BIOburners Business Plan

Team 3: Grass to Gas
Matthew Lomasney, Nicole Michmerhuizen, Nate Myton, and Eric Sager
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1. Executive Summary

BIOburners is a startup business that produces biomass gasifier kits. This company places a high value on sustainability, stewardship, and integrity in its operations. BIOburners hopes to provide consumers with an inexpensive alternative energy solution that will eliminate consumer dependence on power suppliers and fossil fuels.

The parts included in BIOburners' gasifier kits are easily assembled into gasifiers that can be used to provide the power required for an average home. The gasifiers provide an alternative, sustainable energy source. They have much lower costs than kits currently on the market. BIOburners' gasifiers operate with a variety of fuels, produce minimal amounts of tar, and have high efficiency. BIOburners will use these features of their products, as well as the price of their gasifier kits, to attract customers and succeed in the market.

At present, the US market for biomass gasifiers is small and unhindered by legal or capital barriers. BIOburners anticipates large market growth in the next decade due to increasing environmental awareness and decreasing payback time for the gasifier.

BIOburners will initially employ one full-time engineer and will contract a second to complete the manufacturing of each kit as products are ordered. Nate Myton is a Chemical Engineering graduate of Calvin College and will be responsible for all of the company's decisions on product design and manufacturing. He will also be responsible for BIOburners' finances. Matt Lomasney, also a Chemical Engineering Calvin College graduate, will complete kit construction. As the business grows, Matt will work more hours and additional employees may be hired.

BIOburners will request a loan of $25,000 USD. This loan will be used to finance the initial cost of the raw materials as well as the costs of the machinery and salaries of the employee and contractor. After doing extensive market research, BIOburners determined that, based on the anticipated demand for biomass gasifiers, they would be able to pay back the loan in 3 years.
2. Vision and Mission Statement

BIOburners' vision is to produce and distribute biomass gasifier kits which operate efficiently, are easy to use, and are environmentally friendly. Employees will continually strive to improve these aspects of the design through research and testing. BIOburners also seeks to provide gasifiers at low cost, which will allow a larger group of customers to enter the market, and consequently will increase the use of gasification over other less sustainable energy sources.

BIOburners values sustainability and stewardship as well as integrity. This business strives to offer products that do not unnecessarily harm other people or animals and that will not have negative effects on the environment. BIOburners places the highest priority on developing gasifiers that are safe to operate and that will safely handle the hazardous synthesis gas it produces. BIOburners will also, as much as possible, use heat provided by the gasifier efficiently and reduce the amount of tar produced. BIOburners displays concern for customers by providing all necessary and relevant information truthfully, and also striving to produce gasifier kits which are easy to assemble, operate, and maintain. BIOburners also promotes trust by offering warranties on their gasifier kits.

3. Industry Profile and Overview

3.1 Industry Background and Overview

Gasifiers have been used for nearly a century. The biomass gasification industry began to develop in Europe during the early 1900s and grew throughout the rest of the century. Originally gasifiers were used solely as a replacement for fossil fuels. Since then, an increasing concern for cleaner renewable fuels has led many other countries to invest in biomass gasification. Commercial large scale gasification has grown significantly in the past 10 years. Currently, there are approximately 50 manufacturers of large scale commercial gasifiers.¹

3.2 Major Customer Groups

There are three primary target customers for BIOburners' product. The largest group is composed of rural homeowners. Gas and electric prices can be exorbitant in rural areas and biomass gasification could prove to be an economical solution that would reduce these high costs. An additional group of customers is disaster relief foundations. When a natural disaster strikes, inhabitants are often

left with no power for long periods of time. Disaster relief foundations and church programs may be interested in biomass gasification as it requires no infrastructure and biomass is readily available nearly everywhere. These characteristics would be ideal in a post-disaster setting. "Doomsday Preppers" are a final group of customers that BIOburners seeks to target. Doomsday Preppers are individuals who are preparing for an apocalypse during which they will not able to rely on electricity provided by power companies. Therefore, the individuals in this group will be interested in alternative forms of energy, such as biofuel.

3.3 Regulatory Restrictions

There are no emissions during the gasifier manufacturing process. The emissions released while the gasifier is running are equivalent to those of a gas furnace. Therefore, there will be no regulatory restrictions of concern for this business.

3.4 Barriers to Entry or Exit

As the previous section suggests, there are no regulatory barriers to entering the market. Additionally, BIOburners will not require a large amount of capital to enter the market because of the proposed business structure (see section 9). The capital cost of equipment required is relatively inexpensive and does not pose a hindrance to entering the market either. Because the loan required is small, there are no significant barriers to exit the market.

3.4 Significant Trends

One of the target customer groups for BIOburners is people who are passionate about environmentally sustainable living. As more Americans are becoming interested in this, the market for alternative energy products, such as gasifier kits, is also likely to expand. Additionally, large tax breaks are offered to users of solar panels, and it is anticipated that similar incentives will be offered to users of biomass gasifiers when the use of this alternative energy source is realized in the United States. This would provide an increased motivation toward biomass gasification and would help further expand BIOburners' market.

