

**STRATEGIC ANALYSIS OF A MANUFACTURING
COMPANY AND THE NORTH AMERICAN AUXILIARY
POWER UNIT MARKET**

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ABSTRACT

Power Systems has been the leader in the truck auxiliary power unit business since 2000 and has been making significant advancements in the price of the product as well as its reliability and robustness. Unfortunately the reliability and robustness requirement is increasing further and the profit margin is shrinking to the point that Power Systems needs to undertake a new product development program.

The new product offering will result in zero increase in the price to the customer but provide a lower cost to manufacture, while at the same time addressing the reliability requirements of the market. The market focus also needs to change to that of the fleet customers, with a reduced emphasis on the individual owner operators of trucks.

The strategy proposed is in alignment with the current cost based strategy of the company but requires a few modifications to the organization structure and management systems

DEDICATION

I would like to dedicate this work to my wife, Babita, and my four children, Alec, Isaac, Veronica and Conner. Their support and forgiveness for all the missed family activities made the completion of the EMBA program possible.

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1 INTRODUCTION

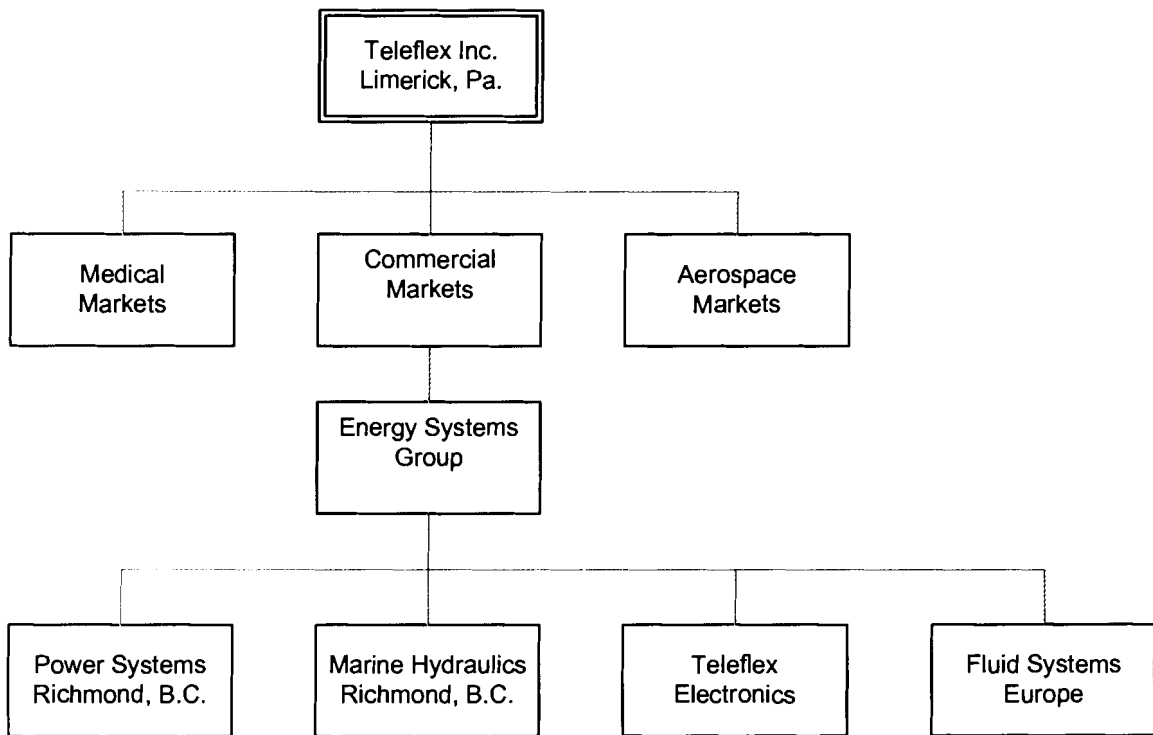
1.1 Overview of the Firm

Teleflex Energy has been the leading manufacturer of anti-idling equipment for the truck market for over 15 years, specializing in the design and manufacturing of electromechanical devices for use in long haul truck applications. Teleflex originally designed and supplied heaters for trucks that operate in low temperature climates so that the drivers could shut off the main truck engine when resting. This experience in the heater market enabled the identification of another need for idling in high temperature climates. It is in these hot climates where the trucker runs the main truck engine all night in order to keep the air conditioning on for a comfortable sleep. This resulted in Teleflex acquiring a small company that had established a presence in the market for Auxiliary Power Units. These devices typically consist of a small 2-cylinder diesel engine that drives a generator and air conditioning compressor. This device provides the truck driver basic comfort in the form of temperature control and electricity for TV's, VCR's, fridges etc. and are important to truck companies for driver retention as well as reduced fuel costs and extending the life of the main truck engine due to reduced idle time.

Teleflex Energy is a wholly owned subsidiary of Teleflex Incorporated, an American based corporation with 220 business units worldwide, over 20,000 employees and yearly sales in excess of \$2 billion. When Energy was acquired in 1975, it was a small hydraulics company with 25 employees and sales of \$250,000/yr. The company has grown to its current size of over 450 employees and close to \$150 million/year in sales.

The current structure of the corporation is shown in Figure 1. This shows Energy being part of the commercial group which makes up one of the four main groups in the organization. Inside the Energy division, Power Systems, Fluid Systems, Marine Hydraulics and Teleflex Electronics are shown as the primary business units. It is the Power Systems business unit that will be analysed in this report

Figure 1: Corporate Structure¹



1.2 Current Strategy

The current strategy of the firm is cost based and specializes in dominating niche markets through aggressive pricing. Through the cost-based strategy, the company has centralized its structure and decision-making and built on economies of scale to secure

¹ By author.

the lowest cost pricing from suppliers around the world. The corporate values and objectives are:

Strategic Objectives

Think and execute as a unified global operating company

Maintain balance and diversification among our markets

Seek leadership in technical niche markets

Strive for long-term, sustainable growth

Operating Objectives

Innovate and deliver unique products and services

Team with customers to provide superior service

Achieve continuous improvement in quality and efficiency

Implement consistent business processes and metrics

Financial Objectives

Attain 10 to 14 percent average annual growth in revenues

Attain 14 to 18 percent increase in net income

Return 10 percent of revenues in cash flow from operations

Pay dividends to shareholders that represent 25% of trailing 12 months earnings

Earn 17% on average shareholders' equity

Corporate Values

Act with integrity in all our business dealings

Create a common sense of purpose

Provide superior customer service

Treat employees with respect

Cultivate an entrepreneurial spirit of creativity and innovation

Commit to create long-term value for our shareholders

These objectives as well as a number of new policies put in place by corporate have started to show more alignment in the strategy of the company. Historically Teleflex had a differentiation strategy with “remote autonomy and trust” as a fundamental value of the corporation. This change in the strategy started when the long time CEO of the corporation retired and was replaced in 2001. Individual business units that were allowed to formulate a strategy that best served the markets they were in as long as the returns were satisfactory, are now facing increased involvement from corporate as the new cost based strategy starts to take root. These changes are in the form of global responsibility towards procurement and manufacturing, as well as centralized decision making and approvals.

As can be seen in Figure 2 the strategy of the division is becoming more aligned with a cost based strategy. The arrows indicate the direction of movement in some components of the strategy. These changes are slowly taking place in the organization and are causing a shift in some of the categories from being a differentiator to a cost based company. In the following section I will explain how the transition is happening and if not, how it could be assisted if possible.

Figure 2: Energy Systems Group Strategy²

Generic Strategies												
	Cost Based Low Cost/Adequate Quality	1	2	3	4	5	6	7	8	9	10	Differentiation High Cost/Adequate Quality
Product Strategy	Rapid Follower											Innovative
R&D Expense	Low R&D											High R&D
Structure	Centralized											Decentralized
Decision Making	Less Autonomy											Autonomy
Manufacturing	Economies of Scale											Economies of Scope/Flexible
Labor	Mass Production											Highly Skilled/Flexible
Marketing	Comparative/Push											High Cost/Pioneering/Pull
Risk Profile	Low-Risk											High Risk
Capital Structure	Leveraged											Conservative

1.2.1 Product Strategy

The product strategy of Teleflex has always been one of new development and innovation. New product sales are one part of the mandatory scorecard and are designed to track new product launches that generate sales. New products are defined by the corporation as a “new product or concept that has been developed and not sold previously to serve the needs of an existing or new market including company sales”. The target is set by working with the existing engineering and marketing groups of the divisions and is designed to support the objective of “Innovate and deliver unique products and services”. Engineering groups are pushed to launch products quickly and to keep the pipeline full of new products with a 3 to 5 year outlook. Schedules and progress are tracked at the

² Adapted from Bukszar, Ed (Simon Fraser University 2004) used with permission

division level to ensure that the targets are met and sales and marketing groups are encouraged to seek new opportunities in their fields and work closely with engineering to bring these concepts to market. This is also part of the corporate value of “cultivating an entrepreneurial spirit of creativity and innovation”.

During the product development process the stage gate system is used to ensure products meet minimum levels of revenues and profits required by the division. Risk assessments are done as well as Internal Rate of Return to approve projects going forward and then reviewed during 5 different gates to determine if anything has changed and, if required, the project direction is changed. This is where more control and the centralized structure is starting to come into play as corporate starts to review and approve individual business unit projects.

The product strategy looks at first glance to be that of a differentiation company, but upon closer examination of the types of projects undertaken by Power Systems, and the amount of true innovation that is done, it becomes obvious that it is aligned well with the cost based strategy. The auxiliary power unit product line was purchased in order to gain quick entry to the market without a significant investment in product design. Subsequent product redesigns were done based on copying other players in the market and adding inexpensive features to try and drive up price. The focus on cost is the main component of all design projects.

The product development cycle usually starts out by evaluating the current design for any shortcomings or components that result in higher costs. Next the product design team will evaluate the current products in the market for features and discuss with sales and marketing which of the features are being requested by customers or offered by

competitors. After this stage, the designers will focus their attention on similar products in other industries, such as marine, recreational vehicles and stationary systems. These other products that are of interest are then purchased and reverse engineered to try and incorporate the features that sales and marketing believe will be valued in the truck market. With component design a focus on cost is undertaken, working with the suppliers of these components and using off the shelf components first, custom components using standard parts second, and fully custom components using standard processes third. This focus on reverse engineering and standard part usage aligns very well with the cost strategy and also helps to shorten the project timeline.

1.2.2 R&D Expense

The current true R&D expense at Teleflex Energy is very small in comparison with the product design budget. It is difficult to find any aspect of the product design that could be considered R&D. This component is very much in line with the cost based strategy.

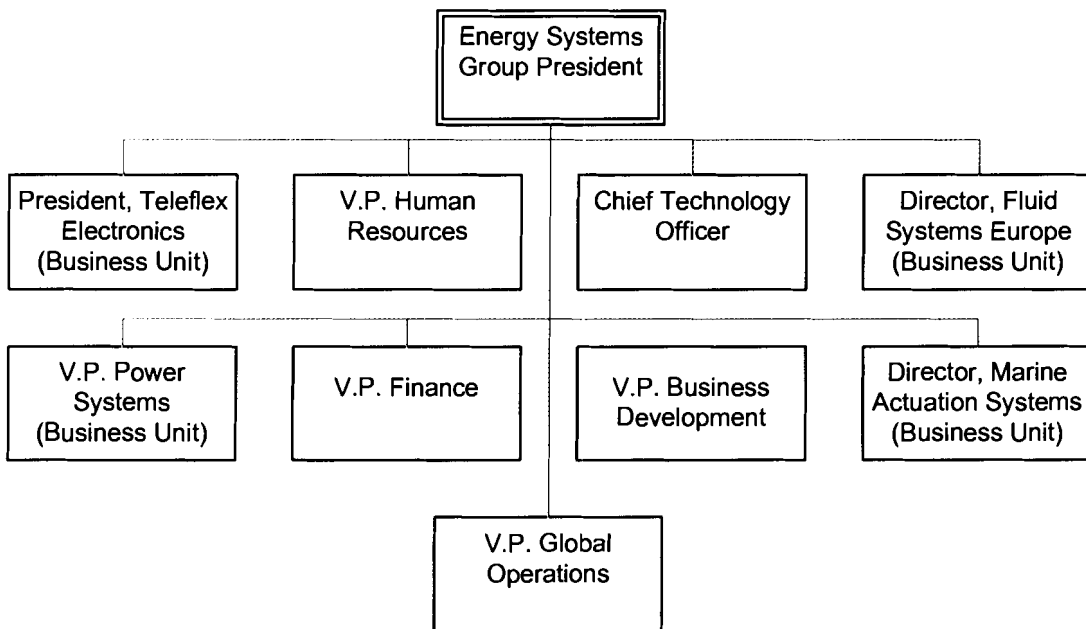
1.2.3 Structure

The company is undergoing significant changes in regards to structure. The new organization chart seen in Figure 3 has the division divided up into nine direct reports to the president.

The four business units report directly to the president and the rest of the functions are shared between them. Operations, Human Resources, and Finance report directly to the president and include all aspect of running the manufacturing and procurement side of the business. There is also a Chief Technology Officer (CTO) who

reports directly to the president. The CTO role is different than what one would typically expect. The function of the CTO is to identify problems in all markets served by the business unit and formulate solutions based on current capabilities of each of the divisions. This structure lends itself very well to the cost based strategy as it allows for larger scale operations, global purchase agreements with common suppliers and utilizes engineering resources of all the business units.

Figure 3: Energy Systems Group Structure³



1.2.4 Decision Making

The new strategic direction is also reducing the level of autonomy held by each of the operating business units. The new structure requires increased levels of communication between the CEO and the division presidents as well as approvals

³ By author

required by finance for any expenditure over \$10,000 by the business unit. This increased centralization of decision making is very much aligned with the cost based strategy.

