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Cummins Crosspoint Kinetics: Positioning and Launching the CK3000 Hybrid Engine

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Introduction

"Merritt, we feel we've got a great opportunity with the CK3000 hybrid engine system in the Class Four, Five and Six Gross Vehicle Weight Rating (GVWR) buses and delivery trucks. As we've discussed, we really feel that our niche is the shuttle and small transit bus market. Now, let's go out and make this product a success!"

With those words of the Cummins Crosspoint president still ringing in his ears, Merritt Becker began to plan just how to make that happen. As the CEO of Crosspoint Kinetics (CK), a newly formed subdivision LLC of the Cummins Engine distributor Cummins Crosspoint, he knew he had quite a challenge in front of him. The CK3000 hybrid engine system had made it through the design verification and validation stages and had already been placed on a number of customers' vehicles. The initial feedback from customers had thus far been encouraging, and Merritt and his team now believed that the product was ready for a full-blown launch into the marketplace. As he pondered how to put the marketing plan for the CK3000 hybrid electrical system together, Merritt knew that he could take advantage of the solid reputation and the brand equity of the parent company, Cummins Engine Corporation, and also the brand equity of Cummins' local distributor, Cummins Crosspoint. However, he also knew that he faced some significant challenges in making this product a success.

Merritt took out a pad of paper and wrote down three letters across the top of the page -- S T P -- standing for segmentation, targeting, and positioning. He knew from past experience that all successful product introductions were dependent on successfully determining the STP for that product, and this situation was certainly no different. However, given the rather unique circumstances surrounding the CK3000 system Merritt knew this introduction was more difficult.

Unlike any other new product introductions Merritt had been a part of, the introduction of the CK3000 system faced three unique and significant challenges. First, a number of previous manufacturers of these types of engines had either gone bankrupt or had discovered they did not have the expertise to service their engines properly. This in turn had given these engines a negative reputation in the marketplace that needed to be overcome. Second, there was not a great deal of demand for the CK3000 system in the marketplace. There were not a lot of

customers actively requesting this product, so CK was faced with the task of creating demand. Finally, when potential customers considered the cost of retrofitting a current vehicle with this engine many would not find the financial payback attractive.

The owner of Cummins Crosspoint had asked Merritt to have viable introduction strategy for the CK3000 system to him within 30 days. He knew he would need all of that time to come up with a plan that would successfully position the product in the market and at the same time deal with the challenges they faced.

History of Cummins Engine

Cummins Engine was a multinational Fortune 500 company that operated and served customers around the globe. The firm was founded in Columbus, Indiana, in 1919 as Cummins Engine Company and named after its founder Clessie Lyle Cummins. The fledgling firm was among the first to see the commercial potential of an unproven engine technology invented two decades earlier by Rudolph Diesel. Fortunately for Clessie Cummins, a self-taught mechanic and inventor, his vision was shared by someone with the financial resources to make it a reality – William Glanton (W.G.) Irwin, a successful local banker and investor who already had provided financial backing for Cummins' auto mechanic operation and machine shop.

After a decade of fits and starts during which time the diesel engine failed to take hold as a commercial success, a stroke of marketing genius by Clessie Cummins helped save the Company. He mounted a diesel engine in a used Packard limousine and on Christmas day in 1929 took W.G. Irwin for a ride in America's first diesel-powered automobile. Irwin's enthusiasm for the new engine led to an infusion of cash into the Company which eventually led to a number of speed and endurance records in the coming years - including a grueling 13,535-mile run at the Indianapolis Motor Speedway in 1931.

In 1933, the company released the Model H, a powerful engine for transportation that launched the company's most successful engine family. By the 1950s, America had embarked on a massive interstate highway construction program and Cummins' engines provided much of the power for the equipment that built the roads and the thousands of the trucks that began to roll down them. By combining lab-based research and field-based trials, including dramatic performances at the Indy 500 races, Cummins achieved a number of technological breakthroughs including the revolutionary PT (pressure-time) fuel injection system of 1954. By the late 1950s, Cummins had sales of over $100 million and had achieved a commanding lead in the market for heavy truck diesels.

As Cummins continued to grow in the United States, the Company also began looking beyond its traditional borders. Cummins opened its first foreign manufacturing facility in Shotts, Scotland, in 1956 and by the end of the 1960s Cummins had expanded its sales and service network to 2,500 dealers in 98 countries. Cummins eventually established more than 5,000 facilities in 197 countries and territories. They had also established a family of inter-related yet diversified businesses that created or enhanced value from conducting business with each other or having had those relationships. In 2013 they achieved sales of over $17 billion.

