Portland State University

Department of Engineering & Technology Management

EXECUTIVE SUMMARY for
DOSING UNIT FOR SELECTIVE CATALYTIC REDUCTION SYSTEM

A PROPOSAL TO:
IDEX HEALTH & SCIENCE

ETM 507 - Intrapreneurship

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June 10, 2011

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Executive Summary

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Introduction

IDEX H&S is part of the IDEX Corporation, a world leader in positive displacement pump technologies and other industrial products that are sold to a variety of customers and industries. The company designs, develops, and manufactures liquid subassemblies and precision components for a wide range of applications requiring precise control and measurement [1]. Currently, it serves pharmaceutical, food & beverage, analytical instrumentation, fire & safety and subsea/marine industry [1].

The executive summary outlines a new business opportunity for IDEX H&S's existing product. The new market identified is in automotive industry with expected U.S. market of $400M. This report provides high level summary of the product, the new market, proposed strategy, risks, and key financial projections for the new application.

Business Objectives & Problem/Solution

A segment of IDEX's business is medical pumps, used for precise and accurate dosing, such as those used to dispense medication. Because IDEX is always looking for ways to expand and grow its markets, some intrapreneurs within the company have suggested a potential way to expand the micro-pump business into an application that would serve a new market—refined fuel and gases—that would, in turn, serve the light diesel engine market. By the end of the fifth year, this new application had the potential to generate 400 million in additional revenue, contributing approximately 5.49 percent to total gross revenue, with a ROI of approximately 7.14 [1].

Government policy would shape this nascent market. The Environmental Protection Agency (EPA) mandated stricter pollution controls that pushed for drastic reductions in NOx pollution in diesel truck engines by 2010 [2, 3, 4]. NOx is a primary cause of acid rain, and diesel engines are a major source, as are coal-burning electric plants and other fossil-fuel burning industries. But diesel engines are by far *the* major contributor to NOx pollution.

There are several technologies that treat exhaust in order to reduce pollution, specifically NOx. Most commonly used in internal combustion engines is a device called a catalytic convertor, widely used in both gasoline and diesel burning engines. Exhaust Gas Recirculation (EGR) is another type of pollution control system that re-circulates a portion of an engine's exhaust gas back to the engine air intake. However, as engines get heavier the need for larger radiators and fans for heat ejection increases, thus adding to the weight of the vehicle [4, 7]. Finally, there is the Selective Catalytic Reduction (SCR) system, also known as an exhaust after-treatment system. The SCR system was the technology that the intrapreneurs decided to use for the new business application, as it uses a micro-pump to inject the exhaust with a measured dose of Diesel Exhaust Fluid (DEF). More about the SCR system will be explained later, but basically, DEF is safe, non-flammable, cheap, readily available, and biodegradable. Most importantly, it turns NOx into harmless nitrogen and water. The SCR system provides approximately 5% greater fuel efficiency over any emissions control system currently available. SCR systems have been around for roughly 40 years, but have not been widely used in the United States; however, it is a proven technology [5, 6].

IDEX's business opportunity is manifest, because each SCR system needs an accurate, reliable pump and controller, and IDEX's medical grade pumps are proven accurate and reliable, perfect for this application. The same technology—but different application—would prove to be the catalyst for a successful new business venture.

Product Description

IDEX's micro-pump is a compact brushless DC electromagnetic drive pump with variable speed electronic controller [8] [Figure 1]. It delivers a