3.5 Key Success Factors in Industry

The technology for reducing tar content in the synthesis gas produced by biomass gasifiers will have a profound impact on whether or not this industry flourishes. Tar removal systems are very expensive; as such, a low-cost method for removing tar is required for the success of BIOburners' products. Another factor for success is the availability of biomass. Different areas have different types of biomass available, so the ability of the reactor to function with a variety of feeds is critical. There are
also numerous problems that can occur in the gasifier such as bridging and channeling, and different types of biomass experience these problems in different ways. More research into the optimization of different types of feedstocks is necessary for success in the small-scale biomass gasifier industry.

4. Business Strategy

The following business strategy establishes a set of short-term and long-term goals by which the company hopes to become successful. It also includes an analysis of the company's strengths and weaknesses and details how BIOburners plans to fit within the current market.

4.1 Desired Image and Position in Market

BIOburners is as a company that values trust, integrity, and sustainability. These attributes are central to the mission of the business: to supply local communities with an inexpensive alternative energy solution that has minimal impact on the environment. After a preliminary analysis of the current market, it is clear that the majority of available gasifiers are very expensive and have long payback periods. Because of this, many potential customers are deterred from purchasing gasifiers and other sources of alternative energy. BIOburners anticipates that the best product to sell to such a market is a do-it-yourself (DIY) gasifier kit. This kit will contain all the parts required to assemble a small-scale gasifier, with no welding or heavy machining required. In the first year, BIOburners hopes to produce 50 gasifiers. This quantity will likely be increased in subsequent years once the market demand is more fully understood and the business is more well-established.

4.2 Company Goals and Objectives

BIOburners has both long-term and short-term goals to gauge the company's success. The following list details the short-term goals (first three years) of operation:

- Launch a successful product and enter the market
- Establish strong customer relationships via superior customer service
- Remain competitive on cost
- Expand the customer base for biofuel renewable energy by providing an affordable product
- Conduct effective customer surveys to improve product and business strategy

The following long-term goals (first ten years of operation) are subject to change, but provide a basis for achieving the company's vision:

- Adjust the gasifier design to provide a better product based on customer feedback
- Increase production capacity
Diversify offered products to include related equipment such as pellet mills and additional gasifier models

4.3 SWOT Analysis

BIOburners is a small company with great potential for growth and development in upcoming years. The market that BIOburners seeks to serve is new and growing, and by entering this market BIOburners will be poised as one of the forerunning companies providing easily operable and highly efficiency gasifiers for power generation. However, BIOburners is also inexperienced and unproven, and the market demand is still somewhat uncertain. Therefore, caution must be exercised to overcome related weakness and threats. The following SWOT analysis outlines the internal strengths and weaknesses of BIOburners and outlines the external opportunities and threats facing the company. These factors will determine the competitive strategy of the business, which is described in the next section.

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
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<tbody>
<tr>
<td>- Small and flexible company</td>
<td>- Inexperienced company</td>
</tr>
<tr>
<td>- Innovative design solutions</td>
<td>- Low maximum production capabilities</td>
</tr>
<tr>
<td>- Environmental sustainability goals</td>
<td>- Unproven design</td>
</tr>
<tr>
<td>- Low capital costs for business startup</td>
<td>- Design not currently integrated with generator</td>
</tr>
<tr>
<td>- Low purchase cost for consumers</td>
<td>- Design best suited to supply low power loads</td>
</tr>
<tr>
<td>- Low operating costs (varies by region)</td>
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<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
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<tbody>
<tr>
<td>- Increasing global interest in sustainable energy</td>
<td>- Undeveloped market</td>
</tr>
<tr>
<td>- Agricultural markets with access to inexpensive fuel</td>
<td>- Technology not currently widely understood</td>
</tr>
<tr>
<td>- Suburban markets with money to spend of sustainability</td>
<td>- Low availability of fuel in suburban areas</td>
</tr>
<tr>
<td>- Small businesses interested in advertising their sustainability</td>
<td>- Established competitors</td>
</tr>
<tr>
<td>- Potential for application in motorized vehicles</td>
<td>- Potential perceived safety hazard</td>
</tr>
</tbody>
</table>
4.4 Competitive Strategy

BIOburners' biomass gasifier kits use cost leadership to compete with businesses offering similar products. Low prices will attract customers, leading them to choose to buy a biomass gasifier kit from BIOburners rather than constructing their own unit or purchasing a more expensive version elsewhere. Even if BIOburners' product offers fewer features or is less readily available than other gasifiers, they are still less than half the price of similar commercial gasifiers and are easier to build and operate than other homemade gasifiers.