Cummins was organized around four business segments: Engine, Power Generation, Components Business, and Distribution . It provided products and service to customers in more than 150 countries. Cummins remained a technology leader in the diesel engine market, and has worked relentlessly to provide cutting-edge solutions to the increasingly difficult challenge of producing cleaner-running engines.

Cummins Crosspoint

Cummins Crosspoint was the exclusive distributor of Cummins Engine products in a five-state territory encompassing all or portions of Illinois, Indiana, Kentucky, Tennessee and West Virginia. Headquartered in Indianapolis, Indiana, Cummins Crosspoint had built a solid reputation for providing exceptional sales, service, and support for Cummins engines, generators, filters, and allied products.

Cummins Crosspoint was one of 16 Cummins' North American Distributors. With an integrated network of 12 branches and a sizeable field-service fleet, Cummins Crosspoint was dedicated to serving the needs of all customers in a variety of industries including trucking, mining, marine, oil and gas, power generation, recreation, and agriculture.

Crosspoint Kinetics and the CK3000 Hybrid

Crosspoint Kinetics was formed in 2012 when the assets and the technological intellectual property for the hybrid engine system were purchased from Variable Torque Motors (VTM) of Fort Wayne, Indiana. CK's stated purpose in purchasing the technology and developing the hybrid engine system was to develop and deliver solutions that conserved, captured, and reused energy for the benefit of their customers and their communities. CK was headquartered in Indianapolis, Indiana and had an advanced technology center in Fort Wayne, Indiana.

CK had assembled a team of engineers, product, and program experts that worked to deliver products that could be adopted easily and practically by their users. The CK3000 hybrid system was an alternative fuel solution that was composed of an engine, ultra capacitor, cooling unit, and controller. The system was ideally suited for Class 4-7 GVWR truck and bus applications (see Table 1 for how trucks are classified). An additional application was mid-sized shuttle and para-transit bus applications where the vehicles were driven at lower speeds and had routes that contained multiple stops. The main purpose of the CK3000 system was to generate electricity during the time a vehicle was slowing down and braking. The electricity that was created during that process was stored in a device called a super-capacitor. This electricity was then used immediately during the ensuing acceleration period to deliver incremental power and torque to the engine. This allowed the original combustion engine to work less while the vehicle was accelerating which in turn lowered fuel consumption and also emitted fewer greenhouse gases.

The CK3000 engine system offered the driver the choice of either generating additional power during acceleration or achieving better overall fuel economy. The savings in fuel costs were accomplished by adjusting the amount of electricity used based on how the driver operated the

hybrid vehicle. The more the driver was able to properly slow down and brake during frequent stops the better the fuel economy. Testing and trials by initial customers resulted in fuel savings between 5% and 38% which fluctuated depending on the route driven and operating style of the driver. The more the driver focused on regenerating and capturing electricity, the better the fuel economy.

Rather than using expensive batteries to store the electrical power, the CK3000 system used super capacitors, a unique storage technology for electricity that had been used in aerospace and industrial applications. Super capacitors store and discharge large amounts of electricity much faster than conventional batteries which makes them very efficient and effective for start and stop applications. They also cost much less and last much longer than batteries. It was very easy to integrate the system into new or existing buses which lowered the total cost of ownership of the hybrid. However, super-capacitors were not designed for long-term electricity storage which made them impractical to use on all-electric vehicles.

The CK3000 system did not interface with any of the computers on the vehicle. Because the system was mounted on the engine driveline behind the transmission the CK3000 system also functioned independently of the operation of the engine. Technicians could install the hybrid on either a new or a used bus. This in turn offered flexibility to a bus or transit fleet operation that had to manage their operations on a tight budget.

Due to its simple integration and open design the CK3000 system could be utilized with gas, diesel, compressed natural gas, and propane (autogas) engines. This gave the CK3000 system a unique advantage in the marketplace and offered additional flexibility for fleet and transit operations. Fleet operations had the option of either purchasing the CK3000 system on a new vehicle or retrofitting it on to an existing vehicle.