1.2.5 Manufacturing

Each business unit typically has its own manufacturing facility and some of the facilities have access to low labour cost countries such as China and Taiwan. Individual units make investments into manufacturing and machining equipment for the products based on a typical payback of 18 months to 2 years. Teleflex has also adopted the Toyota production system which is based around reducing cycle times and work in process inventory. Being in niche markets usually does not bring the scale that would help in being a low cost producer, but efforts by the Operations group and Supply Chain management to implement new, lean systems are taking advantage of the economies of scale available to the combined business units.

1.2.6 Labour

The typical labour force at most of the business unit is usually one of highly trained persons that engage not only in producing the product but also in coming up with process improvements, cell designs, quality checks and in some cases do the training and selection of perspective employees. These employees are given many hours a year in onsite training by internal training departments in business practices and are also introduced to other products manufactured around the plant. All of this has developed a highly skilled and flexible workforce in many of the units. With the Power System division the labour force is very different. The manufacturing facility is located in Sault Ste. Marie, Ontario and is set up for mass production of only one product, the auxiliary

power unit. The complexity of the job is reduced by dividing the tasks up into many smaller tasks. This has enabled a very low skill workforce to be used to produce the unit and results in a labour rate half that of the Richmond facility. This type of labour force is very much in line with a cost based strategy.

1.2.7 Marketing

The marketing strategy of Power Systems has always been a push strategy. Sales and marketing efforts have been directed at helping our master dealers promote the products to the customers. We offer price breaks on larger volumes and also set up a subsidy program with the Canadian government to help spur sales. This component is very much aligned with the cost based strategy.

1.2.8 Risk Profile/Capital Structure

Teleflex has long been a low risk company, relying on large cash reserves to do its investing into its existing units or new ones. At one point the company had in excess of \$100 million dollars of cash reserves waiting to be used to grow the business. With the new strategy, the company has slowly been leveraging its assets to fund more growth as seen recently with a \$400 million dollar line of credit, which is aligning well with the cost based strategy.

1.3 The Problem

This paper focuses on the problem that Power Systems has been facing in this market for the last two years; profitability. The current product offering is not profitable enough to maintain the business for the foreseeable future. Previously, the low Canadian

dollar propped the business up but in light of the increasing dollar value to the US, profitability has decreased significantly.

Current net operating profit for the division is 2.2% on sales of \$18 Million. In order for corporate to allow us to continue operations, we need to have a net operating profit of at least 10%.

The decision criteria that will be used for the successful solution will be the following.

- 1) Does the solution meet the net operating profit objective of 10%?
- 2) Does the solution fit the cost based strategy?
- 3) Can the solution be implemented by 2006?
- 4) Does the solution provide a sufficient internal rate of return?

2 EXTERNAL ANALYSIS

In this section I will perform an industry analysis using Porter's Five Forces Model⁴ as well as an Industry and Firm level value chain. These analyses will be used to determine the Key Success Factors for the industry.

2.1 Five Force Industry Analysis

2.1.1 Threat of Entry

The threat of entry of new players is medium for this market. This is due to the increasing awareness of the market opportunity by a number of large players that are already in the market with unrelated products. These companies are starting to take notice of the large growth and demand for these devices. The factors that were considered for this section are shown below in Table 1.

Regulatory policy is shifting to support new market entrants. This support is typically in the form of grants to fund research into idling reduction and is available through many of the U.S. state governments as well as the Canadian government. In Canada, Scientific Research and Economic Development funding as well as Technology Partnership Canada funding can cover millions of dollars of development and easily aid a new company in entering the market. The Canadian government, more so than the US, is pushing this initiative due to its impact on the Kyoto Accord that drives towards reduced emissions. Funding for a potential emission reducing device could have high political

⁴ Michael E. Porter, *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. (New York: Free Press, 1980)

backing just for that reason. In the US the push is less due to Kyoto and more from citizen coalitions and the Environmental Protection Agency (EPA). EPA regulations are resulting in many trucking companies to have to comply, but at the risk of going out of business due to driver attrition and operating costs. This results in government incentives to try and get auxiliary power units onto trucks in the form of rebates to the consumer or the manufacturer.

Table 1: Threat of New Entrants⁵

Threat of New Entrants is High When:		This Industry
Rate of Regulatory Policy Introduction is	High	High
Scale Effects are	Low	Low
Likelihood of retaliation to entrance is	Low	Low
Vertical integration requirements are	Low	Med
Capital requirements are	Low	Low
Ability to Bundle with other products is	Med.	Low
Product differentiation is	Low	Low
Branding/Ad costs are	Low	High
Learning curve for environment survival is	Low	High
Quantity of Intellectual Property Rights is	Low	Low
Switching costs are	Low	High
Overall assessment of threat of new entrants is		Med.

The low scale effects have shown that a small company can enter this industry easily. The two main players in the market started as small operations with yearly sales of only one to two hundred units and have since grown to 2000 to 3000 units per year. At

⁵ Based on Porter, 1980

these low levels of output it was difficult to take advantage of scale on the purchasing side or even internally through the use of operational efficiencies. This is changing with the increase in market size and could be a benefit to a larger manufacturer with similar products already in production.

The likelihood of retaliation to new entrants is also low. The two current players have shown that price may be too low in the market and have been slowly raising prices in the last year. If a new entrant came to market with a significantly lower cost structure and wanted to capture a large share they could through the use of lower pricing. It may be that the two existing players could not survive a long term price war, especially after weathering the downturn in the market 2 years ago.

Vertical integration requirements are medium. One of the keys to making it in the business is to eliminate or reduce the amount of cost that a dealer adds when they sell and install the unit. The current dealers get a 10-15% mark-up to the customer as well as an install time of 10-15 hours based on a profitable shop rate. If a company can reduce the amount of time to install a unit or make it more attractive to sell more units through volume discounts the price to the end customer can be reduced, resulting in increased sales. On the supply chain side the low yearly volumes experienced in the last two years have made it difficult to buy direct from the manufacturer as they refer you to a distributor. The engines for example need to be purchased from either the US or Canadian rep who puts a profit margin on top of the unit.

Capital requirements are low. The product itself is a combination of components that just need to be assembled together. Initial capital needs are mainly for engineering

and design and would roughly take \$3 million dollars to bring a product to market and another \$1 million to set up a manufacturing facility.

Ability to bundle with other products is low. Two of the main threats of entering the market have other products that could be grouped together to provide some type of bundling to the end customer. Products like refrigeration units for truck trailers could be sold with auxiliary power units but the market size for each of them is different as there are more trailers than there are trucks. Other products or maintenance services could also be bundled that would be beneficial to the end customer, such as oil changes, belt changes, overhauls etc, that a small player without a service network could not offer. Currently only one of our main competitors, Thermo-King, has the ability to bundle the product.

Differentiation between products is low. Currently the products we sell are of two to three varieties with the majority of the sales (90%) coming from one product configuration. The bulk of the market can be served with this configuration and the others are for unique installations where the main product has features that the customer does not need or want. The removal of these features does little to the product cost, roughly 10% less, and usually results in the customer taking the more expensive unit.

Branding and advertisement costs are high. For potential entrants that already have brand recognition these costs will be low. A company like Thermo-King is well recognized as leader in the industry with current product offerings. It would be expected by customers that the auxiliary power unit from this supplier would be of the same quality level as other products with the Thermo-King name on it. For new entrants the branding costs would be much higher. Existing companies have been in the market for

over 7 years and new entrants will require a large advertising campaign to build recognition. On top of that any large advertising campaign will have beneficial effects for the existing competitors as it would raise awareness of the benefits of auxiliary power units even more.

Learning curve for environmental survival is high. The truck market is largely underestimated by entrants as to the level of aggressiveness that the auxiliary power unit experiences while being driven down the road. To put this in perspective, an auxiliary power unit is designed to run for 10,000 hours, which equates to roughly 5 years of operating every night and then survive for a million miles of transport driving by the truck. A typical car is driven around 2 hours per day 365 days a year at an average speed of 35 mph. This equals 25K miles per year and 730 hours of transport time. The auxiliary power units are also expected to survive road debris, snow, salt, rain, and desert temperatures along with the incessant pounding of the road. As a result of this environment, extensive testing and qualification is required to ensure the product survives for its expected lifetime. A highly experienced design team is also required to avoid the not so simple problems that lab testing cannot expose.

The quantity of intellectual property right is low. Existing players only have a few patents that try to restrict entrants from using their ideas in new products. Patents on using the auxiliary power unit as a step to get into the truck, the method of mounting the unit, the controls of the unit as well as generator design exist as roadblocks to slow down the entrants. For a new entrant the decision must be made as to how valid the patents are and whether they wish to take the chances on an infringement case or design around it. Either of the choices will cause an entrant to slow slightly in the product design process.

Switching costs are high even though each unit basically fits in the same spot on the truck. The unit uses the same fuel as the truck, etc, but it would require that the old unit be removed first which would take roughly 2-4 hours to do so, this at a cost of \$90 per hour results in \$320 to switch along with the sunk cost of the unit. Also for fleet customers, if the existing units were kept and new units were from a different manufacturer, then uncommon spare parts inventories would result along with increased complexity for the mechanics servicing the different units.

In summary, there are two main areas to concentrate on to reduce the threat of new entrants into the market. The first is to capitalize on the learning curve required to understand what it takes to achieve an acceptable product life and to push the customer expectations further. The second is to encourage sales and capitalize on the switching costs associated with the fleet customers.

2.1.2 Bargaining Power of Suppliers

The bargaining power of suppliers was high but has recently shifted to low as the market grows. The reason for the previous high bargaining power was that yearly demand to the suppliers was relatively low compared to some of their existing customers in other markets. This low demand was deemed by some of the suppliers as more of an annoyance than an opportunity and was treated as such. The factors that were considered for this section are shown below in Table 2.

Table 2: Bargaining Power of Suppliers⁶

Bargaining Power of Suppliers is High When:		This Industry
Yearly quantities are	Low	Low
Market/use knowledge	High	Low
Lead times are	Low	High
Market Growth is	Low	High
Overall assessment of supplier bargaining power is		Low

Yearly quantities of parts are low. Current yearly quantities are 5000 pieces, which is up considerably from last years 2000 pieces. This increased volume is beginning to help with better pricing from suppliers but not as much as one would hope. Some of the suppliers are used to dealing with account volumes of 100K+ pieces per year and are still resistant to aggressive pricing and delivery agreements, they also will short ship product in order to satisfy the requirements of their large customers.

Market and use knowledge is low. Suppliers of components to be used in our system usually have no understanding of what the end product requires. The 160,000⁷ miles of road travel and 2000 hours per year of operating time is magnitudes above the current use of their products. As a result we typically have to do the applications testing for the suppliers in our system and usually have suggestions to improve the product that potentially can be used by our competitors.

⁶ Based on Porter, 1980

⁷ American Trucking Association, *American Trucking Trends 2003*

Lead times are high. The material cost of an auxiliary power unit is roughly 90% of the overall cost. This high material cost drives improvement requests on delivery to reduce inventory levels. JIT manufacturing methods are employed to keep these levels down and reduce the time to fill customer orders. This in turn depends on rapid turnaround from suppliers on increased quantities and expedited delivery that most of them cannot or will not respond to. A potential entrant that can solidify an agreement with some specific vendors for flexible deliveries will have an advantage over existing players. Vendors of engines, radiators, compressors, and heat exchangers come to mind as being key.

Market growth is high. The rapidly growing market is helping to take some of the bargaining power away from the suppliers due to it attracting new suppliers that previously refused to quote on the low volumes. The market is very attractive at this time and most components need to be designed in at the beginning, thereby making change difficult during the life of the product. This is starting to result in key suppliers coming forward with price reductions or specific product changes to help secure a position in the offering, as they realize that the future spare parts business of the auxiliary power unit has the potential to be very lucrative.

In summary, the main factor required to reduce the bargaining power of suppliers is to help them recognize that the market is about to experience rapid growth, and that in order for them to take advantage of the parts business in years to come as well as gain a large market presence, they need to partner with an auxiliary power unit supplier.

2.1.3 Threat of Substitutes

The overall assessment of the threat of substitutes at this time is medium. Current technologies are largely accepted and understood, and the likelihood of a significant technological advancement that is cost effective for the truck market is low. The factors that were considered for this section are shown below in Table 3.

Table 3: Threat of Substitutes⁸

Threat of Potential Substitute Products is High When:		This Industry
Availability of Substitutes is	High	High
Switching costs of Substitutes is	Low	High
Rate of Technological Change is	High	Low
Overall assessment of substitution threat is		Med.

Currently with the number of manufacturers in the market the availability of substitutes is high. A customer has a number of products to choose from when looking for an anti-idling solution. Choices range from air-conditioning only units to full comfort solutions of heat, air-conditioning and 120 volt household power. There are also shore power solutions where the truck can plug into a house outlet or drive up and attach an air conditioning unit to the passenger side window with television and internet access built in.

Switching costs are high. Once a choice has been made it is difficult and expensive to change. For the owner operators it is likely that the unit will remain on the truck until the truck is taken out of service. Repairs can be made over the years that will

⁸ Based on Porter, 1980

be less costly than replacing it with another system. For fleets, the switching costs are even higher as they will have to carry spare parts for each of the different manufacturers units as well as train mechanics on proper service and repair.

Rate of technological change is low. Major technological breakthroughs are required to significantly threaten the current auxiliary power unit market. Batteries have limited storage capacity and large numbers of them are required to supply the heat or air-conditioning throughout the eight hours of rest time required by the driver. Fuel cells are also too far in the future to be considered a threat at this time.

In summary, the main factor to concentrate on to reduce the threat of substitutes is with respect to switching costs. Switching costs need to be increased so that once customers choose our product they cannot easily switch.

2.1.4 Bargaining Power of Customers

The overall assessment of the bargaining power of the customer is high. The customer is very aware of the unit's benefits and is usually quite astute when it comes to running a business. Payback on investment is largely understood and operating costs are usually kept in a very detailed way. The factors that were considered for this section are shown below in Table 4.