BIOburners may also compete somewhat on differentiation. BIOburners' gasifiers are efficient, produce low levels of tar, and are easy to use. BIOburners also offers a gasifier that is fairly compact, environmentally friendly, and runs on a variety of fuels. BIOburners will be profitable because, despite their low costs, the gasifiers will achieve a high level of performance. With prices well below those of similar gasifiers and a superior design, BIOburners’ product will attract customers and allow BIOburners to increase production as the market for gasifiers increases.

5. Company Products and Services

5.1 Product Description

A biomass gasifier is a reactor that converts biomass into synthesis gas, which is primarily composed of carbon monoxide and hydrogen. A simplified gasifier design is presented below in figure 1. The biomass fuel is fed into the top of the reactor where it is dried and then is pyrolyzed. Pyrolysis is a process that breaks down the biomass into aromatic chemical compounds, also called tar. Tar is detrimental to an internal combustion engine, and must be removed from the product gas before entering the engine. After traveling through the pyrolysis zone, the biomass is combusted with a lack of oxygen to produce the final synthesis gas product. During this process some of the tars produced during pyrolysis can be further decomposed. The final product, synthesis gas, can be combusted in an internal combustion engine to provide power.
5.2 Product Overview

BIOburners is producing a DIY gasifier kit (patent pending). These kits are a unique product because they offer three key design features presented below:

- **Low Tar Production**: This eliminates the need for a separations unit and reduces the bulk of the overall product. It also greatly reduces the cost of the product, as the separations unit is the most expensive part of most gasifiers.

- **Ease of Use and Assembly**: An automated feed and fuel hopper make this gasifier intuitive to use. The gasifier is not only user-friendly, but the kit sold by BIOburners also comes with all the welding and machining completed, allowing for easy assembly.

- **High Efficiency**: This product will supply more power for a given amount of biomass fed than the gasifiers produced by BIOburners' competitors because of its superior design.

- **Additional customer benefits** include a ten-year warranty.
In the future, BIOburners may provide additional services such as a maintenance servicing staff, manufacturing and sales of biomass pellets, and pellet mills purposed for personal biomass pelletizing.

6. Marketing Strategy

6.1 Target Market

BIOburners hopes to market gasifier kits to homeowners who are passionate about environmental sustainability and who are interested in DIY projects. BIOburners' product offers a simple and effective way for customers to produce renewable energy for their homes. Because the product is a kit instead of a fully assembled and automated system, it is inexpensive and also appeals to customers that desire to understand the equipment and be involved in its assembly. While the gasifier does not come ready-to-use, the product can easily be assembled and operated without the need for design expertise or specialized tools. BIOburners also sees the DIY aspect of this product as a benefit because customers will be more equipped to fix small malfunctions on their own.

BIOburners' target demographic will initially be limited to educated homeowners in the United States. Customers will possess an interest in sustainability and renewable energy and have some degree of experience with do-it-yourself projects or metal work. BIOburners’ customers will likely already have some related equipment, such as tools for construction or wood processing equipment (wood splitter, wood chipper, etc.). Furthermore, customers will be motivated by practical economic benefits including potential energy savings and by appeals to environmental responsibility such as possible reductions in fossil fuel dependence.

6.2 Customer’s Motivation to Buy

BIOburners will advertise two aspects of the gasifier kit that will appeal to customers. First, assuming a source of biomass that is available at no cost to the customer with an average energy usage of 11,000 kWh/year at $0.12/kWh, the company's gasifier kit can save $1,300/year in energy costs. Second, BIOburners' gasifier runs completely on renewable fuels. Thus, by using this gasifier kit, the 9,000 pounds of coal that would be necessary to produce 11,000 kWh of energy does not need to be burned and 22,000 pounds of CO₂ are not released to the environment. Customers interested in gasifiers will choose to purchase from BIOburners on the basis of low cost and other user-friendly and environmentally sustainable features of this product.
6.3 Market Size and Trends

The current market for biomass gasifiers in America remains very small, especially for gasifiers designed to produce less than 10 kW. Because of the low cost of natural gas and other energy alternatives, the market in the US is a fraction of the size of the market in European countries, which have significantly higher gasoline and energy costs. While the market for biomass gasification in Europe has fallen over the last decade due to decreasing natural gas prices, the interest in biomass gasification has been recently renewed as the privatization of electrical companies has increased the price of electricity. In addition, in the United Kingdom offers lucrative incentives that are available for electrical companies that provide renewable energy.

Even though the current United States market for home-scale biomass gasifiers is very small and relatively undeveloped, the future of biomass gasification looks bright. Although natural gas prices are at a historic low, the increasing concern of expending non-renewable energy sources is driving interest in biomass gasification. As the United States Department of Energy is providing incentives for use of solar energy, it will not be long before incentives for biomass gasification follow. Coupled with advancing technologies for more efficient biomass gasification, these incentives will decrease the capital cost of biomass gasifiers and cause the market to grow in the years to come.

