gearbox ratio. Using a high-ratio gearbox was necessary due to the high rotations per minute requirements necessary to produce the desired power from the generator. The system incorporates an external box containing the majority of electrical components. This box also serves as a user interface. Further design specifications can be found in the design report.

Va. Impact Analyses

Economic development

Madison Wind Solutions, LLC's wind turbine provides electricity that will combat the social costs of energy poverty in Kenya. The electricity generated by the turbine will be used to power lights and communication technologies. Additional lighting in a school can allow children to study for longer hours into the night, resulting in increased investment in their futures. The increased education of the population is a primary factor for further economic development. Furthermore, additional lighting

provided by the wind turbine will allow Kenyan businesses to operate during nighttime hours, thus increasing economic productivity.[xx]

In addition, providing electricity will increase the reliability of Kenyan citizen's access to communication technologies. These technologies include mobile phones and radios. Having the ability to charge a mobile phone will increase economic productivity through mobile business transactions, mobile banking, and emergency phone service. The opportunity cost of a rural mobile phone owner having to walk to an urban center to charge his/her phone will be foregone, and the time saved could instead be used for more economically productive activities. Moreover, having the ability to power a radio will increase marketing opportunities throughout Kenya.

Community involvement

Madison Wind Solutions, LLC will use direct marketing strategies in order to introduce the turbine to communities. Workshops will be developed to educate people within communities about how the turbine works and why it is valuable. The goal of these workshops will not be to sell the turbines directly, but instead to educate them about the benefits in order for them to value it enough to want to purchase it. These workshops will include overviews of how the turbine can make electricity, demonstrations of the turbine, and potential applications within their community. In addition to the workshops, Madison Wind Solutions, LLC plans to offer technical certifications to people who demonstrate competency working with the turbine. These technical certifications will not only provide citizens with a form of social capital, but will instill a sense of pride that may lead to future opportunities.

Environmental Practices

According to Lighting Africa, 73.5 % of Kenyan households use kerosene as their main lighting fuel.[xxi] Incomplete combustion of kerosene fuel produces greenhouse gases and poses environmental health hazards. "Simple kerosene lamps, used in regions with limited or n access to electricity, are now

understood to be a significant global source of atmospheric black carbon (BC), a strong climate warmer".[xxii] In addition, smoke from the lamps can cause adverse respiratory effects, such as tuberculosis. [xxiii]

Electricity produced by a wind turbine would reduce the number of respiratory diseases caused by kerosene.[xxiv] Wind turbine generated electricity produces no carbon emissions or greenhouse gases, thus reducing negative climate externalities and decreasing the carbon footprint of the end user.

VII. FINANCIAL ANALYSIS

Five years of pro-forma statements were created and can be found in Appendix 1 through 3 with financial assumptions. It is key when reviewing the financial statements to note that Madison Wind Solutions is non-profit enterprise. Because of this, the income statement contains "program revenues" and "program expenses". These are revenues and expenses directly associated with non-profit operations. Net income is stated as "Change in net assets" which is consistently zero due to grants being used to cover operational losses. Certain assumptions have been made to determine the viability of the turbine that are also stated in the appendix. In year one, $8000 of program revenues is estimated, requiring approximately $134,000 in contributions to reach break-even. In this year, two hundred turbines will be installed. Following year one, two additional sales representatives are hired to increase turbine sales/installation to 500 units/year. By year five, program revenues reach an estimated $88000, requiring $152,000 in contributions. It is assumed that there will be an unlimited demand for the energy producing turbines.

Appendices

Appendix 1: Pro Forma Income Statement

Pro Forma Income Statement					
Revenues	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Program Revenues	**$8,000**	**$28,000**	**$48,000**	**$68,000**	**$88,000**
Contributions	**$132,173.08**	**$211,327**	**$187,327**	**$167,327**	**$147,327**
Expenses					
Program expenses	(130,173)	(234,327)	(234,327)	(234,327)	(234,327)
General and Admin expenses	(10,000)	(5,000)	(1,000)	(1,000)	(1,000)
Change in Net Assets	$ -	$ -	$ -	$ -	$ -