Competition between the two dominant suppliers is high. It is largely well known in the industry that Teleflex and Rigmaster are the two main competitors, and customers regularly play each of the companies off on each other. Quotes are given and then used to drive price down resulting in bidding wars over larger customers. This has resulted in a very difficult market to be in as customers not only drive price down but at the same time

demand similar features to make their decision process easier. If the products both have the same features, even if the customer won't use these features, then the risk of making the wrong decision is lowered.

Table 4: Power of Customer⁹

Power of Customer/Buyer is High When:		This Industry
Competition is	High	High
Payback on investment	High	High
Buyer concentration is	High	Low
Purchase risk is	Low	High
Information asymmetry is	Low	Low
Product differentiation is	Low	Low
Service requirement is	Low	High
Overall assessment of customers' strength:		High

Payback on investment is high. Customers generally look at the different units and see relatively the same thing; both have the same basic features, but look somewhat different on the outside. Sometimes the decision is made on preference but the underlying decision to buy an auxiliary power unit at all is based on payback due to fuel savings, the comfort for the operator is secondary to this initial payback. One ancillary benefit that has helped sell a customer on installing auxiliary power units was the need to be able to keep the batteries in the truck charged so they reduced the cost of having to jump start trucks on Monday mornings. One fleet estimated a cost of \$50 per unit for jumpstarts

⁹ Based on Porter, 1980

every Monday morning which affected 5-10% of the trucks. Take a fleet of 200 trucks and the Monday costs are around \$1000, calculated yearly, \$52,000

Buyer concentration is low. In the US there are over 40,000¹⁰ fleets, with more than 20 trucks in each fleet, which are listed in the fleet directory published every year by the fleet association. There are a number of large fleets that could keep a new entrant very busy for a number of years and help gain market acceptance. Fleets also tend to copy each other, so if a new entrant could buy their way into a particular fleet, get some scale effects due to volume, and lower their cost to a decent profitability level, a significant amount of market share could be had in a relatively short time frame.

Purchase risk is high. This makes the sales job of trying to change a customers mind difficult as he has a very intricate knowledge of the product and has made his decision likely based on facts from the industry. The importance of making the right decision for the customer is very high especially for fleets as they will have a large number of units installed on trucks and will not want to switch after their mechanics have been trained and spare parts purchased. The costs associated with the maintenance and training of mechanics is also calculated and some fleets try to keep commonality between components to reduce this cost.

Information asymmetry is low. The consumers have quickly understood how a unit works and what it can offer; they also know the differences between the manufacturers and the operation of the unit. This results in the product mainly being sold strictly on price.

¹⁰ American Trucking Association, *American Trucking Trends 2003*

Product differentiation is low. The difference between products is getting more and more difficult to get a price premium. The different heating and air conditioning systems no longer seem to matter, nor does the weight or size of the unit, if anything the aesthetics of the unit cause more people to choose one over the other. Reliability and maintenance is quickly becoming the main differentiator and is driving the product design for future models. New entrants would benefit from capitalizing on this demand and proving to the market that maintenance of their offering is lower. Increased warranty periods have some value but the owner is not compensated for downtime of the truck while the unit is repaired, what they want is a unit that does not cause them downtime.

Service requirement is high. The truck environment, as stated earlier, is a difficult one in which to achieve a life that is acceptable to an owner. Most owners would prefer that they never have to touch the unit for the life of the truck. Unfortunately this is not the case as it is a hard working piece of machinery and requires a minimum level of maintenance to avoid larger repair bills. It is also not a trivial item to install and troubleshoot and requires high levels of training and a service/support network for parts and diagnostics. This service cost is becoming a more significant factor in the total cost of the unit as more information is available to the field. Potential customers almost always purchase a number of units from each of the main competitors to use as a field trial to determine which is more reliable and easier to service.

In summary, the factors that should be concentrated on are service and price. By having a service network that can train, troubleshoot and provide fast part delivery will help to reduce customer bargaining power. This service network also provides a key role in the development of new products for reliability as will be discussed in the next chapter.

Finally the product design needs to reduce the service requirement and installation time which will in turn reduce the price of the product to the customer.

2.1.5 Rivalry among Existing Competitors

Rivalry among existing competitors is quite high. The factors that were considered for this section are shown below in Table 5.

Table 5: Intensity of Competitive Rivalry¹¹

Intensity of Competitive Rivalry is High When:		This Industry
Growth rate is	High	High
Differences in cost structure	Low	Low
Number of competitors is	High	Low
Engineering and Development are	High	High
Competition on the basis of price is	High	High
Overall assessment of competitive rivalry is		High

Growth rate is high. This has heightened the competitiveness between the players as they battle for more market share and try to establish a large presence in the field. The high growth rate has also raised the visibility level such that other entrants who long considered the market too small are now looking to enter. Based on data collected by the American Trucking Association, yearly sales of class 8 trucks, which are the likely buyers of auxiliary power units, averaged around 180,000¹² units per year from 1992 to 2001. Conservative estimates by our marketing group suggest that at least 30% of the

¹¹ Based on Porter, 1980

¹² American Trucking Association, *American Trucking Trends 2003*

buyers of these trucks would consider installing an auxiliary power unit to save fuel and reduce the wear and tear on the truck. This equates to roughly a potential market size of 54,000 units per year if the justification due to fuel costs and maintenance costs on the truck provide the necessary payback on the investment. On top of the new trucks sales every year there will also be retrofits of auxiliary power units to existing trucks that have a sufficient useful life left to justify the cost of the unit. This retrofit figure is hard to determine but it is anticipated that anywhere between 10,000 to 20,000 units per year over the next 3 to 5 years is possible if fuel costs continue to rise. After the retrofits have been completed, and most of the trucks have been replaced with new trucks, the yearly new truck sales figure is expected to remain constant as it is mainly due to the natural attrition rate of the vehicles that reach the end of their useful life.

The differences in cost structure of the business are low. Cost structures have typically been the same other than the fact that Rigmaster has been a private family company that only has to make a profit that the owners are happy with, whereas Teleflex has costs associated with being part of a corporation as well as a minimum profit margin in order to be viable. On the other hand, with Teleflex being part of a large company, cash flow has been less a concern and hanging on during slow times was made easier due to the company bankroll. Both companies have the same type of manufacturing facility and are based in Canada, both have engineering but Teleflex has a much larger engineering department. A new entrant with a better cost structure such as utilizing a low cost labour country could have an advantage in this area.

The number of competitors is low. There are currently 3 competitors in the truck auxiliary power unit market that offer a complete solution. The main competitors are discussed in the competitive analysis section.

High fixed engineering costs. Engineering costs for developing new products and taking advantage of cost savings on existing offerings are around \$1,500,000 per year. Secondly the experience and knowledge of the engineering department is key to the survival of the product in the market. Lessons learned are usually expensive and knowledge transfer slow between employees due to the complexity of the product. Significant commitment is required by new entrants in this regard if they are to be successful.

Competition on the basis of price is high. Both of the current market leaders have been in a price war over the last 3 years as the market grew. This price war was intended to achieve sales during a significant down period in the truck market. Sales of auxiliary power units were too low to sustain either of the businesses or to encourage further investment in the product. The hope internal to Teleflex was that the increased volume would help garner efficiency effects and reduce the cost of the product, and it is believed that our competitor had the same hope. Unfortunately the increased volume did not translate as much as expected into reduced costs and this has resulted in price increases over the last year to try and achieve profitability. The current published prices of the three competitors are within \$600 of each other, and prices are routinely reduced in order to make the sale, especially with larger orders. Power Systems is the price leader at \$6495 with Rigmaster second at \$6740 and Thermo-King at the highest price point of \$7100.

These prices are to the dealer network and do not include mark-up or installation charges which are consistent between the three units.

In summary, the factors that need to be concentrated on are engineering and development and price. These two factors are integrally related as engineering and development have a direct impact on product costs in the form of reducing costs by utilizing more cost effective components.

2.1.6 Overall Industry Attractiveness

The truck auxiliary power unit industry is currently very attractive for new players. Government regulations are forcing users into having to buy units or else pay large fines for idling, fuel costs are rising, and funding is available to help get a company started. Research grants can also be had by established companies and tax credits can help with reducing the up front costs of designing and launching a new product. For an existing company with a name that has credibility in the industry, branding costs are low and the advertising costs to reach customers is very reasonable considering that the market is very well defined and easily identifiable.

Another reason for the attractiveness of the industry is its current growth rate of 100% per year for the last two years with no slowdown expected. As well as the fact that a truck life cycle is only 5 years, resulting in very high customer lifetime value since new trucks will require a unit and the old unit is likely sold with the truck in the second hand market.

For industry incumbents the attractiveness of the industry is very high as significant investments have been made to establish a market presence and the time to

capitalize on those investments is now. Existing players are desperately trying to secure large orders with fleets to increase volumes and take advantage of efficiency improvements on the production floor, or volume discounts of components on the supply chain front.

The major drawback to the industry is that the price level has already been set and little upward mobility is expected, costs will need to be kept down, and reliability needs to be increased well above current offerings. The learning curve to achieve this is quite high for an inexperienced company.

2.2 Value Chain Analysis

2.2.1 Industry Value Chain

This value chain is composed of nine parts, Product Design, Testing, Inbound Logistics, Manufacturing, Marketing, Sales, Distribution, Retail, and Product Support. The product design and testing sections could be combined into one as a great deal of testing is done during development, but I have chosen to break it out as testing is identified in the industry as a part of the product acceptance process that many larger customers look for before purchasing a unit. Of the value chain the important sections for this industry are Product Design, Testing, Manufacturing, Marketing, and Product Support.

Figure 4: Industry Value Chain for the North American Truck Auxiliary Power Unit Market.

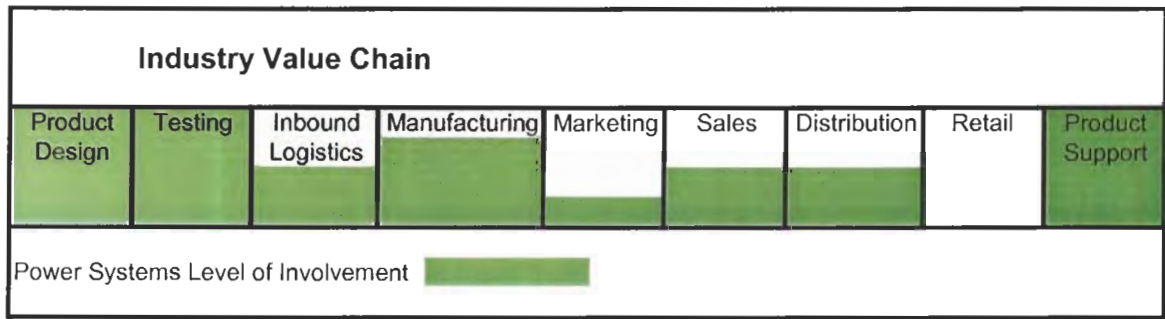


Figure 4 shows the total industry footprint and tries to show the level of which Power Systems performs each of the parts, shown by the colour green and the remainder of the part being done by supplier. For example the Product Design and Testing sections are performed 100% by Power Systems whereas Inbound Logistics is performed 50%.

2.2.2 Product Design

Product design largely consists of the engineering function of selecting components that are usually available off the shelf and configuring them in a way that the unit functions as desired. This process can be followed for 80% of the components but, due to the environment that the product has to endure, the remaining 20% must be custom designed for the application. This is an important point in the process as any company in the industry will require an engineering department that can perform this work. The fact that the device hangs on the side of a truck and could possibly break, fall off and careen down the highway at high speeds warrants this skill set. Product design will also need to incorporate historical knowledge into the design in order to meet the increasingly demanding market requirements for life expectancy, weight reduction and overall product cost. Power Systems does all of its design and testing, with only limited use of consultant specialists that help to develop internal expertise.

In house expertise in a number of core technologies involved with product design is also key to the success of the company. In general there are three main aspects to the auxiliary power unit. The first is the mechanical design so that it stands up to the environment. This can be achieved with careful testing and analysis. The second is the control system that performs the start/stop functionality of the unit as well as the user interface. This is what most users see as the defining difference between competitors. It is where functionality can be programmed in, which allows for added fuel savings and user comfort. Finally the last aspect of the system is where the air conditioning and heating comes from. This component needs to be engineered for high heat and cooling output while at the same time have as small a footprint as possible so that it takes up little room inside the cab. All three of these aspects require skilled product design and in house capabilities in order to be successful.

Product design is also integral to the marketing and sales component of the industry value chain. Part of product design's function is to take the customer needs and wants and transpose them into a usable product or feature. These inputs are usually vague or unrefined and the engineering process will often require further analyses to determine the real customer requirements.

Product design also performs a support function for the manufacturing component of the industry value chain in the area of design for manufacturability and assembly. By utilizing these techniques early in the product, designers are able to work with the operations group to error proof the assembly process and reduce the handling or re-orientation of parts during the assembly process. This can be overlooked in companies

where the entire manufacturing component is outsourced and communications between the group non-existent.

The last function of the product design activity is that of warranty analysis. This is an area in which we are currently focusing efforts to improve upon. It is recognized that the product support group component of the industry values chain can only provide limited analysis in regards to root cause failure of components. This warranty analysis function has now been taken over by product design to help close the circle between what is happening in the field and what needs to be changed in the design going forward. This aspect completes the feedback loop to the sales and marketing activity in the value chain and provides a significant advantage over others in the industry that do not recognize its importance.

In summary, the factors that need to be considered in the product design section of the industry value chain are having the in house design expertise to engineer the most reliable and durable product with the lowest cost components while at the same time incorporating new features requested by the market. This is imperative to being the market leader by maintaining the lowest total overall cost which includes initial purchase price, installation and yearly service costs.

2.2.3 Testing

Testing is split out in the footprint due to its complexity. The environment that a truck exists in is very difficult to simulate in the lab. Road vibration, temperature, debris, dust, salt, water, and electromagnetic interference vary around North America and because the unit is mobile, it is subjected to the extremes of all these conditions. This

therefore requires a significant amount of lab testing and field trials in order to design a product that will survive. Many types of tests are available to an engineer for determining whether a product will meet its design requirement, but by not fully understanding the environment and a products use, many months of effort as well as considerable dollars can be wasted without significantly improving a design. A dedicated group is required for this function and competencies must be developed in order to be successful. Power Systems does all of its testing and monitoring of units in certified labs and select field locations.