6.4 Advertising and Promotion

BIOburners’ plans to market their gasifier kit as an inexpensive and environmentally sustainable means of producing electricity for an average home. Because the market for BIOburners’ product is currently undeveloped, the main goal of the business in marketing will be to educate the public regarding the advantages of producing energy using a gasifier. Additionally, marketing will communicate to potential buyers the following three key advantages of BIOburners’ gasifier kit in comparison to other available systems:

- Inexpensive
- High efficiency
- Ease of assembly and operation

BIOburners will advertise online in message boards and forums related to renewable energy. The company will post ads in magazines including Green@Work Magazine and E – The Environmental Magazine. To target the local market, BIOburners will advertise at farm supply stores and locations that sell wood burning stoves and furnaces in Grand Rapids. If this aspect of our marketing campaign is successful, BIOburners will expand marketing to other parts of the Midwest.
The company has budgeted 5% of sales toward marketing. Because BIOburners will be small and independently run, the company will not employ an internal marketing manager, but instead will contract an independent marketing firm to handle all advertising. BIOburners hopes to build local publicity with demonstrations in a variety of Midwest locations; the company will also post videos of the demonstrations on related online message boards.

6.5 Pricing

BIOburners will position itself as one of the least expensive options on the market for biomass gasifiers and gasifier kits. The company's final product will sell for $3,000. Competitors’ prices range from $7,000 to $35,000. However, BIOburners' product does not include a generator, which costs about $1,000 and requires assembly and testing. This increases the effective price somewhat, but BIOburners' product remains one of the most attractive options for the budget conscious customer. BIOburners also hopes that their design will be one of the most innovative on the market despite its low price.

Pricing for a single unit will be $3,000, but a 5% discount will be applied for orders of two or more units and a 10% discount will be applied for orders of 10 or more units. For single unit pricing the gross profit margin is initially -10%, however, the average profit margin over the first three years of operation is 10.3%.

6.6 Distribution Strategy – Channels of Distributions

BIOburners will employ a direct distribution model. Under normal production conditions an inventory of less than five units will be held in stock and production will respond directly to demand. Each unit will be shipped directly to the customer. This strategy will be effective given the small size of the company and will also reduce waste.

6.7 Test Market Results

A formal test market survey will not be performed because the viability of the market has already been demonstrated by competitors like All Power Labs. Additionally, because the initial capital investment is relatively small and is tailored to allow for very low production volumes while is still able to be increased rather quickly, the size of the market will not have a large impact on the initial business strategy.
7. Competitive Analysis

7.1 Existing Competitors

7.1.1. All Power Labs

This company is the world leader in personal gasification systems. All Power Labs offers a gasifier kit, which is targeted to customers intending to carry out their own optimization. This kit also offers a few automation processes. It is sold for just under $6000. This unit provides 4 kW of power and runs well on nut shells, hardwood chips, softwood chips, and coconut shells. This design offers more features than the one sold by BIOburners, but it is also over twice as expensive.

The assembled gasifier designs of All Power Labs come in 10 kW and 20 kW sizes and are fully automated, compact, and are easy to use. The 10 kW model costs $19,000. While the systems operate with a variety of fuels, they are not able to provide power from straw or rice husks.

7.1.2. Homemade Gasifiers

Many people have attempted to produce their own gasification systems and have detailed this process online. This will be an alternative for anyone considering purchasing a kit from BIOburners. If the customer wants to ensure that their gasifier works efficiently and smoothly, they will not attempt to construct it themselves. However, if they want to learn more about gasifiers and have time to commit to building their own system, they may choose this alternative. By keeping prices reasonably affordable, BIOburners will limit the number of potential customers who consider constructing a homemade gasifier. A kit serves an appealing option for those who are interested in learning about gasification processes and how they work but do not want to commit too much time to designing and building a gasifier from scratch.

7.2 Potential Competitors: Companies that might enter the market

7.2.1. Vulcan Gasifiers LLC

The gasifiers produced by this company range in price from $1650 to $14,000 and provide 2 kW to 5 kW. The products of Vulcan Gasifiers are also easily transported. This company is a recent start-up, but is willing to design systems that meet unique customer specifications. This company does not currently provide kits, but they could easily enter this specific market as they expand. As some of the gasifiers they produce are on the low-end of the price range, Vulcan could be a significant competitor if they offered gasifier kits because their prices might undercut those of BIOburners.

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7.2.2. Victory Gasworks

This company offers products that provide 5 kW of power with quality design, tar free gas, hands-free automation, and a 20 year warranty. Biomass gasifiers produced by this company run on dry, uniform, clean biomass only, however. Ideal feedstocks include wood from various sources, nut shells, and waste rounds. These gasifiers cost about $35,000, which is a significant expense compared to those made by BIOburners. If Victory Gasworks began to offer kits rather than assembled reactors, they would be competitors of BIOburners but likely would still be charging significantly more per unit.