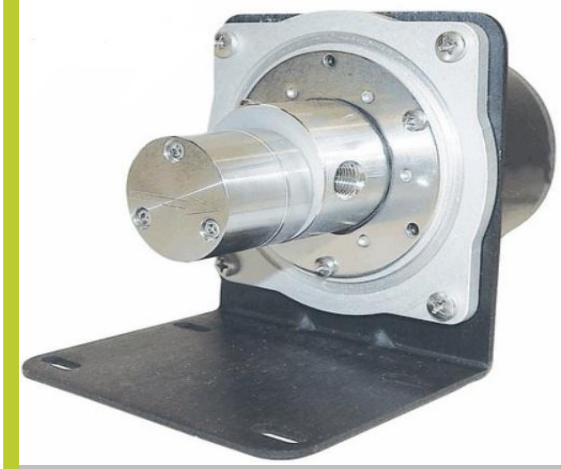

Figure 1 [1]

smooth, accurate, pulseless flow which is critical for the SCR applications. It is a medical industry-proven technology with bottom-line advantages to commercial truck manufacturers and owners. It provides the best urea dosing solution and is the heart for in-vehicle diesel engine SCR systems. Because of the compactness and lightweight nature of the pump, it doesn't add extra weight to the automobile, thus contributing towards the fuel efficiency [9]. IDEX's micro- pumps—because of the superior technology, design and component selections—are more reliable and require less maintenance. One of the most important benefits our micro-pump provides is accurate dosing and dispensing, and because of this it provides ten percent more miles between DEF fill-ups.

Technology

The SCR system works by a simple chemical process involving Nitrogen in the form of urea which is mixed with pure de-mineralized water to form DEF (Diesel Engine Fluid) [9,10]. DEF is pumped at low pressure into engine exhaust system and mixed in the form of fine spray with escaping hot exhaust gases. This process results in the formation of ammonia molecules which starts a simple chemical reduction process in the engine exhaust catalyst, thus reducing NOx and NH3 Ammonia molecules into water vapor and harmless free Nitrogen molecules from the exhaust gases [9,10]. Figure 2 shows the SCR system working process. Thus SCR is an elegantly simple engineering solution for both ensuring clean exhaust gases and providing increased engine performance and efficiency [9].

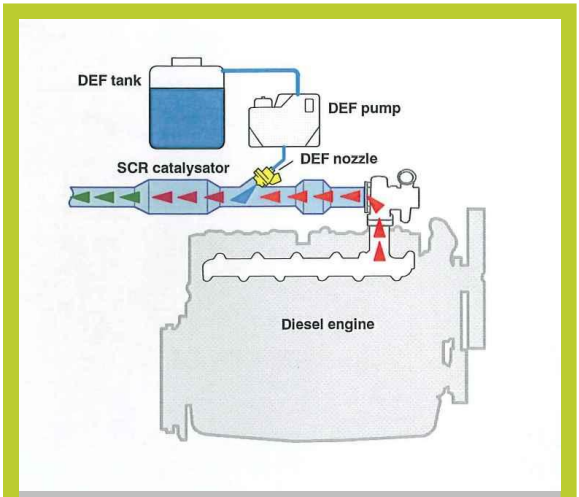

Figure 2 [9]

Market Analysis

A bibliometric analysis [13] was carried out on Google Scholar with regard to the SCR technology in diesel vehicles; it was found to be in the rapid adoption phase by 2010. The technology maturity curve derived from this analysis shows three distinct phases; early adoption, rapid adoption and maturity [Figure 3]. The solid line going down to 2010 represents the current maturity level of SCR technology. That is an indication that the sales of products using SCR technology are growing steadily and will continue to do so at least five years into the future as indicated by the curve below. According to *Diesel Progress International*, sales of products using the SCR technology have been growing at an average annual rate of 12% for the last 3 years and sales growth is projected to remain at 12% for the next 5 years [15].