Another aspect of the testing activity is to test and approve new parts or products that have been sourced by the procurement group. This testing can often take many months to do, which the engineering department helps to reduce by being directly involved in the supplier selection process, often times reviewing the technical capabilities of the supplier, before sample parts have even been ordered.

In summary, the important factor with respect to testing is being able to single out the important tests to perform to ensure robustness and reliability and then to perform those tests with minimal delay. The testing needs to adequately reflect the product use and needs to be accelerated so that new products can be implemented to keep up with competitors new features or to help reduce costs.

2.2.4 Inbound Logistics

Inbound logistics is that component of the operation function that controls the steady and on time supply of raw materials and components for the finished product. This function is becoming more and more important as overseas, low cost suppliers are

sourced to try and reduce overall costs. This component helps the company reduce freight costs as well as inventory carrying charges by trying to increase inventory turns and consolidate shipments from various suppliers.

2.2.5 Manufacturing

Manufacturing can be made up of a number of components and can be viewed in a few different ways. First manufacturing of an auxiliary power unit system involves a number of different processes. Metal fabrication is a key component of the manufacturing process as all auxiliary power units require a frame and enclosures, but since these parts could be classed as specialty and do not have any proprietary processes behind them, any metal fabricator could be used. But with outsourced metal fabrication comes some margin erosion as this is a large part of the overall cost of the end product. Next in the manufacture process is that of machining, which does have some proprietary information in regards to clearances and fit between some of the high tolerance components. This aspect of the manufacturing process could be outsourced easily in order to reduce capital requirements for equipment. Finally the part of the manufacture that makes up the largest portion of the labour component is that of assembly and packaging. To assemble and pack takes 16 hours of labour and requires that components are assembled correctly for function and safety purposes and the overall assembly tested for correct operation. Power Systems footprint in this section is large on the assembly portion but has been outsourcing the machining and fabricating aspects.

Power Systems has always been centred on operational excellence and specialized in high tolerance/precision processes that created value for the company. We have always viewed manufacturing and the processes involved as being critical to the competitive

advantage of the company and have invested in these activities to keep them at the forefront of the industry. This investment in the operation function has allowed us to achieve low costs that are difficult to match. This created a very strong position in the manufacturing engineering function of the company as well as the ability to increase capacity easily due to the standard methods and equipment that workers can be quickly trained to use.

Capacity at the Sault Ste-Marie facility is currently estimated at 16,000 units per year. This estimate is based on the past output of 3,000 units per year with one shift at 60 units per week. Due to the increase in sales this year the operation group, through outsourcing of fabrication and machining, has managed to increase throughput to 200 units per week with 2 shifts. If the expected sales volume of 15,000 units per year is achieved a third shift will be added along with further operation efficiencies to increase throughput to 16,000 units giving us a little breathing space above the sales forecast of 15,000.

If the market size estimates of 60,000 to 80,000 units per year come to fruition faster than expected, the Sault Ste-Marie facility will need to be expanded. Currently land is available to build on as well as other facilities in the area that could easily be adapted for production of the required volumes. The low skill requirement for the workforce as well as the ability to quickly duplicate the production cell will enable a fairly rapid ramp-up of output to meet the demand.

Manufacturing engineering's sole focus was to design and build custom machine tools, jigs, fixtures and assembly devices that increased throughput and reduced labour content. This focus created some of the most intricate pieces of equipment that enabled us

to be a product leader through precision and quality at low costs that none of our competitors could match. This enabled us to keep jobs in Canada that most companies would try to outsource to lower cost countries at the expense of quality and control. The test benches that were created record significant quality levels and provide detail to engineering on product output through the use of statistical methods which helps to ensure a quality product to the end customer.

The manufacturing component of the company has been changing slightly over the last few months as more outsourcing takes place in the machining and fabrication side of the process. Fabrication has long been identified as not a core competency and the capital required to make it such was not available. It was therefore decided that fabrication would be outsourced. Machining has also been identified as being something that needs to be outsourced. This is largely due to not having the capital available for new machine centres, and not having a very highly skilled workforce to operate the equipment. Assembly and packaging are still a major component of the manufacturing process and continue to be the focus of the operations group.

Another significant factor in the manufacturing component is the procurement function. With more outsourcing of manufacturing happening and the increasing level of complexity in the component designs for which there is not an internal source, a company needs to be strong in this area.

In Power Systems the Supply Chain Management group specializes in the global sourcing of components for our designs and helps set up long term relationships with those companies that have competencies in areas we do not. An example of this is with mufflers. A significant complaint from the field has been the level of noise from our unit

during the night when running. This noise level can only be reduced with advances in mufflers, which we have no capabilities to do so. If we are to maintain a competitive advantage we require a muffler that none of our competitors have, and that has been custom designed and fit to our unit. The supply chain group has started to look for a muffler company that can provide this and is doing the up front work of weeding out suppliers and ensuring that risk assessments are done to ensure ongoing supply of parts. The supply chain function augments the sales/marketing primary function as they will be part of the customer requirements process and will be responsible for finding suitable components and suppliers to address these issues.

The supply chain group also provides a support function directly to the inbound logistics primary function through the use of proper company selection and contract terms to enable success in parts delivery and supply. They also provide a service in managing the freight duty and brokerage and are responsible for clear passage through customs, again ensuring timely supply of components and reducing lead time and inventory levels.

As part of the primary function of manufacturing, the SCM group plays a key role in the re-sourcing of components and companies that do not meet the operational requirements of the business, again a key group in the successful operation of the company.

In summary, the important factors in the manufacturing component of the values chain are that of end product manufacturing and the careful selection of and partnering with suppliers that bring value to the product. The end product manufacturing is important due to its impact on quality and the high level of complexity of the design. This

assembly information feeds back into the design group for further improvements for end product maintenance as well as design for manufacturability to reduce costs. The supply chain group role in supplier selection and component sourcing also plays a key role in the value chain as their partner relationships will have long term effects on the product in the form of cost and quality, as well as influence the design of new products.

2.2.6 Marketing

Marketing in the industry is usually done by the producers of the products, running ads in trade journals, magazines and truck stop newsletters. These producers also have a large presence in all the trade shows around North America where they show their current products as well as future generations to come. Promotion is also done at point of sale in the dealer's showrooms or different truck repair garages around the country. Power Systems has developed a dealer network throughout North America with 120 locations that sell and service the system. Other producers use the same type of process and still others may be entering by using their established formal distribution network.

The Power Systems division has a marketing group of 4 that help the master dealers and distributors with their larger customers. Their efforts are directed towards the larger deals of 10+ units and little time is spent on the individual truck driver. The marketing team has divided North America into four main areas that each of them manage. The marketing group works actively with the dealers on pricing for volumes and discounts to help make sales to fleets. The fleet customers account for almost half of the sales of the division with rest of the sales coming from individual owner operators that frequent the master dealers and distributors.

The final component for the marketing quadrant is made up of original equipment manufacturers. The current marketing group is not concentrating on this component at this time as they are consumed by the fleet market for the current product. As part of the management team of Power Systems there is a Product Manager that spends some of his time with original equipment manufacturers. This work has resulted recently in Power Systems being awarded a contract to supply auxiliary power units to Caterpillar as part of the Mor-Electric Initiative. We were chosen as the supplier for this unit as we had the most experience in the field and provided the lowest cost solution for their program.

Another important aspect that that marketing function performs is the voice of the customer. It is through the contact with customers and experiences in the field that customer wants are clarified for product design so that it can be incorporated into the next design or modified for the current design.

There are two key factors for the marketing component of the value chain. The first is establishing relationships with select dealers and fleets so that the appropriate information is communicated back to the engineering department for further product development. The second is in expanding the current dealer network to gain access to other fleets around North America.

2.2.7 Sales

Currently we do not offer direct sales to customers. All sales are directed to our dealer and distributor network where installations are carried out and troubleshooting performed if problems arise. These dealers usually stock spare parts as well as complete units. Our main competitor Rigmaster, uses a mixed system of sales, they offer direct

from the manufacturer sales and installation at their one factory in Canada, as well as sales and installation through their dealer network. Thermo-King also only sells through a dealer network.

2.2.8 Distribution

The distribution component is left either to standard freight delivery services or to the truck company that is buying the units as they regularly send their own truck to pickup and haul the units to their maintenance facility. Our only involvement in the process is the scheduling for pickup and sometimes customs documentation. Our main competitor is using the same methodology, but a potential market entrant has a complete distribution network for existing product lines that they already sell to the same customers. This may enable them to leverage some costs that we cannot through the use of their own truck delivery fleet.

2.2.9 Retail

Power Systems does not have direct control over a retail chain in North America, but does have a network of licensed dealers that can sell, install and service the product. This has been recognized as being one key to the success of the product. This factor will only be successful if the authorized dealers are carefully trained so that they can install and troubleshoot the product reliably. If the dealers are not set up correctly, it can end up costing the company a great deal of money in warranty costs as well as reputation. The retail portion of the value chain also takes away some margin as they take a mark-up as well as an installation charge to mount the unit on the truck. This has been recognized as

a double money-maker for dealers as they not only make the profit on the product mark-up, they also make profit on their shop rate that they charge to do the install.

2.2.10 Product Support

Product Support is the final portion of the value chain and some in the industry regard it as one of the most important considerations when choosing one unit over another. The industry was built around mobile equipment and the repair and maintenance of that equipment. The hours of use are long, the environment difficult and profitability is based on keeping trucks on the road. Therefore the company that can provide timely support with respect to trouble-shooting, spare parts, and installation training will have a significant advantage over ones that do not. Power Systems has a product support department dedicated to providing this service and is recognized in the industry as one that can be counted on to stand behind the product.

The product support group is responsible for the training of all service personnel in our dealer network on the proper installation and trouble shooting of the unit. This function should not be underestimated as the system is a very complex one that is usually being installed by a less than enthusiastic mechanic. If the unit is installed poorly, improper operation will result and warranty calls will ensue. This in turn results in unhappy customers who are not afraid to tell everyone they meet driving around North America.

The product support team spends 3 weeks every month on the road travelling from dealer to dealer and re-training or training new individuals due to the high attrition rate in the industry. They also make customer service calls to address particularly

troublesome issues that some customers may be having. The product support group is generally on call 12 hours per day to keep customers running when they are having issues that cannot be addressed on the road.

Finally the most important aspect of the product support group is their communication of problems found in the field to the product design group so that corrective actions can be put in place to eliminate the problem on future units. Direct to source troubleshooting is important in order to get this type of information back without having a middle man to distort the findings or the symptoms. All of this makes for a better product in the end.

The two aspects that we cannot fully control in the product support activity of the value chain are those that the product support team was set up to address, being installation and repair. Quite often the installs do not go according to the instruction manual and a poorly installed unit is left to go out the door. Repairs of these same units can result in loss of profit due to the high costs of labour required to effectively troubleshoot and repair the problem. If the unit is let out the door, and a problem comes up the next night in the field, the truck may be forced to go to a different dealer for repair. When this happens the repair falls under the warranty agreement of which we pick up the cost. It is quite common for a warranty claim to have multiple items listed on the claim, but only one of which is truly malfunctioning and qualifies for warranty. With the current process and the complexity of the unit, we will warrant all of the components regardless. This is an area of extreme concern as a single claim of this nature could wipe out all profits realized from the original sale.

In summary, a dedicated product support team is crucial for the success of the product. This team is needed to provide the necessary training for installations and troubleshooting of the unit as well as communicate product improvement ideas back to the product design group so that they can be incorporated into the next product version.

2.3 Key Success Factors

Based on the external analysis and the industry value chain the most important key success factors were selected and are listed below. Following this list is a description of the key success factor and how it pertains to this industry:

- 1) Product Design for Robustness and Reliability
- 2) Dealer Network
- 3) Total Overall Product Cost
- 4) Product Support/Training
- 5) Marketing Expertise/Voice of the Customer
- 6) Supply Chain Management/Strategic Partnering
- 7) World Class Manufacturing
- 8) Vertical Integration of Core Technologies

Product design for robustness and reliability is the most important key success factor. This is heard throughout the industry where down time is not acceptable as it results in a truck driver being fined for idling his main truck engine or missing a delivery due to a mechanical problem. The product needs to be able to go an acceptable time period without maintenance and still perform trouble free. This reliability factor will also

have a large impact on future sales to the customer or sales to other customers due to the speed at which negative opinions travel throughout the industry.

Robustness to the road conditions and environment is also crucial as the life expectancy of the unit increases. More and more owners are expecting the unit to last the lifetime of the truck which has been increasing over the last few years. In the past the expected time that an owner would keep a truck on the road was around 4 years, but this has increased to 5 years and is likely to increase again as profits in the industry drop and the cost of replacing trucks increase. Due to the increased lifespan, new products need to be designed to last for the duration as owners will be very frustrated if they have to spend \$8000 for a new unit one or two years before they retire their truck.

The dealer network is the second key success factor. This factor is important as it is the means by which units are sold, installed and serviced in the marketplace. Without a nation wide service network in the United States and Canada an auxiliary power unit provider will not be able to achieve any sizable market share. This dealer network needs to be able to make contacts with local fleets and have the qualified and capable personnel necessary to perform quality installations as well as rapid trouble shooting of problems.

Total Overall Product Cost is the third key success factor. This factor is important in order to be the price leader by reducing the installation and yearly service costs to the end customer. Table 6 shows the costs a customer can expect upon purchase and for running the unit in the first year. By reducing the install and maintenance costs, the total cost to the customer can be reduced as well as increasing the price of our unit to the dealer. The reason that this is possible is that the customer is given a total price for the

unit that includes installation because warranty is void if not installed by an approved dealer.