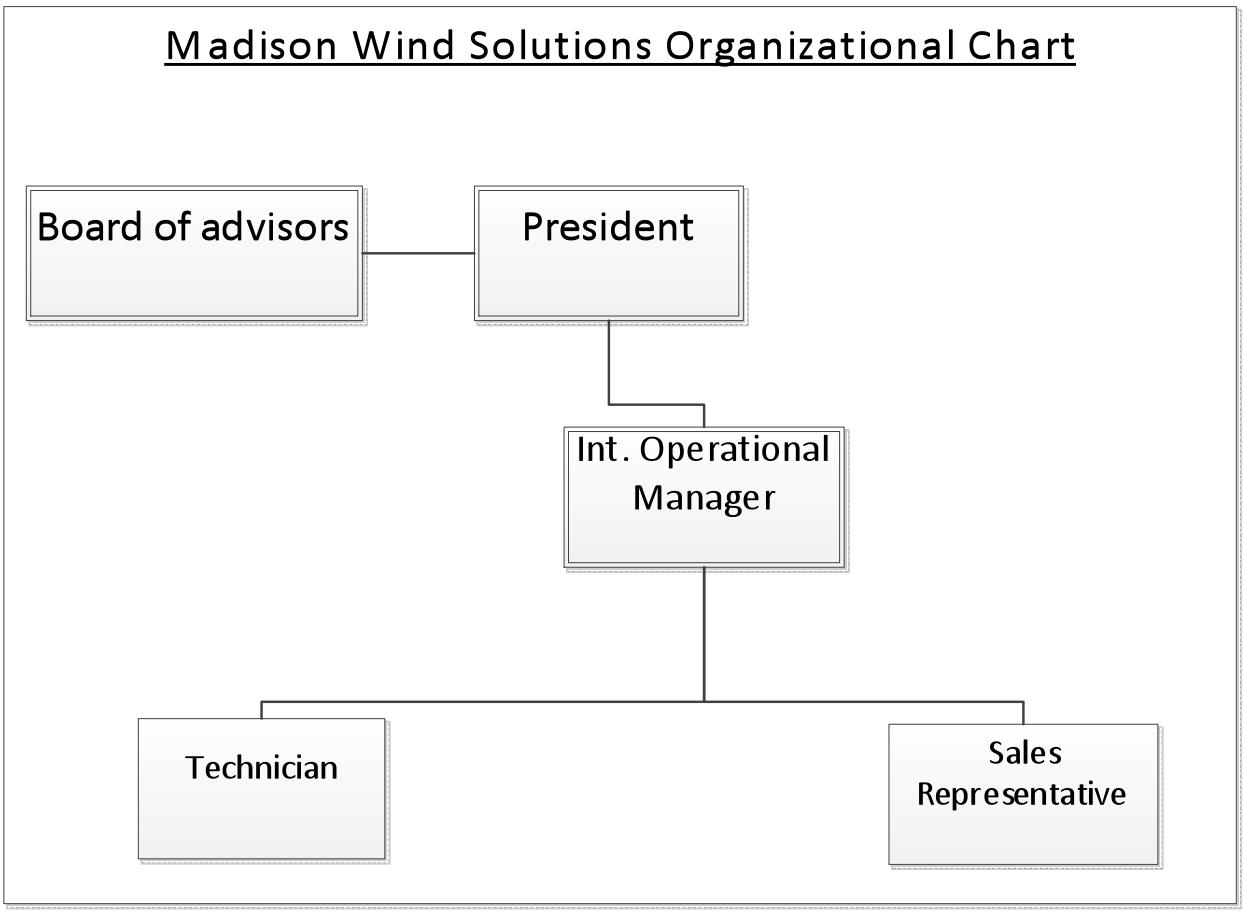
Appendix 2: Pro Forma Balance Sheet

Pro Forma Balance Sheet					
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Cash	(106,763)	(305,231)	(479,699)	(634,167)	(768,635)
Accounts Receivable	32,000	104,000	156,000	188,000	200,000
Inventory	0	0	0	0	0
Total Current Assets	**$(74,763)**	**$(201,231)**	**$(323,699)**	**$(446,167)**	**$(568,635)**
Net Fixed Assets	18,000	17,000	16,000	15,000	14,000
Total Assets	**$(56,763)**	**$(184,231)**	**$(307,699)**	**$(431,167)**	**$(554,635)**
Accounts Payable	4,333	16,000	27,667	39,333	51,000
Accruals	2,192	5,269	8,346	11,423	14,500
Current Liabilities	**$6,526**	**$21,269**	**$36,013**	**$50,756**	**$65,500**
Long-term Debt	0	0	0	-	0
Common Stock	35,000	35,000	35,000	35,000	35,000
Temporarily Restricted Assets	(98,288)	(240,500)	(378,712)	(516,923)	(655,135)
Total Liabilities & Net Assets	**$(56,763)**	**$(184,231)**	**$(307,699)**	**$(431,167)**	**$(554,635)**