8. Description of Management Team

8.1 Key Managers and Employees

Currently, Nate Myton is BIOburners' only full-time engineer. Nate has a degree in chemical engineering and chemistry from Calvin College and also has international experience. He held an internship at Vertellus Corporation where he worked under a process engineer learning about productivity improvements, environmental and safety considerations as well as practical aspects of chemical engineering.

Matt Lomasney works for BIOburners on a contract basis. He is involved primarily in the preparation of the parts for the kits. Matt has studied chemical engineering and biochemistry at Calvin College and has one year's experience working in the electroplating industry at Master Finish Company. While at Master Finish he worked as an intern in multiple areas including research and development and general production, and he served as a design engineer for several small projects.

Nate and Matt worked with two colleagues, Nicole Michmerhuizen and Eric Sager, to research, design, build, and optimize a biomass gasifier as part of a year-long design project in their senior year as undergraduate students. The background knowledge provided by this experience will be useful to the company in developing designs and implementing changes that improve gasifier efficiency, reduce emissions, and enhance ease of use. Nate served as team manager for the project and Matt was the construction manager. Experience in these roles will be beneficial as they launch their business.

See the Appendices for Nate and Matt’s full resumes.

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4http://gasifier.wpengine.com/personal-energy-grid
8.3 Future Additions to Management Team

BIOburners will launch with Nate working full-time and Matt working part-time as production requires. As the business grows, it is expected that Matt will begin to work nearly full-time and that an additional employee for finance, sales, and marketing tasks will be hired. This employee must have experience in business and be familiar with accounting practices. He or she will represent the company to potential customers and could oversee other accountants or sales representatives in the future. BIOburners plans to have three employees after three years of operation. An additional contracted position similar to Matt's will be added if the number of gasifier kits demanded exceeds the quantity that can be assembled by a single full-time employee. This additional employee will require similar skills and experiences as Matt possesses.

8.4 Board of Advisors

The board of advisors for BIOburners is made up of several individuals who have experience in various aspects of gasifier design and manufacturing. This board will include, among others, Jan Pieter Speyart Van Woerden, who has interest in gasifier design and has extensively studied and worked with these systems. Every two months Nate will meet with this board. The primary purpose of the board of advisors is to provide the company with accountability and advice.

9. Operations

9.1 Company Structure

BIOburners will be organized as a sole proprietorship. This business organization was selected because it is the simplest model. Since the business will initially be comprised of only two workers, a more complex business model is not justified and would not benefit the business in any way.

Nate is in charge of managing the business. This includes marketing the product, managing the company finances, and establishing good customer rapport. He will make many decisions in communication with Matt and the board of advisors, but ultimately decisions are made by Nate. Matt will report all significant construction concerns to Nate.

9.2 Significant Compensation and Benefits Packages

BIOburners will offer fair compensation to its full-time employees. These employees will receive two weeks of paid vacation and 401k retirement plans. Healthcare, dental, and life insurances will also be offered to all full-time employees.
9.3 Description of Production or Process

The raw materials for the production of BIOburners' gasifier kit include a 6 inch stainless steel pipe with bottom flange for the reactor body and 1/2 inch stainless steel pipe for the 27 air feed tubes. Steel and stainless steel sheet metal will be used for the air manifold system, the bottom of the reactor, and the biomass feed hopper. An auger and an electrical motor will be included to complete the feed system. Additionally, insulation and various sealants are required to complete the assembly of the gasifier.

First, the air feed tubes will be cut to size, both ends will be threaded, and the locations for gas entry or exit will be drilled. It is anticipated that the preparation of the 27 air feed tubes will take approximately 4 hours. The sheet metal will be cut to size and pre-drilled and the flange on the reactor body will be pre-drilled. It is anticipated that these operations will take an hour. For the first year of production, each gasifier will be assembled (without the insulation) and inspected before being dismantled, packaged, and shipped to the customer. It is estimated that this will take an additional 3 hours. These approximations account for an estimated total production time of 8 hours per gasifier.

The primary production costs come from the raw materials; however, there are additional hidden costs required to maintain the machining equipment (saw blades, drill bits, lubricants, etc.). The raw materials will be purchased from Metals Depot or Online Metals.

9.4 Facilities

BIOburners will be located in Grand Rapids, Michigan. There are many people interested in sustainable energy in this area, so Grand Rapids is a good place to establish this company. It is anticipated that shipping costs will be one of the major costs of the company as the materials required for production are quite heavy. Being located in an urban setting will greatly reduce these shipping costs. Additionally, Grand Rapids is centrally located in the Midwest, which will make it easier to expand the market in the future.

The business will initially be run out of a large garage connected to Nate’s home. This will eliminate overhead costs, insurance costs, and some taxes. It is anticipated that no more than five gasifiers will be on hand at a given time; a garage is an ideal space for operations on this scale. An office space in the house will also be necessary for the Nate to work with customers and manage finances.