Table 6: First Year Costs

Product Cost	\$ 6,495
Shipping	\$ 200
Inventory Carrying Charge (7%)	\$ 455
Dealer Markup (10%)	\$ 650
Installation Cost @ \$90/hr	\$ 900
Yearly Maintenance Costs	
Belts (2 x \$100)	\$ 200
Oil (6 x \$50)	\$ 300
Total Costs in Year 1	\$ 9,199

Product support and training is the fourth key success factor and needs to be considered carefully when entering this market. Due to the complexity of the design and the difficulty that is encountered during typical installations, proper training is a must to ensure correct operation. Installations must be carefully planned to minimize work time and allow the owner to get his truck back on the road as soon as possible. Many owners are also very particular about the aesthetics of their truck and demand that the unit be installed in the utmost professional manner. A typical installation requires 5 to 8 hours with two mechanics and will require on site experience based training in order to get them up to an acceptable level of quality and timeliness. On site training will be required for a minimum of 3 installations and will require phone support and refresher training throughout the year due to employee turnover and different truck configurations.

Product support also plays a key role in the successful troubleshooting and repair of installed units. The objective of the design is to provide as long lasting and trouble free

unit as possible, but failures do occur. It is up to the training provided by the product support group to effectively diagnose and repair problems quickly so that the truck can be returned to service. Phone support by product support personnel to walk a mechanic through this is crucial when the more difficult problems arise, and also results in lower warranty costs as the correct components are replaced, rather than good components due to using the trial and error method of failure analysis.

Marketing Expertise/Voice of the customer is the fifth key success factor. This factor tries to describe the product inputs that are required for adequate product designs that address customer needs in the marketplace. Without a strong marketing group the market requirements are unclear and, in the worst case, can be misguided resulting in the wrong product and a major setback in the design process. Marketing will also provide market intelligence to the design department as to which new features our competitors are talking about. The other aspect to the marketing component is in the promotion of the product. In order to build recognition and raise the reputation of the product the marketing group will need to work with our existing dealers to accurately promote the product and the brand to new fleet customers. Help will be required at trade shows and on advertising campaigns through the dealer network.

Supply Chain Management/Strategic Partnering is the sixth key success factor. The reason this is important is due to the key components in the system that the manufacturer does not have core competencies in. These partnerships allow for components to be designed to meet the rigors of the truck market as well as to allow for long term agreements in order to achieve the lowest total cost for the selected components. Items like engines, compressors, and heat exchangers are likely for strategic

partnering as all can be re-designed to meet the product demands as well as the end product re-designed to allow for more common configurations to be used to take advantage of scale.

World Class Manufacturing is the seventh key success factor. This factor is required to ensure that the product is built in the most efficient way possible so that the end cost is as low as possible. Quality systems and variation reduction will result in a more consistent output to the end user and result in higher levels of customer satisfaction.

Vertical Integration of core technologies is the eighth and final key success factor. Certain components such as electronic controls and the generator itself should be considered for in house design and manufacturing. Core competencies in the design of these components are crucial in order to understand what can go wrong in the field and in turn design in the qualities required for the product. Controls need to be designed with specific understanding of the user requirements and software for the controls needs to be updateable to address required changes or configurations. The only way to accomplish this in a timely fashion is to have the in house capability.

2.4 Competitive Analysis

The North American auxiliary power unit market for trucks has a large number of players, many of which are garage type companies that are trying to get into the industry. Most of these players do not sell more than 100 units per year and have been ignored for the competitive analysis. I have focussed on the three main players in the market, ourselves (Power Systems), Rigmaster (our longest running competitor) and Thermo-King (a new entrant, but with an extensive history in the truck market with other similar

products). In Table 7, I have listed the key success factors from the previous section and applied a relative weight based on importance for the truck market. Then the three companies were assigned a relative score on each KSF.

Table 7: Competitive Comparison of Key Success Factors

Auxillary Power Units Key Success Factors	Weight	Power		Rigmaster		Thermo-King	
		Value	Score	Value	Score	Value	Score
Product Design for Robustness and Reliability	24	6	144	4	96	4	96
Dealer Network	20	3	60	3	60	8	160
Total Overall Product Cost	16	4	64	3	48	7	112
Product Support/Training/Service	12	6	72	3	36	8	96
Marketing/Voice of the Customer	10	4	40	3	30	8	80
Supply Chain Management/Strategic Partnering	8	3	24	3	24	7	56
World Class Manufacturing	6	6	36	1	6	6	36
Vertical Integration of Core Technologies	4	5	20	2	8	5	20
Total	100		460		308		656

Rigmaster has a strategy focussed on being a low cost provider of auxiliary power units in the market and were the first to offer factory direct sales and installations.

Rigmaster has an extremely small engineering department for new product design which is evident with the current model changing very little over the years. This has allowed Rigmaster to stay focussed on fine tuning its offering. So far Rigmaster has been very successful, managing to compete on price and quality without having a large corporation's support during the slowdown in the truck market 2 years ago.

Thermo-King is the leading supplier of refrigeration devices for stationary applications such as grocery store freezers and mobile applications such as truck trailers. Thermo-King is a high quality, innovative company that has been very successful in its markets.

The score for product design for robustness and reliability was done based on personal field exposure to the devices and feedback from users. The current unit offered by Power Systems has a warranty rate of 7% of sales, and is regarded as the most reliable unit in the market. Our competitors have been tested at various fleet customers side by side with our own and it has been stated that our unit is more reliable. The Rigmaster unit is different in design by having the condenser inside the unit rather than mounted outside on the back of the truck cab. This will result in premature failures at higher temperatures as the unit is unable to dissipate the heat of the engine and the air conditioning condenser. Our unit has the condenser mounted remotely from the enclosure and has proven to work in climates where the Rigmaster will not. The Thermo-king unit is a reverse engineered copy of our unit with some added features such as a larger alternator and the ability to start and stop as needed throughout the night for improved fuel savings. But the unit has the same significant disadvantage as the Rigmaster, with the condenser coil inside the main enclosure, which again will likely result in overheating at higher temperatures.

Thermo-King scored much higher in Dealer Network as they have a significantly larger dealer network throughout North America, numbering over 800 facilities. Power Systems has 120 licensed dealers and Rigmaster has 126 dealer locations with one of them being the production facility. This dealer network allows for faster distribution and product availability enabling Thermo-King to capture significant market share.

The Thermo-King unit scored higher in Total Overall Product Cost as it is has a larger alternator for faster battery charging, higher BTU output for air-conditioning, and the ability of the unit to start and stop automatically due to heating and cooling requirements of the operator. This results in lower fuel consumption as well as decreased

hours of use which in turn results in a longer maintenance interval. The Rigmaster was scored slightly lower than the Power Systems unit as it requires more maintenance due to the extra belt to drive the air conditioning compressor and the fact that it does not start and stop automatically like the Thermo-King unit.

Thermo-King scored higher than Power Systems and much higher than Rigmaster in the product support service and training section. This is due to the larger dealer network and reputation in the industry for product support. Power Systems, even with a dealer network the same size as Rigmaster, has a stronger reputation in the industry for product support and training than Rigmaster.

Thermo-King again scored higher in the marketing key success factor due to its length of history in the truck market with refrigeration units for trailers as well as other ancillary products. Thermo-King invented truck trailer refrigeration units back in 1938 and has since been the market leader in that product line. This has given Thermo-King a huge market presence as well as an established customer base in order to get applicable data and customer input. Power Systems scored slightly higher than Rigmaster due to their longer market presence with the heater product line that uses the same brand name “Proheat” as the auxiliary power units.

Power systems and Rigmaster scored the same on the supply chain management/strategic partnering factor as few partnerships exist at this time. Thermo-King on the other hand has some existing relationships with engine suppliers as well as air conditioning components due to these components use in the truck refrigeration units.

Thermo-King and Power Systems scored higher than Rigmaster in the world class manufacturing KSF mainly due to their large manufacturing base and experience in other

product lines. Rigmaster has only been in business for 10 years whereas Power Systems and Thermo-King have over 50 years of manufacturing experience.

In the vertical integration of core technologies both Power Systems and Thermo-King scored the same as each are experts in developing some component of the product. With Power Systems the expertise is in control systems and mechanical structures, with the heating, air conditioning, generator and engine being purchased off the shelf components. With Thermo-King, their expertise is in the design of the heating and air conditioning components and the control Systems, with the engine and power source being purchased off the shelf. Rigmaster is 100% off the shelf components.

2.5 Opportunities and Threats

Based on the competitive analysis a number of threats have been identified. The first threat is that of Marketing. Thermo-King is a brand that is very well known in the truck industry as it was the inventor of the reefer unit (refrigeration units that cool the trailers of long haul trucks) more than 60 years ago and the current market leader in that product. The Thermo-King marketing group has the expertise to establish itself as a leader in the market by utilizing the same marketing style that has made them successful in reefers with the brand name that carries with it the quality, expertise and support that customers are looking for. Our current brand “Proheat” is also well known in the industry for heaters in trucks, another fuel saving, idle reduction product. Our auxiliary power units carry this same name which gives us credibility in the market as a company that has been around for a fairly long time, 15 years, and one that stands behind our products.

The second major threat is that of the dealer network. The dealer network that Thermo-King has available for the sales and service of the unit is much larger than our own and has the potential of shutting us out of current dealers that could be pressured by Thermo-King to drop our product line altogether. Each of these dealers has the ability to service and maintain units as they have extensive experience with reefer units that, as mentioned previously, are very similar in design.

The third major threat is that of total overall product cost. It has been seen by the introduction of the Thermo-King unit that only runs as needed, and thereby reduces operating hours resulting in increased fuel savings and decreased maintenance costs, that this factor is significant. The base cost of the unit and the installation time are higher than ours, but the savings on fuel and maintenance has resulted in our losing sales, most recently that of the Wal-Mart fleet of potentially 8000 units.

Our opportunity is that of product design for robustness and reliability and lowest cost. Our experience in this market has given us a significant head start over the competition. Even if they were to reverse engineer our current product as Thermo-King did, our engineering and product support teams have 2 years of product knowledge and learning that our competitors do not. This knowledge for a competitor to get will take extensive testing as well as at least one winter and one summer on a large quantity of vehicles. By the time they accomplish this we will already be releasing a new design that incorporates their new features as well as any deficiencies we recognized a year earlier.

2.6 Strategic Alternative

Considering the problem of low profitability the analysis has identified the following opportunities and/or threats:

- 1) Product Design for Robustness and Reliability
- 2) Product Support
- 3) Total Overall Product Cost
- 4) Dealer Network

Based on the above the author suggests a focused cost based strategy. The focus of the strategy needs to be on the fleet customer not the owner operators or single points of sale. This strategy is aligned with our current corporate strategy and will require some changes in product development, systems and organizational structure in order to be successful.

Power Systems needs to capitalize on the experience gained over the last 2 years in this market and develop a new product offering that significantly increases its reliability and robustness. This product needs to have longer service intervals, fewer components, increased wear resistance to corrosion and vibration, and must incorporate the new features that current customers want and our competitors offer. This new unit needs to be developed so that the installation time and product complexity is greatly reduced, which will reduce total cost to the customer and also reduce the amount of product support required to service the expanding market.

With the increasing market size, the potential for aggressive pricing exists if we can get a unit that can be produced for less than the current unit. We are currently priced

in the market at \$235 less than Rigmaster and \$600 less than Thermo-King. If the new unit has significant cost savings further price reductions could be made, which will enable us to capture a significantly larger market share. Market share could also be captured with a more reliable and robust unit as a longer mean time between failures for warrantable components allows for the warranty period to be extended past those of our competitors.

Another benefit of a more reliable product is that the product support group will be able to do more training of dealers on proper installation and maintenance rather than spending a lot of their time on troubleshooting support. This will help with the setting up of more dealers that can perform good installations, thereby increasing customer satisfaction and increasing the brand value through word of mouth.

Marketing needs to work more closely with our dealers to educate the fleet market on our product offering and promote the fact that we have the most experience in this market and that our products have been tried and tested longer than any of the competitors. Marketing must then expand its dealer network, especially to dealers not affiliated with a competitor such as Thermo-King and Rigmaster, and work with these new dealers on fleet focussed sales. More aggressive pricing will be able to be offered with a lower cost unit and increased sales volume resulting in increased market share. This focus with the dealers more directed at the fleet customer rather than the owner/operators and will also help to free up the product support resources that are currently spending time on the individual owner/operators.

To expand the dealer network there are 3 main alternatives. This first is to continue to look for dealers in much the same way as present and slowly add them on a

state by state basis. The second is to work with one or two of the national truck stop repair companies that already have locations around North America. By partnering with one of these companies, such as Travel Centers of America Inc., we could gain access to their 150+ locations that offer full service garage facilities for installation and sales of the units. The third option would be to look at a company such as Carrier Inc., Caterpillar Inc, or Cummins Diesel Inc. who also have a national dealer network and who may be interested in getting into the market through a partnership arrangement or by acquiring the Power Systems division from Teleflex Inc. It is estimated that in order to achieve our target sales figures over the next 3 years, the dealer network will need to double in size from its current 120 locations to 250 locations in North America.

Marketing will also need to capitalize on the “Proheat” brand name that we have had in the market for idle reduction heaters for the last 15 years. This brand is well recognized in the industry and currently carries with it a level of confidence in product reliability and product support comparable to Thermo-King. This brand history needs to be promoted by the dealers as much as possible to maintain its image.

Another benefit of the project will be to make us even more attractive as a partner to the original equipment manufacturers who will likely consider an auxiliary power unit to be installed at the factory level on trucks sometime in the next few years. A product that has the lowest cost as well as a being well recognized in the market may be incentive enough for the manufacturers to work with us rather than designing their own unit.

Lastly, this strategy capitalizes on our in house engineering ability in new product development and will require an ongoing investment into the engineering department to ensure new features can be incorporated into the current design as soon as possible after a

competitor introduces it to the market. The product design team will also continue to work with supply chain management and operations on potential price reductions due to sourcing activities or efficiency improvements. This new product development will combat the threat of Thermo-King or Rigmaster by keeping up in the product design process and maintaining price leadership by cost reducing and implementing the new features that competitors come up with.