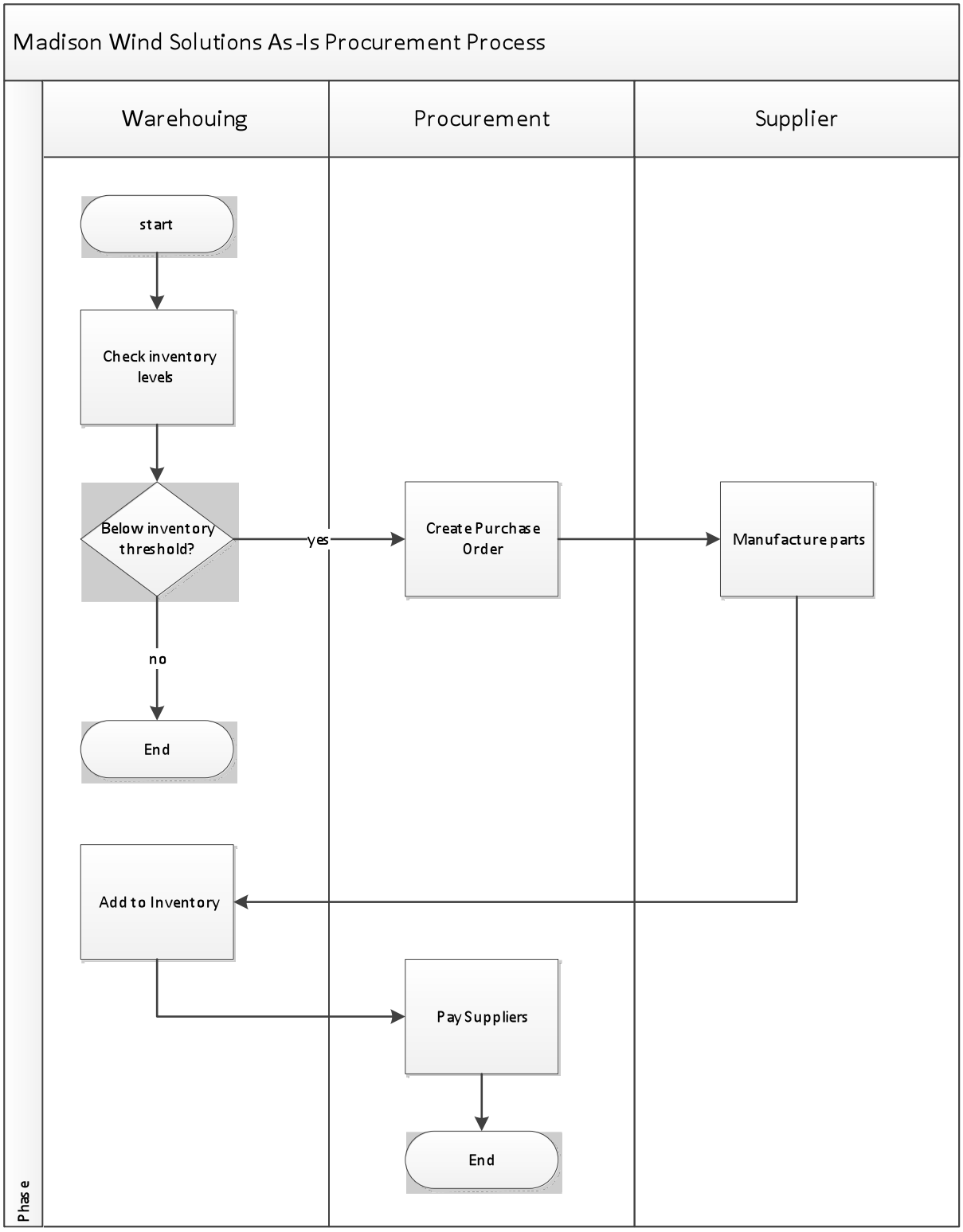
Appendix 3: Pro Forma Statement of Cash Flows