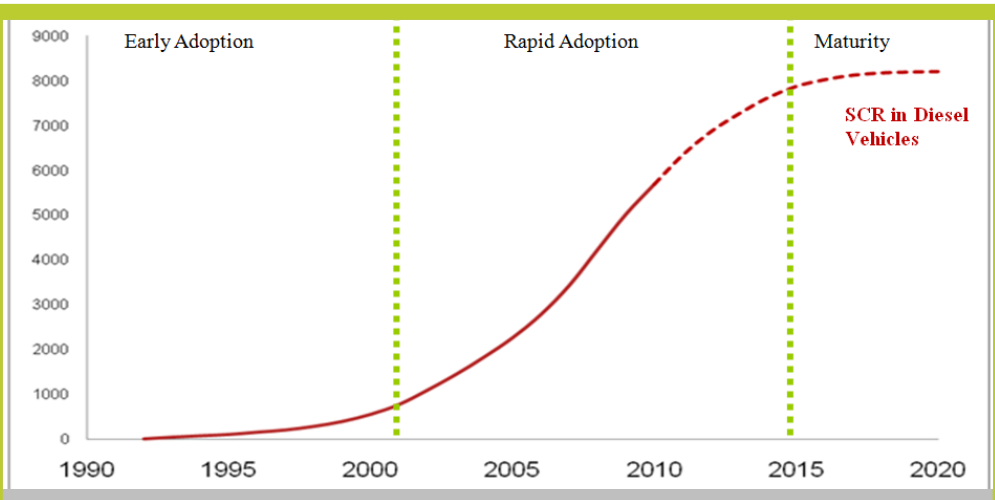

Figure 3

Furthermore, the fact that EPA regulations continue to tighten ensures a steady growth of sales of these products. Further still, there is room for growth in the industrial diesel engine sector – ships, trains, factories etc. in the very long term.

The total market is small diesel engines in the entire United States and is worth $400 million. The accessible market is the small diesel engines of the United States Northwest region worth $60m [12]. The objective is to go national and have achieved a 24 percent market share of the total market by the end of the 5th year of operation. The project team made a decision not to consider any market beyond the borders of the United States at this point because the risk will be substantially high as a result of added complexity with additional and possibly different regulations.

The product will be supplied directly to truck manufacturers; in the Northwest region of the United States, this will be Daimler (Freightliner Trucks and Western Star Trucks) and Kenworth Trucks which is part of PACCAR [11]. Once IDEX goes national with this product, there will be six additional truck manufacturers and 10 smaller vehicle manufacturers.

Competition

Figure 4 shows IDEX's position in relation to its key competitors. IDEX rates higher than any of its key competitors in brands, platform, solutions, organization and processes (5 of 11 factors). In the areas where it is not as strong, there are contingency plans to aid the situation. For instance, IDEX is weak in the supply chain factor; the solution to this is use of Daimler's well established supply chain in the industry. Additionally, where it rates relatively lower, IDEX is either equal to or higher than most of its competitors.

A technical comparison of IDEX's micro-pump to those of its key competitors shows that the IDEX micro-pump leads in 5 of 11 attributes, two of which are critical in SCR technology—accurate dosing and precision.

The positioning of new micro-pump will be stuck-in-the-middle position— medium cost and medium quality. Prices of micro-pumps in the industry range from $700 to $1300; IDEX's micro-pump is priced at $920, about midway through the industry range.

Marketing Strategy

As we already have a strong product that is highly reliable and very accurate with total IP patented and a strong reputation in the medical field where accuracy and reliability are critical, our plan is to start contacting truck manufacturers in the NW region through our senior application engineers to demonstrate the potential of our product applied to their application.