3 INTERNAL ANALYSIS

In the internal analysis I have tried to evaluate the proposed strategy against management preferences, current resources, and the organizational strategy. The strategy proposes that a new product development initiative is undertaken that will result in a product that has a lower total cost to the end customer. This product needs to be designed to reduce installation cost, extend the service interval to reduce maintenance costs and to reduce the fuel consumption to increase the return on investment of the end product to the customer. This new product, if proven to be significantly more reliable and less expensive than the competition, will allow for us to continue with our price leadership and make it more difficult for Thermo-King to gain market share.

3.1 Management Preference Analysis

In the following section, I have analysed if the required management preferences for the strategy are present in the organization and the risks associated with these preferences.

3.1.1 Management Preference Identification

The proposed strategy fits with the current strategy of being aggressive on price and leading in niche markets. It has been observed that new product development is promoted and supported in Power Systems and there is no indication that this won't continue. Engineering, Purchasing, Manufacturing Engineering, and Operations work together on new product launches to try and incorporate as many improvements in the

design as possible from an early stage. The only risk associated with the new product development portion of the strategy is that the individual department goals may take priority over the new product development due to the short term gains that can be realized versus the impact of the product over a year away. This risk would likely result in one of two things: 1) the product development cycle would take longer than expected or; 2) the product cost would be higher than planned. Both of these risks are significant to the strategy as they could have significant impact on the financial health of the division. If the product takes longer to launch, we will lag behind our competitors, and if the product cost is higher, lost profits would occur while costs were worked out.

3.1.2 Existing Preference Comparison

The management preference for the design department fits well with the proposed strategy. The current engineering departments are receptive to input from other departments such as product support, manufacturing and purchasing. Current product development is done in a number of ways all directed at achieving the lowest total cost.

The manufacturing engineering department manager's preference is also for the proposed strategy as it is recognized that growth due to new products is required for the long term success of the company, but it has been observed that current production problems or cost reduction initiatives can take priority away from the new product development. Current metrics for this department don't include that of new product development. The risk of this happening is low-medium.

The supply chain management department is also supportive of new product design but again can be easily distracted to work on more immediate cost reduction

efforts that help make the targets for the current year. This distraction can cause delay in parts being ordered or haphazard selection of vendors for expedience sake. Again, much like manufacturing engineering, current metrics for this department do not include new product development. The risk of this happening is medium-high.

Product support is very much committed to new product development, especially if the project is centred about improving the current model so that it is easier to install, maintain and more reliable. This makes their job easier and lets them focus on the other half of their job which is training and installations rather than troubleshooting and repair. The product support manager works hard to contribute to all designs and is constantly suggesting new and improved ways of doing things. His commitment is almost guaranteed to the new product development program, with the only risk being that the workload increases to a point that his involvement is threatened. I would quantify this risk as low.

The marketing component of the strategy fits well with the current corporate cost based strategy but will need to be directed even more towards the fleet customer. Sales and Marketing needs to work at expanding our existing dealer network with dealers that are well connected to fleets. The current dealer network should be reviewed and any that are not should be encouraged to focus less on the individual owner operators and more on fleets in the immediate area. By concentrating on fleets we will be able to focus our product support resources on single customers with many units rather than many customers with single units. Technical support can be given directly to the fleet maintenance manager rather than to the many different service centres.

3.1.3 Management Preference Gap Closing Analysis

The engineering design group needs very little in the way of gap closing in order to be able to come up with the new product design that meets the requirements of the strategy. But the other inputs into a successful development and launch of the product such as manufacturing engineering and supply chain management are where the difficulties lie.

In order to close the gap with respect to manufacturing engineering, and that of having a dedicated resource for the project, a new directive must come from senior management that takes the involvement of the individual on the team and holds it in as high a regard as those activities in cost reduction initiatives. The manager of the department must be able to reward those persons on the team in the same way as other successful manufacturing engineers when the dollar figures resulting from their contributions are not yet recognized. To do this the manager must be able to fill the position and not be tempted to use the dedicated resource on other activities. To alleviate the temptation to pull the resource away from the project, the manager must be allowed to hire another person to do the tasks that the person who was re-assigned to the project was doing. A new metric should be given to the manufacturing engineering team that clearly promotes the role of new product development and sets goals with respect to design for manufacturability and fixture/process development that can be related to a successful launch. This new metric will help to justify the personnel for new products as well as maintain existing personnel for cost reduction and efficiency improvement projects on products already in production.

If this formal commitment by senior management can be given to the manufacturing engineering group, I believe the likelihood of success is quite high. The motivation is already there, the skills exist, and the people committed to making every product a success.

The supply chain management group also suffers from the same type of distractions as manufacturing engineering. Part shortages, cost increases, delivery delays, and supplier shutdowns are just a portion of the problems faced daily by purchasing. To lose a resource to a project on a full time basis would only apply a larger workload to those in the department and result in the project purchaser being pulled back to help out. Again, much like manufacturing engineering, a full time person is required for the project and this person must be replaced in the purchasing department. New metrics inclined towards new product development must be implemented to get this dedication as current metrics based on part cost reductions are easily measured.

The likelihood of closing this gap is more difficult than the manufacturing engineering role as management bonuses are closely tied to that of cost reductions and not to new product development. It is almost in conflict as it is in the best interest of the supply chain to have a product launch with a higher cost so that the next year can be spent reducing the cost, resulting again in bonuses.

3.2 Resource Analysis

In the following sections I will analyse if the proposed strategy can be accomplished with the current resources and determine the costs and risks associated with any new resource requirements.

3.2.1 Resource Requirements

In order to accomplish a focussed cost based strategy that capitalizes on the current product knowledge for reliability and robustness a team with specific technical abilities will be needed.

Mechanical design will require a team of four mechanical engineers for the project. This team will be responsible for the entire mechanical package of the unit, which include engine mounting, frame, enclosures and exhaust (noise reduction). The skills required by this team will be knowledge of the environment that the product needs to survive in as well as ability to design for manufacturing and assembly to keep product costs low. This skill set is already available in house.

Two more designers will be required for the heating and air-conditioning unit that goes under the bunk in the truck cab. This group will be responsible for the arrangement of components inside the enclosure and the simplification of the split system to reduce leakage points and installation time. This design will require the careful selection of components from existing vendors to ensure long life and increased BTU output. This skill set also exists in the Power Systems division, but only with one individual; the second designer will need to be hired for the project.

One designer will be required to work with existing generator manufacturers on the design of a generator that can be direct coupled to the engine to eliminate the belt drive, thereby increasing service intervals and lending the design to a more sealed unit. The sealed unit helps with life expectancy as it keeps road debris to a minimum, which can be hard on bearing and wear surfaces. This skill set is available in the Power Systems division.

A team of four electronic engineers will be required for the development and integration of a new control system that is more adaptable and trouble free than our current control system. The controls need to be designed resistant to electromagnetic interference as well as being easy to install. The control system also needs to have a minimum of connection points and if required those connection points need to be sealed and secure in order to eliminate the likelihood of intermittent contact that can cause system failure. This skill set is also already available in the Power Systems division.

One model prototype builder will be required for the development of prototypes for design evaluation purposes and testing. This person should be a mechanical engineer or technologist with a strong mechanical background so that technical problems with the design can be communicated properly to the appropriate design engineer. The skill set for this position is available in the Power Systems division.

Two test engineers are required for the validation testing of the new designs to the specification criteria. These engineers will be required to perform static and dynamic testing of prototypes as well as environmental testing for vibration and corrosion effects. Further to the lab testing will be the requirement of real life field testing where these engineers will need to go to a fleet of trucks, install prototypes and then monitor their progress via email, phone and if possible direct contact with the users to ensure proper operation. This skill set also exists in the Power Systems division, but only with one individual; the second test engineer will need to be hired for the project.

In order for the design and launch process to go smoothly a dedicated project purchaser is required to source components and begin building relationships with key vendors. This purchaser will work side by side with the engineers to ensure that suppliers

have the required technical ability as well as the quality requirements for the end product. This skill set is available in the supply chain department in the Energy Systems division.

As the project gets past the early development stage there will be a requirement for two manufacturing engineers. These engineers need to be able to bring manufacturing process expertise to the design so that parts are developed that can be consistently manufactured to the minimum quality requirements at minimum cost. All too often designs are taken too far down the path only to discover that with a few changes quality could have been much better and cost lower, this can be mitigated by having manufacturing engineers in the design process early. Currently there are a number of individuals with this skill set in the operations department of the Energy Systems division.

In order to adequately support the launch of the new product and the expected sales increases over the next two years, the product support group will need 6 technicians. This group will come on to the project as final prototypes are completed and prepared for field installation and will attend the field trial locations to document the installation procedure and convey any problems or suggested improvements to the design team. This group will also be responsible for writing the installation manual as well as the troubleshooting guide and will be required to assist with different dealers in the installation of new units and train mechanics in this regard.. The new product development project can be supported by this existing group without the need for additional resources, but the future sales increase and the expansion of the dealer network will result in the need for two more product support technicians to keep the level of support to our dealers at an acceptable level.

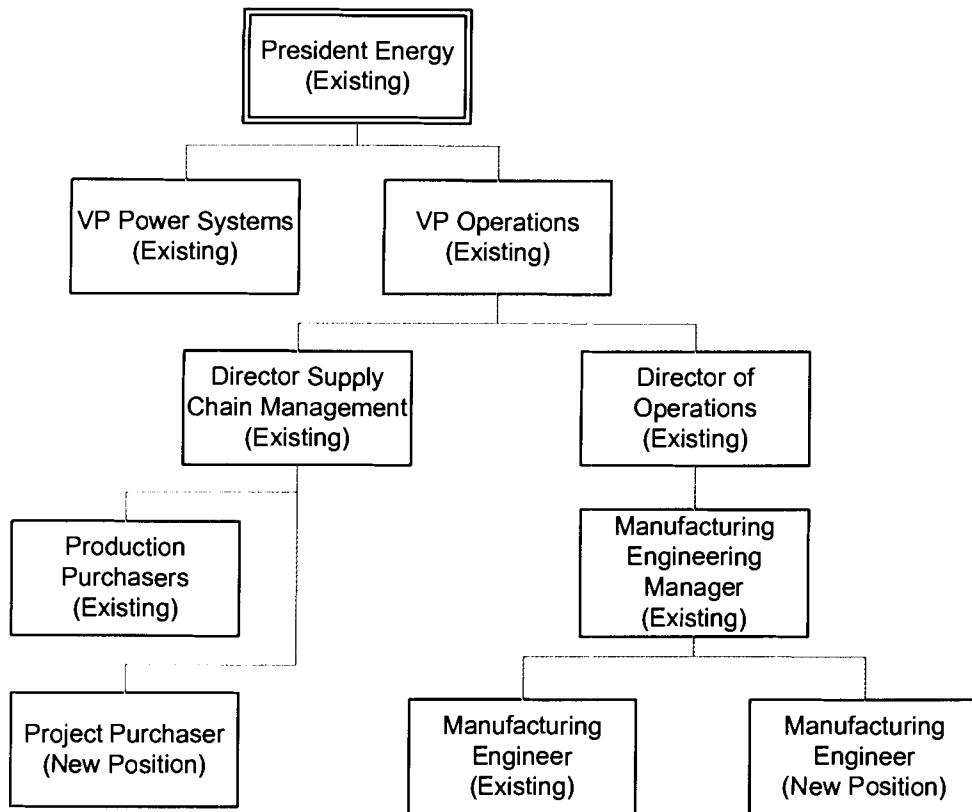
The sales and marketing group will require additional resources in order to double the number of dealers. It is estimated by sales and marketing, that two more individuals will be required to facilitate the new dealers, thereby allowing for each individual to handle 40 dealers, working out to one week per year including travel time for each dealer.

3.2.2 Existing Resource Comparison

Based on the requirements from the previous section, I have compiled a list of positions and compared it to the resources currently available in the division. In Figure 5 I have shown the Energy Division organization chart showing the relationship between the Operations group and Power Systems business unit and the resources required for the proposed strategy. Figure 6 shows where the design team fits in the Power Systems division, followed by Figure 7 where the required design team has been broken down. All other aspects of the business remain in place as no new requirements are needed to facilitate the operations, accounting, human resource and procurement functions. The new product would supplant the existing product offering and only scale effects would be noted as sales increase.

The individual positions are called out on the chart with the appropriate job description and indicate if an individual currently exists in the company to fill the position (existing) or if a new individual needs to be hired to fill the position (new position).

Figure 5: Energy Systems Org Chart¹³



Based on Figure 5 we can see that there are two positions that need to be filled. The first position in Manufacturing Engineering will need an individual with 5 years of manufacturing experience in fabrication, assembly, fixture design and design for manufacturability and assembly and have a diploma or degree in the school of engineering.

The second position to be filled is that of the project purchaser. The individual for this position will have 10-15 years of purchasing experience across multiple product lines such as fabrication, electronics and off the shelf components suitable for the product.