Pro Forma Statement of Cash Flows	Year 1	Year 2	Year 3	Year 4	Year 5
Cash flows from operating activities					
Cash receipts from customers	$8,000	$28,000	$48,000	$68,000	$88,000
Contributions	$132,173	$211,327	$187,327	$167,327	$147,327
Cash paid to suppliers	(51,667)	(128,333)	(128,333)	(128,333)	(128,333)
Cash paid to employees	(52,885)	(72,115)	(72,115)	(72,115)	(72,115)
Expenses (SGA, credit card, etc.)	(32,288)	(19,288)	(15,288)	(15,288)	(15,288)
Net cash flows from operating activities	**$3,333**	**$19,590**	**$19,590**	**$19,590**	**$19,590**
Cash flow from investing activities					
Capital expenditure	$(11,000)	-	-	-	-
Proceeds from the sale of equipment	-	-	-	-	-
Net cash flows from investing activities	**$(11,000)**	**$ -**	**$ -**	**$ -**	**$ -**
Cash flow from financing					
Owner Investment	$35,000	$0	$0	$0	$0
Net cash flows from investing activities	**$35,000**	**$0**	**$0**	**$0**	**$0**
Net cash flow	**$27,333**	**$19,590**	**$19,590**	**$19,590**	**$19,590**