There were currently over 100 pre-production CK3000 hybrid systems operating throughout the United States and Canada. Crosspoint Kinetics had worked with several of the top bus manufacturers to integrate the CK3000 system into their specific chassis models and was able to pass the testing requirements of the Federal Transit Authority. CK continued to gather operational and performance data from the field and continued to conduct system-level accelerated testing on the engine test cells at Cummins headquarters. The hybrid electric system had been listed on many state purchasing contracts as an option for alternative fuel systems. Because the system was new and production volume had yet to be established, the price point, which was approximately $50,000, was much higher than what it would have been at maturity. Therefore, investment paybacks periods were relatively high for the intial customer base.

Marketing the CK3000

While the technology of the CK3000 system had been almost fully developed when Crosspoint Kinetics purchased that technology and intellectual property from VTM in 2012, the value proposition, plans to determine specific target audiences, and a strategy to position this product in the market had not been thought out sufficiently. Thus, Merritt and his team were faced with determining the segmentation, targeting, and positioning strategy for the system. After this was

accomplished they then had to decide how to go about creating a differential advantage for the CK3000 system within those desired target audiences.

Based on their market research and extensive conversations with a number of their customers, the CK team had discovered that the segmentation, targeting, and positioning strategies for this engine were going to be impacted by four major considerations:

- How to combine the technology of the hybrid system with the desire of many municipalities and organizations to 'go green';
- How to properly train the drivers of hybrid vehicles on proper slowing down and braking techniques to gain the benefit from these engines. They also needed to provide adequate feedback to the drivers on the performance of the system to help the drivers achieve better overall performance;
- How to best explore the option of combining natural gas technology with the hybrid technology; and
- How to introduce a product with a tarnished past for which there was relatively little overt market demand.

Merrit knew different target audiences were going to require a different mix of the above elements. It was up to him and his team to determine that mix.

Market Justification for A Hybrid Engine System

A study by Pike Research noted that shuttle buses were used at airports, corporate campuses, universities, and national parks. These were typically markets that used fewer larger, transit-style buses and relied more heavily on small, heavy-duty buses of around 26 to 35 feet in length. Medium-duty buses, also known as cutaways, that were typically less than 30 feet in length were also popular. Medium-duty buses in particular had a very low price point, so it was challenging to add on a costly hybrid electric system that could perhaps double the price of a bus. Because of this there had not been widespread adoption of hybrid electric systems for these types of vehicles. Table 2 gives some of the advantages and disadvantages of hybrid electric systems for shuttle applications.

While CK had the ability to add any number of features to enhance the technology of their hybrid system, they rapidly discovered that 'going green'was what was important to many of their customers. This was especially true for state and city government officials. However, while 'green' was becoming increasingly important, the strict economics of the purchase offered little chance of a reasonable financial payback without some sort of financial assistance for the early adoptors .

The main reason for the low probablity of a financial payback is that the savings generated by a hybrid system were determined largely by how a vehicle was driven. The greatest savings from using a hybrid system were on routes that had a high stop/start cycle such as urban areas, airports, college campuses, and anywhere a small shuttle bus would be used. It had become evident that a key factor in obtaining these cost savings was whether or not the driver had been properly trained to generate electricity through methodical slowing down and braking. If the

driver was able to do so properly electricity was generated and flowed to the capacitors which quickly stored the energy for reuse.

As with all hybrid and plug-in vehicles, aggressive driving did not benefit from the use of the hybrid technology. Similarly, driving 55 miles per hour or faster over an extended period of time would not generate a great amount of electricity. The variance of the route, driving style, and regeneration of electricy were the biggest factors that influenced the performance of the hybrid system. If any of these were changed the efficiency of the entire system changed.

Competitive Advantage of the CK3000 Hybrid Engine

A major factor that created a favorable market position for purchasing the CK3000 system was government subsidization of alternative fuel sources by the Federal Transportation Association (FTA). The FTA subsidized 80% of the purchase price of buses for public transit authorities. Thus, if a municipality purchased a bus for $60,000 the cost to the city was $12,000. However, for alternative fuel buses (which would include these with the CK3000 hybrid electric system) the FTA subsidation increased to 90%, so the same $60,000 bus would only cost that municipality $6,000. This FTA subsidization meant that a vehicle purchased with a hybrid engine system turned into a viable economic payback for a public transit authority. Private fleets, however, did not have the same access to government subsidy – they had to pay the full price for a vehicle. The fact that there were more private fleets than public fleets made for a limited market opportunity for CK. Also, government subsidization was only available for new product purchases, not retrofits which CK considered a very viable target market.

