CUBA INFRASTRUCTURE CHALLENGE 2013
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Project Title:
TEMCU Tren ElectroMagnetico CUbano: Cuban Electromagnetic Train System Innovative Concepts for Cuba’s Future Transportation System

Project Abstract (150 words max):
As Cuba loosens restrictions on western investment, infrastructure is first on the list to be modernized. A high-speed electromagnetic train line will serve as a functional mode of transportation for residents as well as a method of transporting commercial freight. This base for future development will prove a vital link for further investment in industry and agriculture on the Caribbean island of Cuba. This will enable Cuban products to be competitive on the international market while providing an essential means for future internal growth. It is a necessary first step to illustrate to the rest of the world Cuba’s ability to apply new technologies with the intent to convert its dilapidated infrastructure into a contemporary, efficient system thereby emerging from an antiquated Communist era into a modern global economy.

Abel Crean contributed to Concept, Business Plan, Writing, and Proofreading.
Stephanie J. Brown Linares was responsible for Marketing Plan, Formatting, Citacions, and Conclusion.
T.E.M.CU

Cuban ElectroMagnetic Train System
Tren ElectroMagnético Cubano
Innovative Concepts for Cuba’s Future Transportation System

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TEMCU
Tren ElectroMagnetico CUbano

Introduction

Since the dawn of time, man has been burning fuel for energy. Cavemen burnt wood for fire. In the industrial age, people harnessed the power of combustible, oil-based fuel for transportation. The current age utilizes an antiquated automobile design. Essentially, the same engine as a Ford Model-T is in contemporary trains (Wells, 2007). Internal combustion is technology left over from 1900's and the mindset dates back to the Neolithic Era. This approach to infrastructure has uncountable, inherent inefficiencies. The potential energy in the sun is neglected. The existing braking system is doubly wasteful, using energy to dispel kinetic energy. Modern infrastructure runs on many similar inefficient models. It is inherently difficult to address the superficial inefficiencies of this system without going back to the flawed base and building a new, solid foundation. The new structure for the Cuban infrastructure system is based on innovation and collaboration rather than waste and competition.

TEMCU is an innovative conceptual company specializing in products in the field of electromagnetic transportation. The company contributes to manufacturing complete electromagnetic systems. The company also provides technological services for daily operation of their product line. They propose a novel innovation applied to the Cuban infrastructure system. Imagine a new approach to transportation that incorporates top of the line technology, making current inefficiencies obsolete. A new road will run east to west on an electromagnetic line, capable of supporting high-speed train traffic. Overpasses eliminate the need for stopping on the TEMCU, or Tren ElectroMagnetico
CUBano. All commercial freight travels in electromagnetic train cars and there is a passenger section for rapid commuting between the farthest parts of the island.

The idea behind this plan is to benefit the global community now and in the future to come by making the transportation industry safer and faster. This is accomplished by improving the infrastructure of today’s system, by implementing a streamlined electromagnetic train entirely controlled by a main computer system. The result is an incredibly efficient transport system. Elapsed time from agricultural area to final destination will decrease with the usage of the electromagnetic train, providing tangible economic benefits.

These implementations eliminate major efficiencies while being economically beneficial. One of the major accomplishments is drastically reducing the need for fossil fuels for automobiles, which reroutes the surplus to other areas of industry. Conventional petroleum fuels will still be necessary for forklifts, tanks, airplanes, etc. This leads to a positive environmental impact. By cutting the use of fossil fuels by trains, there will be a major reduction of Carbon Dioxide emissions. It will also reduce the need to rely on Venezuela for oil and maintain ties with regional socialist governments.

**Benefits to Humans and Society**

High-speed electromagnetic technology travels up to three hundred miles per hour (O’Connor, 1993). This saves society massive amounts of time and strongly benefits the agricultural economy by reducing the product time to market, enabling Cuba to compete in the global economy. It will also
reduce spoilage of fruit and vegetables. Combined with Cuba’s economically strategic location in the Caribbean, the reduced time to market will enable them to compete with agricultural giants like Brazil. The TEMCU line has a driver but is principally operated by computer network navigation feature, thereby eliminating accidents from human error, saving many lives and millions of dollars.