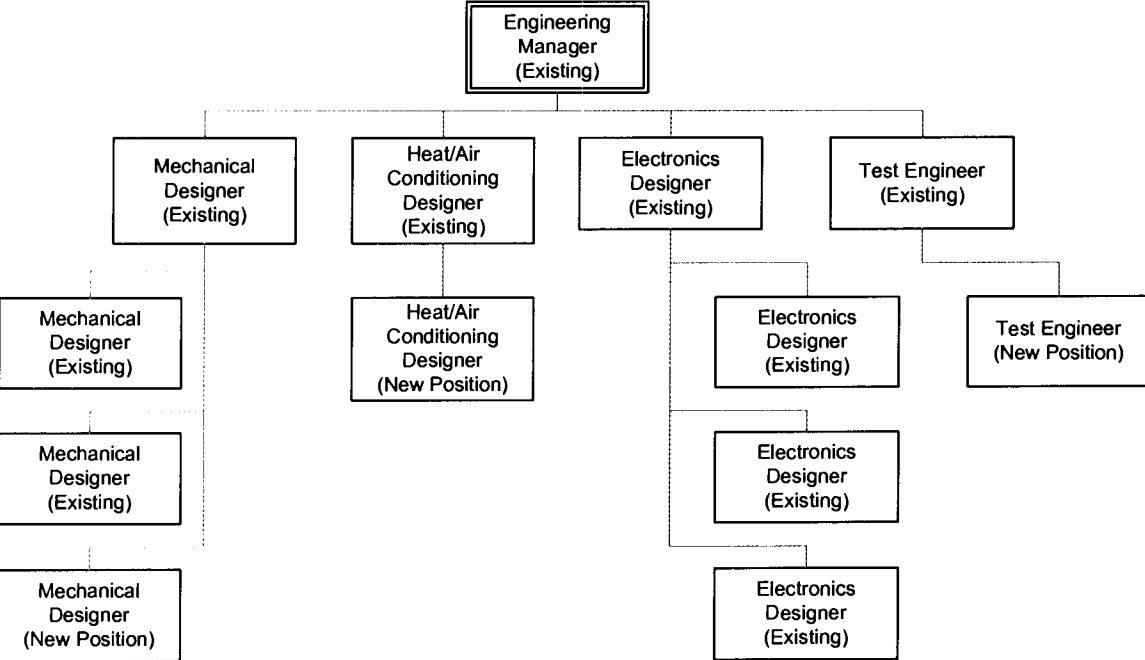
¹³ By author

Figure 7 shows the proposed design team to develop the new product. Again the three positions that do not have an available resource to fill them internally are identified in green.

The mechanical designer and heating/air conditioning designer position requires a less seasoned individual but this person must be proficient in the design tools currently in use in engineering such as Pro-Engineer cad software.

The test engineer position requires an individual with experience in testing products for the automotive market and must be skilled in creating test plans and conducting the required tests. Test report writing is a critical skill for this position in order to capture the knowledge accurately so that learning can be transferred to others in the engineering department.

Figure 7: Design Team Org Chart¹⁵



¹⁵ By author

The rest of the positions that are labelled with (Existing Position) indicate that a person already exists in the division with the skill necessary to perform that function. These people are currently finishing up their current projects and are available to start work in the very near future. This makes for an opportune time to begin the next product development program and with these individuals being fresh off the last design project they can apply their learning to this one.

3.3 Gap Closing Analysis

3.3.1 Engineering Positions

The three new engineering positions, Mechanical Designer, Heating/Air Conditioning Designer and Test Engineer that need to be filled will need to be done so by hiring new people. These extra resources are not available internally, will cost about \$80,000 each per year and can be sourced in the local job market quite easily. In order to try and further align the proposal with the company strategy we could look elsewhere in the global organization for individuals that could be temporarily relocated, if the costs make sense, or even work remotely from the core design team. Generally with all projects there is a core team of full time designers, a few of the positions are usually filled by contractors that do the drawings or other less critical functions of the design. By utilizing a Teleflex employee from another division we help to spread learning across the organization as well as promote the company as one that values its employees. We currently have the ability for live video conferencing and could easily make the arrangements necessary to have the individual perform the tasks that do not require being located with the bulk of the team, such as drawings or test reports. Whichever method is chosen to fill the positions, the associated risk is very low.

The manufacturing engineering position is more difficult to fill due to the complexity of the product, the type of assembly processes involved and the quality output required. In the past, good manufacturing engineers have been difficult to find and when found take a long period of time to train to a level that their contributions are valuable. This position will cost \$60,000 to \$90,000 per year, depending on experience, but will provide for significant return on investment in the form of throughput and quality. The risk associated with filling the position is medium.

3.3.2 Project Purchaser

The project purchaser needs to be able to work with technical people on a daily basis and will be doing a great deal of prototype buying that will likely need to be expedited for the prototype schedule. The project purchaser also needs to be very familiar with the existing product line and the suppliers currently being used, and well versed in the tools in use and lines of communication that exist between the divisions in order to utilize the cost based strategy of the corporation. In order to adequately fill this position it is likely the person needs to come from internally. The person could be selected from the existing Supply Chain department and that position backfilled through hiring a new employee. The cost for the project purchaser is likely around \$80,000 per year with the risk associated with filling the position medium-low if filled internally. If the position needs to be filled externally with someone who has no experience with the Teleflex organization, the risk will be med-high and may impact the project.

3.3.3 Product Support

The product support technicians need to have a broad skill set. They need to have a high mechanical aptitude as well as the ability to speak in public, for training, and to be able to convey information clearly for the phone support calls. This set of skills has been difficult to come by but because these technicians are required for the business at the tail end of the product, we will have sufficient time to hire and train someone with the skills required. The cost for these individuals is around \$75,000 per year, but with another \$50,000 each for travel expenses. The risk associated with filling these two positions is medium.

3.3.4 Sales & Marketing

The sales and marketing individuals should have experience with dealers and distributors in a market similar to the truck market. A high degree of communication skill is also required to be able to work with engineering, product support, and the mechanics and business owners that will be encountered in the field. These positions will have a salary in the range of \$85,000 per year with travel expenses of \$100,000 per year each. The risk associated with filling these positions is medium-low.

As shown in Table 8 the following are the extra costs and risks associated with the resource requirements of the strategy.

Table 8: Extra Costs for New Positions

Position	Salary	Travel	Risk
Mechanical Designer	\$ 80,000		Low
Haet/Air Conditioning Designer	\$ 80,000		Low
Test Engineer	\$ 80,000		Low
Manufacturing Engineer	\$ 75,000	\$ 10,000	Medium
Project Purchaser	\$ 80,000	\$ 20,000	Medium-Low
Product Support Technician	\$ 75,000	\$ 75,000	Medium
Product Support Technician	\$ 75,000	\$ 75,000	Medium
Sales Rep	\$ 85,000	\$ 100,000	Medium-Low
Sales Rep	\$ 85,000	\$ 100,000	Medium-Low
Sub Total	\$ 715,000	\$ 380,000	
Total		\$ 1,095,000	

Based on the risks and costs associated with the resource requirements of the strategy I would recommend proceeding without modification. The likelihood of failure in any of the positions is low to medium.

3.4 Organizational Analysis

In this section I have analysed the current organization with respect to culture, systems and structure and identified the gaps that need to be filled in order to be successful with the proposal.

3.4.1 Identify Organizational Capabilities and Gaps

3.4.1.1 Culture

There are a number of cultural traits that run fairly deep within the management and workforce in Energy Systems. I have tried to concentrate on the three that I think show themselves on a daily basis in all departments, focus on costs, focus on speed, and tenacity.

In all departments from the beginning of a project through to launch there is always a strong focus on doing it for the lowest total cost. All choices are weighed against cost and further pushed to achieve the lowest cost for the benefit received. Costs are looked at for designs, parts, tools, and department expenses. This cultural focus stands out among all team players as cost is reinforced in every review meeting or challenge, and new members are quickly indoctrinated.

The focus on speed is also one that is culturally ingrained. Projects are carried out with aggressive schedules to try and get to market fast, in order to keep up with the competition. The author recalls one instance where at the Louisville truck show in 2003 the main competitor came over to look at our booth. Rumour had it that they had purchased a unit from one of our dealers and were in the process of testing and reverse engineering the product for marketing and development purposes. As they got closer to the booth it was clearly evident by the looks on their faces that they had purchased the model that we were phasing out. The 2004 models in the booth were nothing like the unit they had purchased. No other competitor has been as fast to market with design changes or improvements as Power Systems. It has always been our intent to launch a new product on a yearly basis that addresses any reliability and robustness issues that have come to light with the existing unit, to take advantage of any cost reduction opportunities recognized during the year previous, and to implement any new features offered by our competitors. This focus on speed helps us to pull out all the stops in design, supply chain and manufacturing to get a new product in production as planned.

The last cultural trait that I believe is the basis of them all is that of tenacity. The teams formed to work on any of the new initiatives in the company whether they are

design projects, cost reduction programs, or operational improvements, are committed to its successful completion. Quitting or giving in to the competition is unheard of as the employees put incredible effort into winning.

The gap that is evident with the current culture is that of the competitive nature between the departments in achieving their goals. This competition sometimes creates a selfish stance on those tasks that support the goals of the individual departments. If these goals are not jointly held between these departments and a dependency exists, as between product design and purchasing, the purchasing activity required by the new product design will be the lower priority.

3.4.1.2 Systems

In Teleflex Energy there are a number of different systems in place that support the proposed strategy. The first system is one of corporate wide metrics that are used to set goals for all the different locations around the world that are consistent and measurable. The different locations are all given targets to achieve and quarterly results are sent to corporate for review and, if necessary, plans are put in place to get back on track to achieve the goals.

Figure 8 below is an example of the Power Systems strategic scorecard that lists the nine improvement priorities that the division is focussed on. As can be seen from the list all of the improvements are focussed on reducing costs other than the last priority of New Product Sales. This system is used monthly to track all activities to ensure alignment with the corporate strategy.

Figure 8: Scorecard¹⁶

No.	Improvement Priority	Measure	2005	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
1	Manufacturing Cost Reduction		Plan YTD														
			Act YTD														
			Plan Mtd														
			Act Mtd														
2	On Time Delivery		Plan														
			Actual														
3a	Accounts Receivable		Plan														
			Actual														
3b	Accounts Receivable		Plan														
			Actual														
4	Past Due		Plan														
			Actual														
5	Warranty		Plan														
			Actual														
6	Product Cost Reduction		Plan YTD														
			Act YTD														
			Plan Mtd														
			Act Mtd														
7	Non- Product Cost Reduction		Plan YTD														
			Act YTD														
			Plan Mtd														
			Act Mtd														
8	Inventory Turns		Plan														
			Actual														

No.	Improvement Priority	Measure	2005	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
1	Trade Sales		Plan YTD														
			Act YTD														
			Plan Mtd														
			Act Mtd														
2	Operating Profit		Plan YTD														
			Act YTD														
			Plan Mtd														
			Act Mtd														
3	Working Capital		Plan														
			Actual														
4	New Product Sales		Plan YTD														
			Act YTD														
			Plan Mtd														
			Act Mtd														

The system works very well for most of the activities except for the new product sales target. This activity is difficult to work with as the new product has already been completed and has been launched for sale. If the sales don't materialize or significant product changes are required then the target is missed. It also does not enforce new product development as the activity is in the immediate future, not months or a year down the road. The significance of this point is that the scorecard does not explicitly call out for any new product development activities. By failing to do so, the other departments have

¹⁶ By author

no reason to fully commit to a new product launch as the metrics that they are being graded on do not have anything to do with this activity. Cost reductions and warranty reduction are two very good examples of how the system has a potential to cause undesirable results. Both of these are based on improving the current state of a product that was launched in the previous year, especially for those products with a 2 year warranty, the costs may not be realized until well into the second year. None of these activities focus on getting the product right for launch.

In order to try and ensure a successful new product design Teleflex uses the D-Chart process. The D-chart is divided into 5 stages, with each stage having specific deliverables and requirements for signoff before the project is allowed to enter the following stage.

The first stage of the process D1 (Dream Stage) is when initial concepts and ideas are screened for feasibility and any minor tinkering is done to prove the extreme basics of the proposed solution. The project leader is then assigned and the engineering manager and product manager approve the project to continue into D2.

In D2 (Development) a preliminary budget is submitted by the project leader along with a project team. Once approved by management a more detailed assessment is completed with input from marketing and customers to finalize the product requirements with targets given for costs, price, yearly quantities, regulatory requirements and product performance. D2 will also see design concept layouts done in Pro Engineer and initial prototypes to prove various concepts and for review by management and possibly customers to ensure the design is on the right track. At this stage the project team is revised as required and the budget proposal signed off to continue into D3.

Detailed product design and validation testing is completed in D3 (Design). This is the stage where all engineering analysis, testing, benchmarking, finite element analysis, hazard analysis and field testing is completed. Detailed design will include all prototyping and the careful analysis of all proposed solutions. Test plans, reports and recommendations are made by the engineering team and the project evolves as required to meet the original product requirements or if necessary the presentation of new concepts that require the modification of the design inputs from D2. Once all validation testing is completed a revised resource requirement and budget is presented and the stage is signed off to proceed into D4.

In D4 (Deployment) the process of launching the product to production begins. It is in this stage where detailed drawings and bills of materials are completed and the necessary production procedures put in motion to guarantee the stable supply of parts. This will include careful vendor selection, process approvals, fixture design, machine procurement, tooling, gauging, and assembly area setup along with a detailed launch plan showing when the first saleable unit is expected off of the production line. Once this is completed the project is signed off to progress into the final stage of the D-Chart, D5.