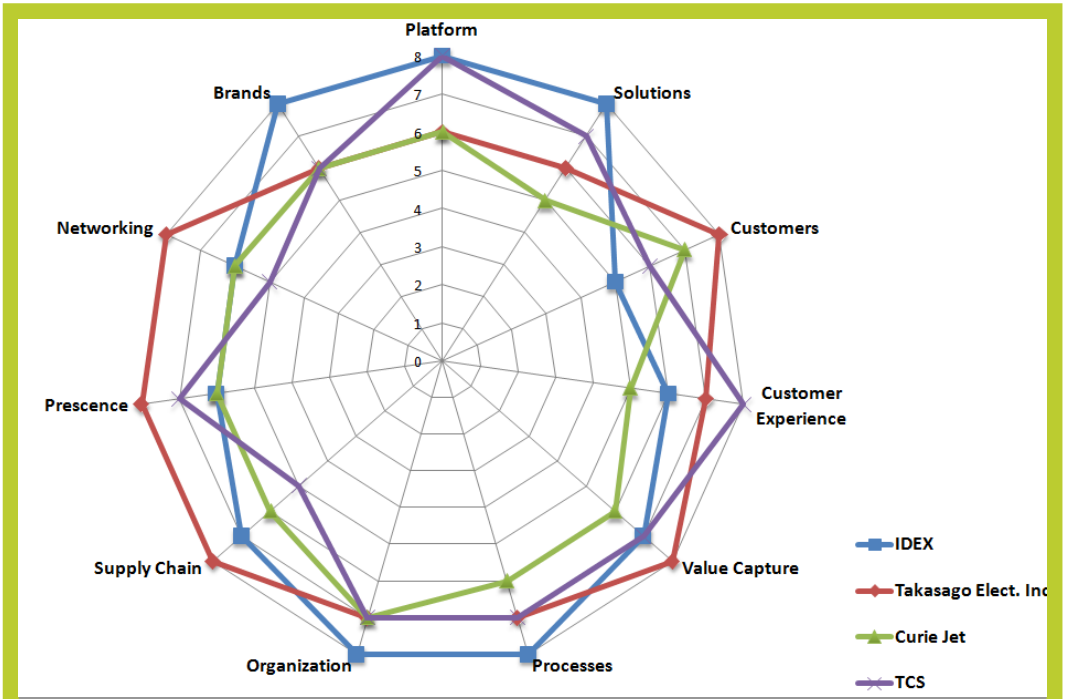

Figure 4

Features	Value/Benefit: Manufacturers	Value/benefit: Truck Drivers & Freight company
Accuracy	• high performance of the SCR system • cleaner exhaust fume ➔ green trucks • consumes less Urea • Reduced repair cost (under warranty)	• Consumes less DEF ➔ low operation cost • cleaner exhaust fume ➔ eco friendly • Fewer stops for DEF refueling
Reliability	• smaller probability of truck breaking under warranty ➔ less cost • better image for the manufacturer	• Less maintenance ➔ Increased security for the long haul truck driver

Table 1

Initial contact and a relationship have already started with Daimler, and our technical application engineers have already gotten a very positive feedback regarding the fitness of our product to their application. Our product's superb technical performance translates very well into values that are very important for the truck manufacturers, and truck drivers/freight companies. They are as shown in Table 1.

Our product benefits enable us to have a Unique Selling Proposition (USP) that will certainly help us achieve our market share goals and expansions throughout US and boost our sales. The IDEX micro-pump technology is in the heart of a truck's SCR system. This enables it to have an environmental friendly truck that requires less maintenance and better operational cost. It is sure to surpass expectations of all truck drivers—from eco minded drivers to the performance savvy ones.

Finally, our focus in this market with this new application is not only very well aligned with our company strategies but also has a very positive effect on our company's mission by extending it to a broader coverage of human being wellness. It can boost our company's brand acceptance and recognition in the market, as well as increase the company's internal collaborators' motivation.

Company Mission

"We focus on fluid delivery systems and solutions that save lives."

New Product Contributes to our Mission

"Our focus is on green products that contribute to a cleaner environment and make lives healthier."

New Extended Company Mission

"We focus on fluid delivery systems and solutions that SAVE LIVES and make LIVES HEALTHIER."

Management Team

Being totally involved and committed with the IDEX vision, mission and the strategy of continuous innovation through IDEX contributors' intrapreneurial actions, the team was formed and committed to the task of finding new sources of growing and sustaining revenues for IDEX.