The implementation of this system will greatly contribute to the Cuban economy. The infrastructure development aspect alone will employ thousands of local people. Investing in scientific advancements is shown to generate economic growth (Macilwain, 2010). "Green job creation is part of a favorable employment trend" (Matthews, 2012). University programs in Information Technology, engineering, and electromagnetic technology will be created. The percentage of degree-seekers being directly employed after graduation will rise. A labor force of Cubans will be required to maintain the TEMCU line and service its technological needs.

**Business Idea and Plan**

The new electromagnetic train line will run roughly east to west, connecting Pinar del Rio, in the west, with Oriente, literally translated as east. The new line will roughly parallel the Carretera Central, the Central Highway. The new Port of Marielle, currently under construction by Brazilian firm Odebrecht, will be incorporated into the TEMCU line. This will enable tobacco, coffee, sugar, rum and raw agricultural products to reach foreign markets rapidly. Faster time to market works hand and hand with Cuba’s organic agriculture industry, as products untreated with chemicals are prone to faster spoilage. In conjunction with some marketing and branding campaigns, Cuban firms could stand to bring in top dollar for their organic produce on foreign markets.
All of the technology necessary for this project is currently in use in a variety of fields. We're planning a paradigm shift in the way we think about transportation and energy. Currently, corporations go through painstaking efforts in an attempt to wring as much profit possible out of each venture with very little social responsibility (Cameron. 2011). In the future, a different model provides corporate profit while favoring a collaborative approach. A joint effort will pool resources such as satellite technology from Internet giants, superconductors from the electronics industry, utility services, and governments together to provide a state-of-the-art transportation system.

Train frames and chassis will be made from lightweight Carbon fiber composite material instead of steel to reduce the weight of the vehicle and save fuel. Carbon Fiber is composed of billions of Carbon nanotubes connected together. Carbon Fiber is currently in use in aviation to reduce weight of the Boeing 787 Dreamliner (Sherman, 2012). Additionally, steel industries account for three percent of global carbon emissions, which will be reduced by utilizing carbon fiber ("Global", 2007). The importance of renewable resources such as Carbon Fiber technology over petroleum-based plastics is increasing as global oil reserves decrease (Jacob, Misra, Mohanty, 2012). Carbon fiber is currently being mass-produced for a reasonable cost. Carbon fiber has more tensile strength than steel and is significantly lighter (Sherman, 2012).
New TEMCU cars are curvaceously sculpted to maximize aerodynamics at high speeds. Vehicles actually levitate a fraction of an inch from the road surface, greatly reducing friction (Zhang, Long, Xue, Zhang, 2012). Twenty percent of fuel is used just to overcome friction (Young, Freedman, 2012, p. 147).

Wasted energy from conventional braking is eliminated as the vehicle is slowed by a diminishing electromagnetic pulse. Magnetic levitation trains can accelerate and decelerate much faster than conventional technology. Overpasses eliminate the need for closing intersections to traffic. Air resistance is beneficial to traveling in a train convoy whereas it is a multiplied negative factor in conventional transportation. Kinetic energy from vibrations will be harnessed and converted into a usable source of power.

Information Technology engineers in a variety of specialties will need to be employed to monitor the network and constantly update information. TEMCU Information Technology system will have to compensate for trajectory and velocity in response to varying weather patterns, turns, and stops. There will need to be a procedure to diagnose system errors, troubleshoot them, and detect glitches to ensure constantly improving software, which handles the expanding network. Highly polished massively supported software is necessary for a project of this nature while some aspects still need to be handled by humans. Computer programs that are capable of making calculations
and decisions within nanoseconds must handle more time dependent factors that are involved. The onboard computer on TEMCU trains will always be synchronized to local and main networks.