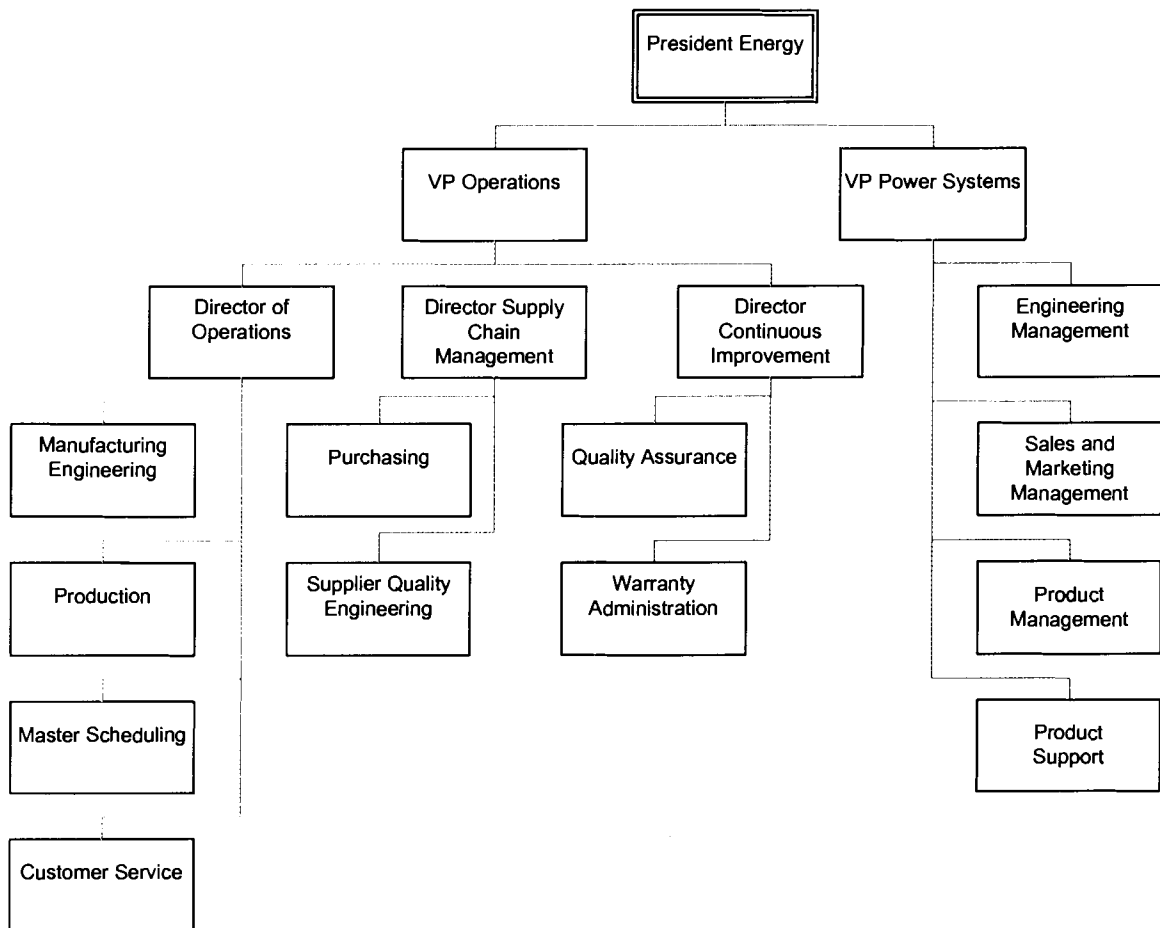
D5 (Delivery) is the stage for ongoing quality improvements and capability studies. It is in this stage where training and processes are refined to the point that quality is guaranteed and that appropriate metrics are set for future performance goals.

The D-Chart and Scorecard systems as described both try to keep costs down but both are lacking by not having a metric ensure that the appropriate amount of attention or commitment is given to the project by other departments that are integral to its ultimate success. This gap is significant to the proposed strategy and will need to be closed.

3.4.1.3 Structure

The current company organization chart is shown in Figure 3 in chapter one. What is not shown in the organization chart is the relationship between the operation function of the company and the Power Systems business unit. In Figure 9 below the operations department is broken down into its main structural components to show the reporting structure of the different groups.

Figure 9: Organization Chart¹⁷



¹⁷ By author

The significance of the org chart shown in Figure 9 is that it shows how the different departments are related to the president of the division. This is important in that there is no direct or dotted line reporting to the VP of the Power Systems Division or to the engineering manager in new product development, of the purchasing and manufacturing engineering function. These are two critical positions for the new product design process and one that is integral to the strategy being successful. On the other hand the organization chart is very well structured to satisfy the requirements of the Strategic Scorecard shown in Figure 8. This enables the operational managers to have direct control over the improvement priorities as laid out by corporate.

The reporting structure between the operations aspects of the business and the VP of Power Systems is the main gap with respect to implementing the strategy proposed.

3.4.1.4 Required Organizational Changes

There are two changes that need to take place to implement the strategic proposal. The first change is with the system used by corporate to track the improvement priorities, the second is with the structure and the reporting of the individuals on the product development team.

The metrics put in place by corporate are very well suited to the cost focus of the current strategy, most of the measures are directly related to cost, while some are related to the operation of the company. What is missing from the scorecard is an item that reinforces new product development as a key component of the cost based strategy.

The measurable that should be added must be directed towards new product development. This measurable should be one that encompasses the development process

and not just the final phase of launch or the sales of the product after launch. The measurable also need to be one that holds all groups accountable, not just the design department. By using the gates in the D-chart process we can come up with a goal that tracks on time to gate signoff for each of the projects for example, but what is missing is who is accountable for the gate signoff and its tracking to plan.

This accountability brings the requirement for change in the organization structure with respect to the new product development process. Currently the team is set up as described previously without direct line reporting to the project manager. This lack of accountability within the team leads to resources supplied by other departments being pulled away for more direct department activities or fire fighting in the day to day business operation. In order to ensure the team focus, members must be assigned solely to the development program and removed from the day to day activities of operations. This requirement is directed solely at the manufacturing engineering and project purchasing function of the development process.

This change in structure will allow the team to focus on the project at hand while using the cultural strengths to ensure the lowest cost product at time of launch. This strive for the lowest cost will come from the competitive nature of the team to not allow any potential cost reductions available to the operation purchasers in the year following for their cost reduction initiatives on the scorecard. It will also see the product launched into production or assembly with lower cycle times, again to make manufacturing cost reductions even harder.

This change in structure may create some difficulties with the teams as knowledge from the production purchasing groups may not be as forthcoming to the development

team, but this needs to be addressed by the President to ensure that the senior management team is working together as a group and ensuring that information flows freely between the online experts and the project team members.

3.5 Financial Justification

The financial justification of the strategy is broken down into two parts. The first is the targeted cost for the end product. The details of the project have been omitted as the scope is a project in itself but the total cost and price target for the end customer are given to show the end effect on the bottom line. The second part of the financial justification is the projected Internal Rate of Return.

Table 9: Proposed Pricing Justification

	Current	Proposed
Product Cost	\$ 6,495	\$ 6,700
Shipping	\$ 200	\$ 200
Inventory Carrying Charge (7%)	\$ 455	\$ 469
Dealer Markup (10%)	\$ 650	\$ 670
Installation Cost @ \$90/hr	\$ 900	\$ 450
Yearly Maintenance Costs		
Belts (2 x \$100)	\$ 200	\$ 100
Oil (6 x \$50)	\$ 300	\$ 150
Total Costs in Year 1	\$ 9,199	\$ 8,739

The target sale price to the dealers for our unit is \$6700, and is justified based on a decrease in installation time of the new product and a decrease in maintenance costs due to the elimination of drive belts and an increase in oil capacity. Table 9 above outlines how the end customer could see a price decrease in the first year from the reduced installation time as well as maintenance costs of the new design. End price to the

customer in the first year is estimated at \$8,739 which is a \$460 price reduction from current levels. This would reinforce us further as the price leader in this market.

The proforma shown below in Table 10 is forecasted for year 2006 based on sales of 6000 units. The total unit volume is a conservative estimate based on current year sales which is expected to increase to 10000 units next year.

The estimated increase due to the seven extra staff for the project has been added to the engineering budget in the pro-forma as well as an increase in fixed overhead costs as it is appropriated to the individual business unit as a percentage of sales.

Table 10: 2006 Proforma

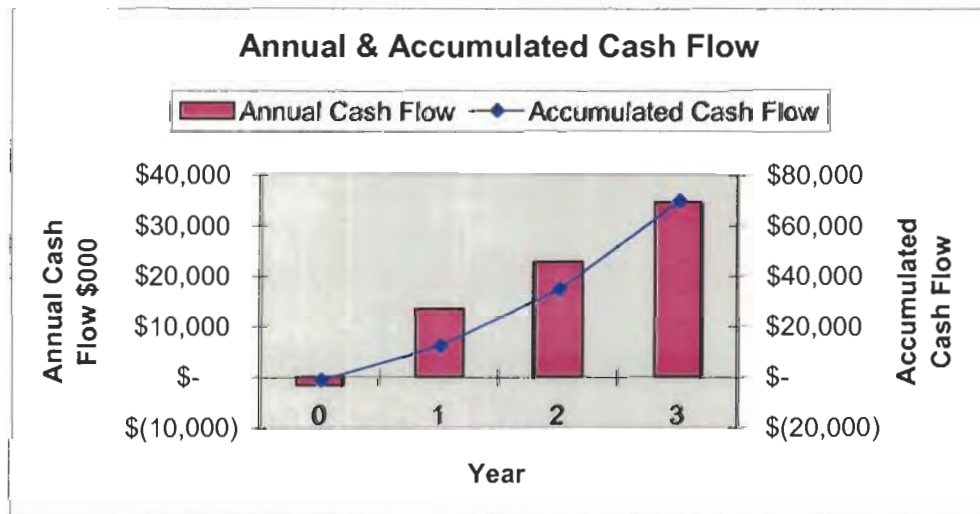
	2006 Current	2006 Proposed
Estimated Unit Sales	6,000	6,000
Sale Price	6,495	6,700
Unit Cost	4,900	4,400
Net Sales	38,970,000	40,200,000
<u>Cost of Sales</u>		
Standard Product Cost	29,400,000	26,400,000
M.I. After Variances	9,570,000 24.6%	13,800,000 34.3%
Fixed Mfg Costs & Operating Exp.	8,398,400	9,665,600
Net Operatin Profit	1,171,600 3.0%	4,134,400 10.3%
All Figures in Canadian Dollars		

The pro-forma shows, with the estimates provided, that the net profit margin target of 10% minimum is met in the first year of sales and would be even better, if after

the first year the engineering budget was reduced to the core group if further product development was not required or another cost reduction opportunity was not recognized.

Table 11: Internal Rate of Return

	Year	0	1	2	3
Development Cost (\$000)	\$	1,623			
Tooling Cost (\$000)	\$		83	167	167
Marketing Launch Costs (\$000)	\$		300		
Total Costs	\$	1,623	383	167	167
Net Sell Price			6700	6700	6700
TVC			4400	4400	4400
MI %			34.3%	34.3%	34.3%
Units Sold, probable			6000	10000	15000
Net Sales (or old COGS) (\$000)	\$		40,200	67,000	100,500
COGS (Cost of Goods Sold) (\$000)	\$		26,400	44,000	66,000
Marginal Income (\$000)	\$		13,800	23,000	34,500
Annual Cash Flow	\$	(1,623)	13,417	22,833	34,333
Accumulated Cash Flow	\$	(1,623)	11,794	34,627	68,960
Teleflex Inc. Discount Rate 15%			15%		
NPV, Net Present Value (\$000)			\$43,377		
IRR, Internal Rate of Return			890%		



The Internal rate of return for the project is shown in Table 11. This table calculates the internal rate of return based on the estimates provided in Table 10 as well as an increase in sales volume to 10,000 units in year 2 and 15,000 units in year 3. This estimate is based on current market forecasts by our sales and marketing team. The sale price of the unit is constant over the three years as it is expected by the sales/marketing team that the cost of fuel will remain high and the cost of the raw materials to make the units will also remain at these same levels. If raw material costs rise it is also expected that it will be felt by all manufacturers of auxiliary power units as the inputs are largely the same. This may cause an across the board inflationary price increase from all manufacturers and would likely not effect our price leader position. As can be seen in Table 11 the rate of return is 890%, which based on past experience is sufficient to allow the project to proceed on a financial basis.

4 RECOMMENDATION

It is the author's recommendation that the proposed new product design project begin immediately and the following changes be made to the market focus, organization structure and management system.

The new product needs to address the current reliability and robustness shortcomings being experienced in the market today. Belt life, air and fuel filter change interval and oil change interval all need to be doubled, noise level reduced, heat and cooling output increased, and installation time reduced to 5 hours.

To accomplish this, the design team needs to continue to focus heavily on reverse engineering any competitive products in this market or similar markets and incorporate any improvements into the design quickly. This product design strategy fits well with the current cost based strategy of the organization, along with the culture in place at Power Systems.

The market focus of the product needs to be directed at the fleet level customers. The dealer network needs to be used to identify key fleets and act as a local supply for the product while the sales and product support teams work with the fleets and dealers on installation and repair. This dealer network also needs to be expanded to increase sales and gain more market share. An agreement with a large nation wide service centre company or working with a potential new entrant to the market needs to be evaluated by the division to determine which offers the best solution

With the new product and the reduction in maintenance costs as well as a reduced installation time the price can be reduced even further than current levels to the end customer while at the same time increasing our profit margin. This is accomplished by the significant reduction in installation time that does not need to be passed entirely on to the customer. Furthermore the target cost of the end product will result in an increase in margin that satisfies the first criteria set forth in Section 1.3. Net operating profit will be 10.3% and a sufficient internal rate of return of 890% is acceptable based on the forecasted project costs and sales volumes.

The organization structure needs to be revised slightly to give direct responsibility to the project manager of the project purchaser and manufacturing engineers. This is crucial to ensure the cost and launch targets of the project are met and utilizes the scale available to the team from the other divisions around the organization. The project purchaser will work as part of the design team without the risk of being pulled off to support current operational activities, while at the same time allow for the use of the current supply chain base. The manufacturing engineers will also work as part of the design team to ensure the product can be produced reliably and at the lowest possible cost using the knowledge and experience gained from previous projects.

In order to reinforce the commitment of management to the new product design program, a metric needs to be added to the facility scorecard that emphasizes the importance of the activity. The proposed metric of "On Time Gate Sign-off" is meant to support the current D-Chart process and provide a means to gauge if a project is on time and to allow for additional resources to be added or the schedule increased if deemed appropriate. Any projects of a significant nature should be broken out individually in this

scorecard. By making this an Improvement Priority on the scorecard, all departments are affected by a failure to meet the plan through the bonus compensation program that uses this scorecard as one of the inputs for determining the total bonus available to the division.

The only criterion that is unlikely to be met by the proposal is that of the solution being implemented by 2006. Based on the author's past experience with projects of this magnitude it is not possible to shorten the timeline by adding more resources or spending more money. Design cannot be rushed, nor can a 60 day field trial or test be done in 30. But even though the product cannot be ready for the beginning of 2006, it can be ready for the third quarter if started immediately. I believe this compromise, for lack of a better alternative, will be acceptable to the management team.

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