Introducing the CK3000 System

As with the introduction of any new product, the key for Merritt and his team for the CK3000 system was segmentation, targeting, and positioning – how to create demand within the desired target audiences and get these audiences interested in purchasing the product. When VTM developed the original design upon which the CK3000 system was based they rushed to introduce the product into the market without the product and marketing strategy being fully developed. In addition to the incomplete design, VTM did not have the resources to properly test and support the engine. As a result there were many product failures that in turn lead to a significant number of warranty claims. In a relatively short period of time the warranty claims exceeded VTM's ability to pay them. Consequently VTM discontinued production of the engine and was forced to sell some of its assets to cover the warranty costs.

Cummins Crosspoint had been VTM's distributor for this engine, and when VTM exited the marketplace Cummins Crosspoint saw a market opportunity. After studying the problems that VTM had experienced in developing and marketing the product, the management and engineers at Cummins Crosspoint were confident that they could finish the development of the system, fully test it, and get it certified by the FTA. They were also confident they could bring it to market successfully. Cummins Crosspoint purchased some assets and technological intellectual property from VTM which in turn lead to the formation of Crosspoint Kinetics. CK then

dedicated the necessary resources to complete the development of the product, establish a proper support infrastructure, and reintroduced and distributed the product into the marketplace. With the technology purchased from VTM and the expertise of their product development team CK was able to produce and market the CK3000 system as a niche product that was well-differentiated, had an established supply chain, and also had the lowest cost in the market.

Merritt and his team still had the problem of how to deal with the unfavorable reputation that this and other hybrid systems had created in the marketplace. A major competitor, Azure Dynmamics, had declared bankruptcy and had subsequently gone out of business. This had left all of their customers needing parts and maintenance support. Eaton Corporation had also made a similar hybrid system using batteries but needed to sell 10,000 systems per year to make it cost effective. Thus, Eaton did not put a lot of marketing effort into their hybrid systems. These events coupled with the VTM failure had created a negative reputation for hybrid electric systems in the marketplace that Crosspoint Kinetics would have to deal with going forward.

The CK3000 system was designed for classes 4, 5, and 6 buses and trucks which constituted a relatively small market. CK's competition was basically first-generation hybrids that were heavily integrated into the vehicle systems and utilized batteries to store and discharge the generated electricity. These batteries were heavy, difficult to maintain, and expensive to replace. It was also difficult to diagnose and repair any problems that they might have. In contrast, the CK3000 was a standalone system that could be easily be installed on the vehicle. The system took about 24 hours to install and was removeable and transferrable between vehicles –it could be removed in 90 minutes and then installed on another vehicle.
The life of a typical shuttle bus was 7 years and roughly 200,000 miles. While the CK3000 system was marketed with a standard 2-year or 36,000 mile warranty, internal test results indicated that the system's estimated life exceeded that of an average shuttle bus. In addition, the manufacturer who produced the super-capacitors guaranteed 1 million charge/discharge cycles. That amounted to an average of 15 years of normal driving of an average shuttle bus, so the capacitor wearing out before the bus was not an issue. Thus, this hybrid system could very often be put on a second bus if its first bus wore out.

In summary, when the technology developed by VTM was combined with the engineering expertise of their product development team Cummins Crosspoint management determined that purchasing that technology and attempting to develop and market the CK3000 system was a fairly low-risk investment. They felt they had the solid reputation of Cummins Brand to build upon, bringing the product in-house would allow them to properly complete the development of the product and reposition it in the marketplace. With the exit of previous manufacturers from the market there was little or no viable competition. The system had a sufficiently large ready-made market and with the features the development team added the product was largely differentiated from others in the market. Government funding via subsidies for public transportation buses would likely continue, and CK management was beginning to explore the possiblity of moving into overseas markets. CK knew they could make a profit even with a relatively low volume of product sales: estimated sales were 1,000 units per year in the United States. Internal estimates predicted that the CK3000 system had a viable market until 2019 when the market had matured fully.

Issues for Crosspoint Kinetics

The main issues for Crosspoint Kinetics were the same as it was for any new product. It needed to segment the market, determine the most viable target audiences, determine what features and benefits these target audiences were looking for in a product, and then create sustainable points of difference for the product to so as to create a competitive advantage in the marketplace. Merritt knew he and his team had four major considerations as they went forward with the product introduction:

Establish the proper emphases between the"green" value and the hybrid technology

Customers had told CK that once they decided to "go green" they had a high probability of selecting the CK3000 system over the other hybrids. Going greeen appeared to have a higher potential customer value than emphazing the economic payback from the savings in fuel consumption. This suggested that a marketing plan that focused on the "green" aspects and the ease of adoption and installation would be more successful than emphasizing the "better technology" message.