Both for practical and security reasons, this software must be constantly improved and developed to handle more and more data as the grid continues to grow and technology improves. This type of system needs to remain top-of-the-line technology for it to remain efficient and secure. It absolutely must constantly adapt its software as well as physical hardware to meet the ever-expanding needs of a rapidly evolving technological world. Unlike today's infrastructure system, this technology will never become antiquated.

The TEMCU line will run on a network, which compartmentalizes the entire train line into different regions. Each administrative region processes all relevant transit data locally. The reason for this is twofold, one is that it is impractical to manage, store, and analyze all of the data received from the entire line in one centralized location. The other reason is that centralizing all of the data in one place makes the whole network much more vulnerable to hacking. This also allows the possibility of system-wide failure, in the event that the central facility is damaged or destroyed by natural disaster. In the event of hacking, malfunction, or unauthorized network access, the compartmentalized approach will allow the specific region of the grid involved to be overridden by the mainframe and redirect its facilities to alternate control regions. "Disasters often result from ‘cascading’ failures of components in which a small external shock to the system causes a single critical component failure that in turn triggers other failures—often both physical, engineered, and social systems contribute to this cascade by obfuscating response to
component failures, whether through complex physical apparatus or bureaucratic and procedural complexity" (Egan, 2010). The compartmentalized approach averts this cumulative effect from errors or hacking interruptions.

In the event of any emergency an alert system will notify the train operator of the situation and prepare them for the pending manual control. Autopilot then transitions to manual control. In the event of an emergency, all affected trains are slowed down to navigable speeds. Drivers can then manually continue the course.

Cuba will ultimately prove a test run for the technology in Latin America and the Caribbean. The collaborative approach to business will provide a revenue stream for all interested parties and a common motive for troubleshooting any technological or implementation issues. It is also intended to be compatible with the evolution of the Cuban government. This gradual approach is intended to allow Cuba a first step into westernization while maintaining government control of foreign investment. The collaborative business method is compatible with the current form of government while opening the door for further development into a capitalist model.

Eventually, Latin American trading partners will offer room for international expansion. Economic giants like Brazil and Mexico offer prime targets for expansion. Again, the common financial interests will provide a motive to overcome any difficulties presented. TEMCU initiative plans to lobby the government to its full extent in order to join as many free trade zones as possible. As the Cuban manufactured TEMCU components freely flow into the foreign market without import tariffs (Boyd, Krutilla), Cuba will be ushered into an economic boom.
Cuba will ultimately serve as a beacon for the rest of the developing world. Other emerging economies will soon follow the shining example of Cuba's innovative infrastructure. After Latin American expansion is maximized, other developing nations such as India will follow in suit. The global demand for TEMCU technologies will continue to rise as growing economies emerge.

A comparable, proposed 84-mile high-speed link between Tampa and Orlando would cost Florida taxpayers about $1.25 billion. This is extremely low cost due to cheap cement and concrete ready-mix manufacturing in the Sunshine State. Existing cement and aggregate production facilities in Cuba should be utilized and expanded to their maximum capacity to provide the necessary materials from a cost-effective source. The proposed TEMCU line runs about 1,250 kilometers or 780 miles and is estimated at a proposed $12.5 billion. A prudent reserve for overages will be capped at fifteen percent of project value or about 18 billion USD. The investment will be assumed by the corporate joint venture that stands to profit from it use in transporting goods and commuters.

Pros and Cons

The most notable positive affect of this initiative is the large-scale elimination of the deleterious effects of Carbon emissions on the environment. This go-green program stands to propel Cuba to the forefront of technology and manufacturing. This innovation has the potential to become a leading contributor to the Gross Domestic Product and the Cuban export-driven economy.
The most obvious criticism of the proposed is the length of time necessary for implementation. It also requires an immense initial start-up investment. This will be offset by massive potential future profits. Opponents may also criticize the socialist aspect of the TEMCU system. Many other government services are socialized and are perfectly accepted. Most governments currently provide infrastructure. In residential areas, the profit ratio of the program will be substantially diminished due to low cost to users and extremely high cost of design.