9.7 Capacity Issues and Constraints

BIOburners' facilities will store up to five gasifier kits in stock during normal operations, but should demand be larger than anticipated, the working space will be allocated for storage of fifteen
gasifiers. The system cycle time for one gasifier is a single 8-hour workday. Based on the current size of the market and the identity of BIOburners' customers, major issues with insufficient capacity are not anticipated. BIOburners' primary customer group are rural homeowners who are unlikely to order more than 1 or 2 biomass gasifiers. The biomass gasification market may experience growth in the future, which may necessitate the purchase of a larger manufacturing facility, but the proposed facilities should be sufficient for at least the next three years.

10. Financial Analysis

10.1 Key Assumptions

Raw material costs are given in Table 1 and will be re-evaluated annually. Direct labor will be contracted out at $25 per hour and will not include benefits, insurance, or worker’s compensation, as these will be provided by the contracting company. Nate is the only individual actually employed by BIOburners, and he is anticipated to work for 40 hours per week and 50 weeks per year. Nate’s salary is $60,000 per year and he will receive health insurance, which is estimated to cost $15,000 per year. Marketing will be handled by a marketing firm that is estimated to charge 5% of gross revenue. Liability insurance will be purchased for $6,000 to cover potential accidents. The cost of raw materials for production will be estimated as described in Table 1 of the team budget request.
### Table 1 Raw Materials Cost Estimates

<table>
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<tr>
<th>Item</th>
<th>Cost</th>
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<tr>
<td>Stainless Sheet Metal (Manifolds)</td>
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<tr>
<td>Air Tubes</td>
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<tr>
<td>Insulation</td>
<td>$200.00</td>
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<tr>
<td>Grate</td>
<td>$20.00</td>
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<tr>
<td>Stainless Steel Reactor Pipe</td>
<td>$285.00</td>
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<tr>
<td>Electric Motor</td>
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<tr>
<td>Feed Auger</td>
<td>$50.00</td>
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<tr>
<td>Feed Tube</td>
<td>$15.00</td>
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<tr>
<td>Mild Steel Sheet Metal (Hopper)</td>
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<tr>
<td>Misc. Electronics</td>
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<tr>
<td>Heating Coil</td>
<td>$25.00</td>
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<tr>
<td>Small Parts</td>
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<tr>
<td><strong>Sum</strong></td>
<td><strong>$1,000.00</strong></td>
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Additionally, the demand for gasifiers was predicted to start at 50 units and increase by 25 units each year over the three year period. The gasifiers were sold at $3,000 each. The initial $25,000 loan was assumed to have an interest rate of 20%, which is high because the business investment is relatively risky.

### 10.2 Financial Statements

#### 10.2.1 Income Statement

The income statement is found in the appendix. After the first year, BIOburners has a negative net income after tax. This loss of $14,957 is due primarily to the start-up costs of the company. BIOburners has net incomes of $26,251 and $65,371 in years 2 and 3, respectively.

#### 10.2.2 Cash Flow Sheet

The cash flow statement is found in the appendix. We will end each year with a positive cash balance, which means that we assessed our financial need adequately. At the end of year three, we predict an ending cash balance of approximately $80,000.

### 10.3 Break-even Analysis

In order to break even, BIOburners needs to sell 67 biomass gasifier kits in year one. This corresponds to about $200,000 in sales volume. The number of units required to break even decreases
in subsequent years to 52 and 48 units, respectively. This makes sense because the fixed costs are lower in years two and three as the equipment necessary for startup has already been purchased.

10.4 Ratio Analysis

The ratios used in this section were compared to industrial averages obtained from companies in the gas utilities industry. The first year profit margin was determined to be -10%. This value is negative because the company is just starting up and the sales from the first year are below the effective capacity. The profit margin increases to 12% and 29% in years two and three, respectively. The industry average for profit margin is around 10%. This value is lower because many gas companies are significantly larger than BIOburners and are able to operate on a lower profit margin. The debt to equity ratio in year one is 2.5. This value is high compared to other companies in the industry, which range from 0.5 to 1.5. In the first year, BIOburners is highly leveraged. Should withdrawal from the market be required, the company would incur a significant loss. Therefore, BIOburners plans to eliminate the debt entirely after the third year of operation. In this debt-free condition, BIOburners will be able to safely prepare for the anticipated increase in the size of the gasifier market.

11. Loan or Investment Proposal

BIOburners estimates that approximately $35,000 in capital will be required for the first year of production. This capital will be spent to purchase all necessary manufacturing equipment ($10,000), purchase raw materials for the first month of production (4 units, $4,000), cover employee salary and benefits for the first month ($13,000), and fund the initial marketing push ($7,500).

Of this $35,000, BIOburners has $10,000 in equity and seeks a loan for $25,000. Should demand meet predicted values, this loan will allow BIOburners to operate self-sufficiently and will allow complete payback of the loan within 3 years. Should the business fail to enter the market, BIOburners will offer the purchased equipment and inventory to the bank as collateral. BIOburners is structured in such a way that there are very few fixed costs, so production volume is quite flexible. If demand is lower than expected, the company will be able to reduce production while pursuing other marketing options to increase demand.