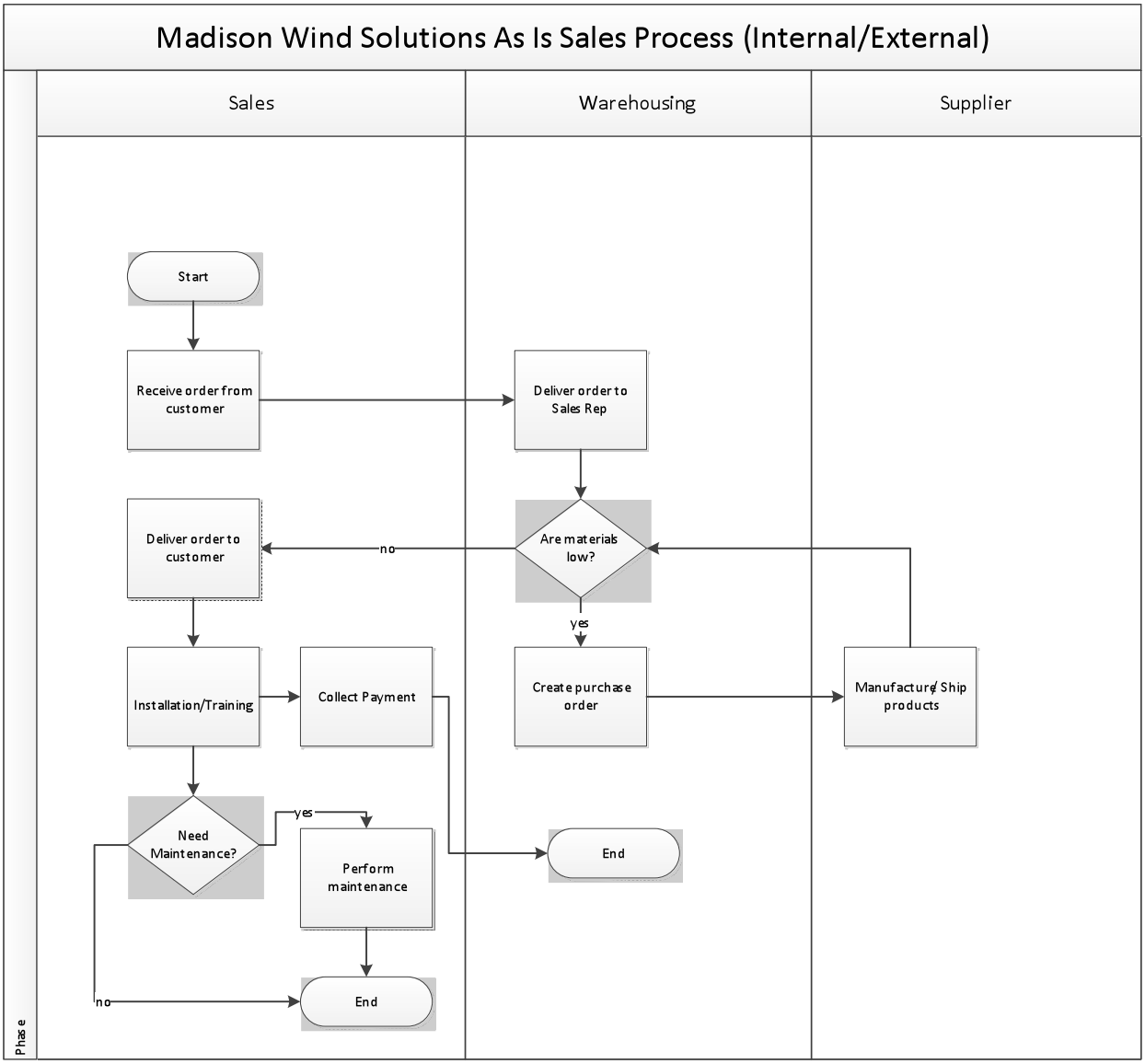
Appendix 4: Organizational Chart



Appendix 5: Procurement Process Activity Diagram



Appendix 6: Sales Process Activity Diagram



Appendix 7: Porters 5 Forces

Force	Threat/Power level	Reasoning
Threat of New Entrants	High	Low product costs Low switching costs Low capital requirements
Threat of Substitutes	High	Many energy sources (solar) Highly Differentiated product (lowers threat)
Bargaining Power of Suppliers	Medium/High	We compose small part of total business Difficult to find substitutes Low threat of forward integration
Bargaining Power of Customers	Low	Differentiated product Small number of choices Many complimentary products
Intensity of Rivalry	Medium	Few large companies dominate small scale energy industry. 70% of turbines at this scale made in US (further from our market) Many New customer segments currently emerging.

Appendix 8:

Madison Wind Solutions, LLC

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Appendix 9:

Financial Assumptions

1. The cost of materials and the cost of labor per turbine is estimated to be $28 and $10, respectively.[1, 2]
2. Demand is assumed to be unlimited. Because of this demand, inventory at the end of each year is zero.
3. A inventory of 200 turbines in year one followed by 500 turbines per year for four years with a zero percent defect rate is assumed.
4. Rent in Kenya is assumed to be $8000 annually.[3]
5. SG&A expenses are assumed to be minimal given the small amount of expenses indirectly related to the non-profit program. These expenses decrease after year one.
6. Salaries, Wages, and Benefits is comprised of $25,000 per International Operations Manager, $15,000 per Technician, and $10,000 per sales representative.[4]
7. Depreciation of office equipment is assumed to be straightline at 20% per year.
8. Taxes are estimated to be 10% of Salaries, Wages, and Benefits due to non-profit status relieving Madison Wind Solutions of other tax obligations.
9. In year one, an initial investment from administrators in the U.S. of $35,000 is assumed.
10. Each year, 20% of the turbine price is assumed as program revenues.
11. It is assumed that no debt will be incurred.
12. To cover operational losses, it is assumed that charitable grants will be given to offset operational costs.

[1] http://drop-kicker.com/wp-content/uploads/2014/02/XXXX_Inj_MOld_Cost_Estimation.pdf
[2] Chougule, 2005
[3] http://kaptichlouis.blogspot.com/2011/07/office-space-price-comparison-in.html
[4] http://www.payscale.com/research/KE/Country=Kenya/Salary/by_Degree

13. It is assumed that although program expenses would be paid in full each year, program revenues will be acquired on an installment basis.
14. In year one, ten percent of the turbine price will be paid as a down payment, followed by a ten percent installment. Each year following, it is assumed that two payments of ten percent will be made.

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[i] http://www.csudp.org/energy-documentary
[ii] http://www.csudp.org/energy-documentary
[iii] http://www.worldenergyoutlook.org/resources/energydevelopment/
[iv] http://www.seps.sk/zp/fond/dieret/biomass.html
[v] http://www.geni.org/globalenergy/library/national_energy_grid/kenya/index.shtml
[vi] http://sustainabledevelopment.un.org/content/documents/nepadkarekezi.pdf
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[x] https://profiles.uonbi.ac.ke/coludhe/files/vol2_paper_4.pdf
[xi] http://sustainabledevelopment.un.org/content/documents/nepadkarekezi.pdf
[xii] http://www.kpmg.com/Africa/en/KPMG-in-Africa/Documents/Kenya.pdf
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[xxiii] http://europepmc.org/articles/PMC2854735
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