Carbon fiber has a significantly higher hardness factor than steel, which means that it shatters more easily. For this reason, it is necessary to blend Carbon fiber with plastics for a composite material. Utilizing plastics maintains our dependence on petroleum products and is counterproductive to the intent of the entire plan. As technology develops, it will be possible to have a carbon fiber without the plastic additives.

**Marketing Plan and Business Structure**

TEMCU’s partnership with high-tech electromagnetic train manufacturers will account for a large portion of revenue in the form of sales. As new TEMCU lines are completed, an immense future demand will be created. Cuba will ultimately prove a test run for the technology. The collaborative approach to business will provide a revenue stream for all interested parties and a common motive for negotiating any implementation issues.
Green marketing is a current trend in Latin countries such as Costa Rica. There is a wide customer base within this niche market. TEMCU will maintain a sustained presence at auto shows and green technology expos. Create a hands-on booth, with the simulation video and commercial. Put together a college job fair marketing team, with the intent to pump up young people about the transition. The intent is to obtain support within the train industry, go-green industry, and create a following and supportive base.

TEMCU is a multifaceted corporation providing various products and services within the field of electromagnetic technology. They work with infrastructure design/build firms to expand our products into new construction. They provide engineering and manufacturing services for electromagnetic products for automobile companies. The Information Technology division maintains smooth daily operation of the grid. There will be a committee of TEMCU employees and industry consultants to unite heads of industry for a common goal. The objective is to procure technology from various industries to incorporate into our end product. This is undertaken in an effort to drive technology in a unifying direction. In the western business model, different organizations compete to win bids. The collaborative approach to infrastructure development is a more efficient business model, promoting cooperation instead of competition. Manufactures of integral products such as solar paint are shareholders in the business venture and stand to profit enormously from their respective contributions.
Conclusion and Recommendations

TEMCU is a step forward in investing in this Cuba's economic, environmental and political future. They stand poised to capitalize on the gradual loosening of restrictions imposed by Castro's regime. This proposal will take time to develop but it will assist in solving many problems in today's world that need reform. TEMCU is a system that provides transportation in a way that diminishes carbon emissions and stabilizes the depletion of natural resources without inhibiting economic growth. This system will not only benefit everyday Cubans’ livelihood but also impact the economy through service production and manufacturing which stands to be key sector in Gross Domestic Product. TEMCU can give Cuba an option for direct foreign investments. The global expansion of this system will give the country the opportunity for a higher GDP in the coming years. The innovation of TEMCU can bring to Cuba a preeminent product that has the potential to drive the global economy while not having to over-exploit their natural resources.

Regulatory bodies need to be formed to regulate the design specifications of various products to be incorporated into TEMCU. An advisory board, made up of business leaders from all agencies involved, mediates all product integration procedures. The board negotiates payment based on the component's percentage of overall final product value. A special committee resolves any disputes. An eight step cross-discipline model is implemented to integrate all factions (Burkett, 2002).

Government plays a pivotal role in our business plan. A special excise tax levied
on TEMCU will augment tax revenue and fund the creation of an oversight committee. A special division will have to be created, as a check and balance, to ensure the overall safety of the TEMCU system, while allowing for adequate government oversight and revenue generation.

The Cuban government is inherently socialist. Capitalist ventures can be successfully employed in countries with a propensity for socialism as evidenced by China’s booming economy. Over time, capitalist forces begin to displace antiquated communist ideologies and systems. As people and institutions begin to realize the benefits of modernization, they will slowly emerge from their old ways to embrace contemporary methodology. Ventures such as TEMCU are a necessary force to begin to usher Cuba out of the antiquated communist era and into a modern global economy.
References


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