Implement a driver education program and provide system feedback to the driver

A factor critical to the success of the CK3000 system was training the drivers of these vehicles on how to slow down and brake properly. CK knew that at some point in time they would need to focus their efforts on driver education. Because the efficiency of the system was largely dependent on how well the driver was taught to generate and use the power from this system, driver education and system feedback were critical. Another concern was the limited talent pool of shuttle bus drivers. Most of them had very limited education and tended to be very transient and unmotivated which in turn lead to a high turnover rate. These factors would make any long-term training success more difficult and more costly.

Combine natural gas engines with hybrid technology

This initiative would involve focusing CK's efforts on vehicles that were equipped with compressed natural gas (CNG) engines. Natural gas was gaining increased popularity in the marketplace and the advantages of the CK3000 could also be applied to natural gas engines. Most of these buses used a 40-gallon natural gas tank that was 5 feel tall and 1 foot in diameter. These tanks offered about 6 hours of run time but presented a variety of issues for companies using CNG engines. Natural gas tanks took about an hour to fill and required special training to ensure safety with the high-speed and high-pressure fill ups. Also, fill-up stations were few and far between. In addition most working shifts for these drivers were 8 hours, but the tank on a natural gas vehicle lasted only about 6 hours. Installing a hybrid could certainly extend the range of the vehicle and allow it to run a full 8-hour shift. No other system could do this.

Improve the perceptions of the engine in the marketplace

A final consideration was the negative perceptions that a hybrid electric system had in the marketplace. While a number of customers had expressed interest in the system, a fair amount of

customers were still unsure as to whether or not the product would perform as expected. CK needed to overcome these negative perceptions if they wished to intoduce the system successfully.

Finally, Merritt and his team also viewed the CK3000 hybrid system with a business model whose use extended beyond its potential use to vehicles. They also considered other potential complementary applications that might exist. The hybrid engine system's technology was transferrable to other systems including elevators, grain elevators, paddle wheels in a water treatment system, and windmills. Windmills appeared to be a particularly high potential application as the gear systems in windmills wore out very quickly when the torque became too great from high winds. The hybrid could alleivate this problem by using its patented technology of a product called a permanant-magnet motor-generator. This product eliminated a significant amount of gearing in current windmills which in turn could increase the life and operational efficiency of the windmill.

What's Next

Crosspoint Kinetics had done their homework on this purchase, and Merritt felt confident that they had completed the development of the product. They now simply had to decide what target audiences to pursue and how to segment, target, and position the product in the marketplace with the right value propostion and the right message.

Merritt checked his calendar again. All of a sudden the 30-day deadline to report back to the owner seemed a lot closer than it did an hour ago.

Table 1
Classes of Vehicles

Class	Weight limit	Type of Vehicle
1	6,000 pounds or less	Pick-up trucks, passenger vans
2	6,001 – 10,000 pounds	Larger vans, step trucks
3	10,001 – 14,000 pounds	Larger vans, larger step trucks
4	14,001 – 16,000	Delivery trucks, smaller shuttle busses
5	16,001 – 19,500	Larger delivery trucks, mid-size shuttle busses
6	19,501- 26,000	School busses
7	26,001 – 33,000	Large transport busses, smaller long-haul trucks
8	33,000 pounds and over	Dump trucks, cement mixers

Table 2
Advantages and Disadvantages of Shuttle Applications for Hybrid Electric Drives

Advantages	Disadvantages
Growing market for busses	More cost conscious than public transit because less likely to be subsidized
Corporations may be interested in presenting a progressive, green image	Lower mileage routes make it harder to recoup capital cost premium
Airports increasingly under pressure to reduce emissions, so busses may become part of that effort	Very small fleets less likely to want to invest in infrastructure
Predictable duty cycles that may be less challenging than transit in terms of daily mileage	Medium duty buses are prevalent in shuttle service and have very low price tag. An electric drivetrain adds more cost proportionally.
National parks looking to lower tailpipe emission and noise	Gaining approval and acceptance to market to the Federal Government

Source: Pike Research

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