BIOburners' timetable for startup begins with four weeks of design refinements and testing. Additionally, during this time the production facility will be set up and materials will be sourced. A website will be created advertising the product and marketing will begin. At the end of these 4 weeks, production will proceed according to market demand.
12. Appendices

12.1 Income Statement

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Units Sold</strong></td>
<td>50</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td><strong>Sales revenue</strong></td>
<td>150,000</td>
<td>225,000</td>
<td>300,000</td>
</tr>
<tr>
<td><strong>Variable Cost of Goods Sold</strong></td>
<td>60,000</td>
<td>65,000</td>
<td>70,000</td>
</tr>
<tr>
<td><strong>Fixed Cost of Goods Sold</strong></td>
<td>10,000</td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td><strong>Depreciation</strong></td>
<td>1,429</td>
<td>2,449</td>
<td>1,749</td>
</tr>
<tr>
<td><strong>Gross Margin</strong></td>
<td>78,571</td>
<td>156,751</td>
<td>227,451</td>
</tr>
<tr>
<td><strong>Variable Operating Costs</strong></td>
<td>13,500</td>
<td>17,750</td>
<td>22,000</td>
</tr>
<tr>
<td><strong>Fixed Operating Costs</strong></td>
<td>87,500</td>
<td>91,250</td>
<td>95,000</td>
</tr>
<tr>
<td><strong>Operating Income</strong></td>
<td>(22,429)</td>
<td>47,751</td>
<td>110,451</td>
</tr>
<tr>
<td><strong>Interest Expense</strong></td>
<td>2,500</td>
<td>4,000</td>
<td>1,500</td>
</tr>
<tr>
<td><strong>Income Before Tax</strong></td>
<td>(24,929)</td>
<td>43,751</td>
<td>108,951</td>
</tr>
<tr>
<td><strong>Income tax (40%)</strong></td>
<td>(9,972)</td>
<td>17,500</td>
<td>43,580</td>
</tr>
<tr>
<td><strong>Net Income After Tax</strong></td>
<td>(14,957)</td>
<td>26,251</td>
<td>65,371</td>
</tr>
</tbody>
</table>

12.2 Cash Flow Sheet

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beginning Cash Balance</strong></td>
<td>-</td>
<td>11,472</td>
<td>30,171</td>
</tr>
<tr>
<td><strong>Net Income After Tax</strong></td>
<td>(14,957)</td>
<td>26,251</td>
<td>65,371</td>
</tr>
<tr>
<td><strong>Depreciation expense</strong></td>
<td>1,429</td>
<td>2,449</td>
<td>1,749</td>
</tr>
<tr>
<td><strong>Invested Capital (Equity)</strong></td>
<td>10000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Increase (decrease) in borrowed funds</strong></td>
<td>25000</td>
<td>-10000</td>
<td>-15000</td>
</tr>
<tr>
<td><strong>Equipment Purchases</strong></td>
<td>(10,000)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Ending Cash Balance</strong></td>
<td>11,472</td>
<td>30,171</td>
<td>82,291</td>
</tr>
</tbody>
</table>
12.3 Break Even Analysis

![Break Even Analysis Table]

12.4 Additional Financial Estimates

![Interest Expense Table]
Matthew Joseph Lomasney

Current Address
1906 Englewood Dr. SE
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Grand Rapids, MI 49506
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www.linkedin.com/pub/matthew-lomasney/41/225/b88/

Permanent Address
637 Maryland Ave. NW
Grand Rapids, MI 49504

Objective
To obtain a full-time chemical engineering position where engineering education and experience as well as strong interpersonal abilities will benefit a company.

Education
Calvin College: Grand Rapids, MI
- Bachelor of Science in Engineering, Chemical Concentration; May 2014
- ACS Biochemistry Major; Overall GPA: 3.641

Related Experience
Senior Design Project: Calvin College (Grand Rapids, MI; September 2013 to present)
- Research existing literature on biomass gasifiers
- Model and design an efficient gasifier that runs on Miscanthus grass
- Produce enough synthesis gas to drive a sterling engine to power a farm house
- Design the reactor to produce ppm quantities of undesirable products to avoid difficult separations: (less than 5 mg of tar produced per m² of synthesis gas)
- Test and optimize the reactor, including the reactor diameter, specific gas rate, and fixed bed height

Chemical Engineering Intern: Master Finish Company (Grand Rapids, MI; February 2013 to present)
- Develop material and energy balances to optimize processes
- Research and develop new bath chemistry, conduct pilot plant studies and scale up to production
- Develop chemical analysis and calculations to maintain bath chemistry
- Test sample parts for customers and new proprietary bath chemistry
- Perform ISO 14001 environmental audits

Engineering Homework Grader: Calvin College (Grand Rapids, MI; September 2011 to present)
- Assess student homework assignments for Material Balance and Thermodynamics courses