We assembled a team of experts covering all dimensions of the expertise needed to develop a winning business plan, ranging from mechanical engineering, electronic and system engineering, project management, business analysis, marketing, and team management.
In total, we have over 100 years of combined experience and expertise in the industry, which lends to the successful execution of the business plan. The team's experience provides a high level

Caroline Mudavadi:	15 years as high-tech business analyst
Diane Yates:	20 years in systems and controls
Lokesh Honnappa:	20 years in mechanical systems NPD and Project Management
Napong Tanatammatorn:	15 years in direct sales and marketing
Tin Nguyen:	15 years Microcontrollers and Firmware
Wlamir Mello:	20 years of R&D, NPD and High-Tech Marketing

Table 2

of expertise and maturity, (theoretical and hands-on) not easily found all together in any place. Table 2 shows the combined industry expertise of all team members.

Financial Summary

The initial investment required is $2.5 million. This investment will be used to design and develop the micro-pump which is compatible with the new application, prototyping, and market testing for entry into the market place. The financial projections indicate the time to profit which is approximately 2 years. Table 3 shows the use of proceeds. Note: The time to market for the new product is approximately 6 months and there will be cash inflow from operations. Hence, only $2.5 M is required initially.

Figure 5 shows the forecasts for five years with a steady double digit increase. The revenue for the first year (2012) is $9.2 million, increasing to 98 million by end of the fifth year (2016) with an average growth of 27.5 percent each year. The gross margin at the end of fifth year is 34 percent with a net profit of 8.7 percent. At the end of fifth year, the new product potentially contributes 5.5 percent of IDEX's total revenue, with a cash balance of $20 million. The ROI at the end of fifth year is expected to be 7.14.

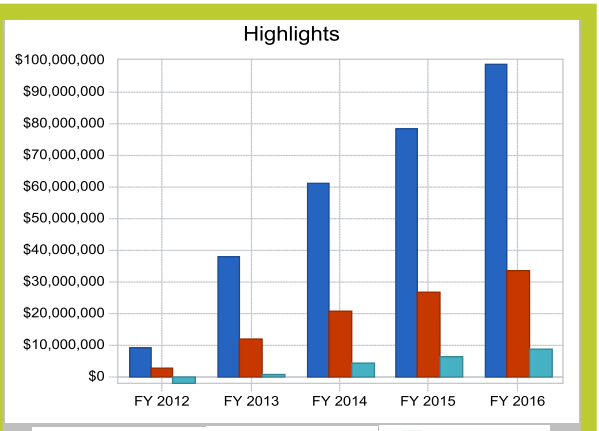

Figure 5

First Year Operating Expenses	$365,992
Payroll	$3,748,128
Marketing/ Promotion	$460,000
Fixed Expenses	$422,961

Table 3

Risk Considerations

We understand that every opportunity comes with risks, and there is no exception with our superior micro-pump. Since this new business opportunity requests the company to commit its precious resources, we have assessed associated risks and present related actions for consideration with the present market and financial opportunities to help mitigate risk. The followings are key risks and their contingencies. We are confident that these key risks can adequately be addressed by our proposed strategy and IDEX's internal strength, which will make the new business opportunity even more appealing.

	Risks	Actions
Techno-logy	Product fails to perform with new liquid in new operating environments.	• Bring in IDEX's core competence in technical knowledge across various fields. • Leverage IDEX's customer-oriented culture to ensure full understanding of customers' requirements. • Share risk with key customers in lengthy and expensive testing.
Organiz-ation	Lack of production capacity and distribution channel in new market	• Plan for capacity expansions of in 2013 & 2015. • Consistently review and update sales forecast. • Secure key customers in NW and expand strategically to all US. • Direct sell, leverage direct sales experience from other service lines using 2-level approach: executives & technical sales.
External	• Resistance to SCR and diesel engine industry • Fierce pricing competition	• Closely monitor the industry & adjust strategy accordingly. • Protect IP of our unique features, build brand image, position at high value, & keep innovating to differentiate. • Apply manufacturing learning curve to reduce production cost.

Table 4

Conclusion

This new business is an excellent opportunity for IDEX considering only the U.S market as:

- It has a $400M annual market and we have only three major players that are capturing a total of 69 percent (fairly divided among the three); IDEX is not serving this market and we have the technology to do.
- It is a fast growing market with projected growth of 12 percent year over year for the next 5 years.
- The technology maturity is right in the middle of the ascending slope of the TALC (Technology Adoption Life Cycle) [figure 6]. It is just "Crossing the Chasm" as per Geoffrey A. Moore [14] and there is the potential for a bigger than 12 percent growth due to tightening of pollution standards in the US.

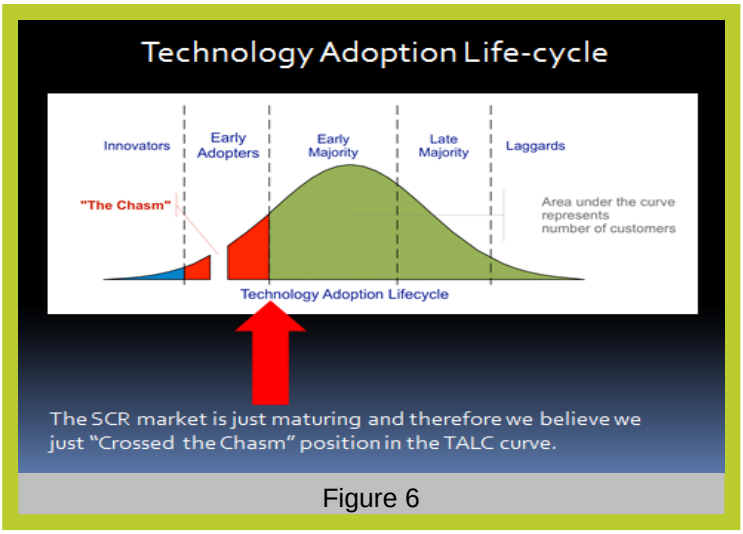

Figure 6

- Only the application is new for IDEX; we already have the technology and the IP.
- Great revenue source: over $98M/year at the end of fifth year, considering only the US market.
- It contributes 5.5 percent of IDEX's total revenue by the end of fifth year.
- It has a substantial ROI of 7.14.
- It has an unmatched short time to profit of only 2 years.
- Superb double digit growth of 27 percent year-over-year with gross margins close to 35 percent.
- Minimum to almost no risk, where mitigation actions are well planned and easily implementable.
- Most importantly, a minimum initial investment of only $2.5 Million (0.2 percent of IDEX's annual revenue) is required.

During the initial investigation, conception, analysis and development of the business plan, the whole team, in a very synergistic way, exercised their various roles, wearing their intrapreneurial hats while managing all aspects of the business plan, are prepared to operate in the white space. Once our senior management team, including our CEO, CFO and CTO, approves this business plan, which we hope has convinced you of its viability and is worthy of approval, that we should move ahead with it. We feel that eventually the project will move into the black space and become one of our core offerings.

We have done all analysis identified, considered all risks, their consequences, and ways to mitigate them. Furthermore, we have a clearer understanding of the market and our key competitors, and have done an industry analysis and product benchmark. We believe this is a game we can win. The team has done its due diligence, and we strongly believe in the favorable outcome of this new business application, as outlined previously. We also believe in and trust the experience and vision of our senior management team and the CEO, whose support is needed for this project, and in a larger sense, to take IDEX one step further towards building its goal as a modern and visionary company. To reiterate: this new business venture is complimentary to, and facilitates IDEX's mission, goals, and strategy, with little risk to its core business; on the contrary, this new business venture has the potential to widen brand acceptance and recognition, and could boost IDEX's name in a new market.

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