Engineering and Chemistry Lab Assistant: Calvin College (Grand Rapids, MI; February to December 2012)
- Prepared and cleaned lab for students
- Maintained chemicals and mechanical equipment involved in lab studies, applied chemical knowledge and safety training
- Answered students’ questions and graded lab books

Other Experience
Resident Assistant: Calvin College (Grand Rapids, MI; January 2012 to May 2013)
- Supervised apartment building with 40 residents
- Organized building events, conducted rounds through buildings
- Built relationships and confronted individuals regarding policy, conduct, and academic violations
- Acted as a third party mediator for conflicts between residents

Computer Skills
UniSIM Design Simulator, AutoCAD, Autodesk Inventor, Express SCH, Express PCB, Solid Works, Mathematica, C++ programming, Sage, Wolfram alpha, Polymath, R-Studio (Statistical Analysis), and Microsoft Word, Excel, and PowerPoint

Extracurricular Activities
Trumpet Player: Calvin College Orchestra (2010-present), Calvin College Wind Ensemble (2010-2011), Founder and President of the Calvin College Jazz Club (2010-present), Play professionally and teach private lessons (2008-present)
Member, Calvin College Dormitory Leadership Team: (2012-2013)
Singer: Calvin College Capella Choir (2012)

References
Dale Mulder: President of Master Finish Company
(877) 590-5819 ext 228, dmulder@masterfinishco.com
Wayne Wentzheiner: Professor of Engineering, Calvin College – Grading and Lab Assisting Supervisor
(616) 526-6318, wwentzhe@calvin.edu
Jeremy Van Antwerp: Engineering Professor – Engineering Grading Supervisor
(616) 526-8582, jva@calvin.edu
Annie Mac-Smith: Knollcrest East Apartment Area Coordinator – Supervisor for RA position
(616) 526-6595, afm2@calvin.edu
Nate Myton

Current Address:
1215 Thomas St. SE
Grand Rapids, MI 49506
(906) 630-1945

Permanent Address:
1100 Parnell Ave.
Sault Ste. Marie, MI 49783
n8myton@gmail.com

Profile
Senior chemical engineering student seeking full-time employment at a company where technical skills, practical experience, and positive enthusiasm will be valued.

Education
Calvin College - Grand Rapids, MI
Bachelor of Science in Engineering, Chemical Concentration, May 2014
Chemistry Major
Overall GPA 3.98/4.00
Chinese Language (six semesters), 2011-2014
Traveled in China for three weeks during “Business and Engineering in China” course, January 2013

Work Experience
Engineering Department, Calvin College – Grand Rapids, MI
Senior Design Project, September 2013 – Present
• Worked closely with four person team of chemical engineering students in conjunction with local entrepreneur
• Designed, built, and optimized wood gasifier to provide sustainable bio-fuel for home or automotive use
• Performed sizing calculations, welded and assembled reactor, designed and built necessary heat exchangers

Vertellus Specialties Inc. – Zeeland, MI
Student Engineer, Summer 2013
• Performed detailed productivity analysis of chemical production process
• Identified areas where improved controls could yield increased performance
• Evaluated proposed distillation process for energy and labor savings; solicited quotes from vendors
• Sized relief devices for many pressure vessels and worked with vendors to purchase
• Evaluated walking/working areas for OSHA compliance

Chemistry Department, Calvin College – Grand Rapids, MI
Biochemistry Student Researcher, Summer 2012
• Performed inorganic biochemistry research investigating crosslink formation in orphan protein BF4112
• Worked independently in protein growth and purification

Calvin College Climbing Center – Grand Rapids, MI
Student Manager, September 2012 – May 2013
• Organized team of volunteer and paid student route setters
• Facilitated group meetings to discuss climbing center goals

Calvin College Wilderness Orientation – Various Locations
Wilderness Orientation Leader, Summers 2011 – 2012
• Led small groups of incoming freshman on wilderness experiences
• Planned, prepared, and organized trip equipment, food, and supplies
• Led group discussions and encouraged group communication
• Managed risk and made decisions quickly and effectively under pressure

Computer Skills
- Windows, Mac, Linux
- Microsoft Office
- Mathcad
- UniSim / HYSYS

Activities
Student Representative, Educational Policy Committee, Calvin College, September 2013 – Present
Leadership Team, Grace Korean Christian Reformed Church English Ministry, September 2012 – Present
Student Representative, Waltman Lake Committee, Calvin College, September 2012 – May 2013

References
Wayne Wentzheuser, Engineering Professor, Calvin College 616-975-9261  wwentzhe@calvin.edu
David Benson, Chemistry Professor, Calvin College 616-526-7699  deb22@calvin.edu
Ryan Koo, Campus Recreation Coordinator, Calvin College 616-526-7541  rmw3@calvin.edu
Randy Elenbaas, Chemical Engineer, Vertellus Specialties Inc. 616-886-2688  relenbaas@vertellus.com