

A Brief Description and Summary of Cartheur Technology Research

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A brief, high-level overview of the kinds of activities and desirable products from the laboratory.

After completion of the modular inductive-link wireless power prototype, I wanted to discover a way to commercialize it. By the public reaction to demonstrations, it seemed to me that there is a very large psychological impact to a person viewing wireless power as an average person would *never* have seen it before. This impact varies across different persons and with age. It is this impact and the impression it leaves behind that will be the criteria by which the viewer will choose to participate in the development of the technology or in some other shade, at the very least a fan dispelling what they had seen to as many persons as possible. This paper will provide a moderately sophisticated analysis of the company's technology vectors and expose to the reader our ambitions.

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The Company

Cartheur Technology Research is a sole proprietorship founded in the Czech Republic in 2007 and registered in The Netherlands in 2009 by an American academic, engineer, and scientist. The company's main activity is research and development engaged in producing model-controllers of the wireless transmission of power over mid-to-long range distances where these controllers will be used to: charge electric vehicles, provide wireless lighting, and power consumer devices—just to name a few.

Our purpose is to purvey our unique brand, based on years of successful research and product development, to the worldwide market becoming a serious competitor and profitable entity in our sector. Our values are to provide the most innovative, creative, and inspired products where the transmission of useful electrical power of a reasonable efficiency can be accomplished without wires. We envision to be a world-leading company within five to ten years controlling substantial portions of a marketplace still under development.

Cartheur Technology Research is a relatively new business that is not afraid to challenge the status-quo in our sector. We are not shy about our opinions. Our primary activity is the development and production of wireless energy transfer, robotic technologies, and autonomous control software in a common language framework. We also provide consulting and knowledge-based advising services and research-by-contract. In the present timeframe, we are focusing on the development, partnerships, and the specialization in three technology-to-market wireless power vectors:

1. The commercialization of the wireless transmission of power for:
 - a. The transmission of electric currents for the charging of electric vehicles, taxis at stands, intercity trams,
 - b. Long distance transmission of lighting in the developing world,
 - c. Consumer products,
 - d. Medical devices,
 - e. Architecture and construction,
 - f. Artistic displays and representations, and,
 - g. Unique lighting.
2. The application of electron compression for:
 - a. Containment of energy systems such as nuclear reactors,
 - b. Shielding for highly-sensitive components or fuselages, and,
 - c. Containment of photons (light energy) for displays.
3. The projection of electron-photon magnetic fields for:
 - a. Dynamic holographic displays,
 - b. Visually stimulating and detailed objectification, and,
 - c. Medical probing and detailed body-scanning.

Those in group one are the closest to being realized commercially. At the present state, Cartheur Technology Research has knowledge specialty of both types of wireless power transmission:

1. Inductive-link power transmission, and,
2. Resonance-link power transmission.

Both systems rely on the use of coils of wire connected to oscillators to convert an output from a 110-220V, 50Hz wall plug to radio-frequency transmissions. The type of oscillator is a key consideration when transmitting efficiently over distances and is kept secret. The frequency of the transmission can vary by design; typically, we build them so they operate in the frequency spectrum with the least amount of interference to external signals, nestled between the long wave (148.5kHz – 283.5kHz) and medium wave (520kHz – 1610kHz) broadcast channels, typically at 420kHz. An important reason to operate in this frequency band is that no adverse biological effects have been reported.¹ However, the perpetuation of the magnetic energy stays within the proximity of the coils, by design of both the inductive link and resonance link methods, and does not leak away in any significant manner. The first category is utilized in short-range distances d where $d \geq r_m$, which means that it only has an effective efficiency η when the distance is equal to twice the mean of the radius of the coils. The second category is utilized in medium and long-range distances, tested up to 10 meters. The leakage factor is similar between the two forms; the amounts that do leak exponentially decay with distance away from the coils, as: $\alpha \frac{1}{d^3}$.

The Utility of the Technology

Wireless power, classified as a green technology and considered many people as a new phenomenon, was first devised by Nikola Tesla in the mid-1890s. His original prototypes, perfected by 1900, were very large entities but could transmit many millions of volts several dozen meters. Notwithstanding, the replication of this work would not take place until the 1960s and would recast at lower voltages to power artificial hearts. The public only caught a glimpse of this technology in 2007 when MIT published its watershed work *Wireless Power Transfer via Strongly Coupled Magnetic Resonances*.² While this work awakened public interest and desire for this technology, they have yet to inspire the successful future development and commercialization of it. The reason for this: they do not understand it and have only subsisted by capturing only a glimmer of Tesla's original vision.

The MIT group founded a company called WiTricity³ and filed a U.S. Patent on their concept basing it on the criteria of propagation of their apparatus. The products which have resulted demonstrate the amount of currents that can be transmitted using a sufficiently large coil. This action firmly sets the viability of the concept over the long term. It is not a matter of whether or not such a machine is fiction or reality, rather, how can we create a successful venture with this as its centerpiece technology? How can we utilize it for maximum gains and how can we create a vision of the future that was not possible before reading this document?

Broadcasting and the public airwaves

In the United States, a company called WiTricity (<http://www.witricity.com>) has obtained broadcast licenses for the use of its technology. A similar broadcast channel licensing model is perceived to be obtained in a similar fashion by precedence. The product is purposefully designed to nest its transmission in the unused areas of the frequency spectrum based on the laws of the country it is operating in. As such, it may be necessary to alter the transmission frequency to accommodate the local laws. This modification is fairly simple in the manufacturing sense and does not present complications to the final products.

Competitors and like-minded interests

At the time of the writing of this document and in real-terms, the competitors in this type of technology can be counted on less than two hands. This count does not include “fans” or those who are waiting for the successful implementation of this technological paradigm. While not digressing in how each competitor's product differs from ours, it is only relevant to understand those competitors who would most directly compete with our market vectors. Considering the product, the wireless charging of electric vehicles, we have seen a move by Siemens in March 2011 in partnership with BMW and the German government setting up trial-runs of the wireless charging of electric vehicles in Berlin. While inductive charging is not new to the marketplace and was first brought by *PowerCast* in the early 2000s, the notion of charging pads made larger delivering more power is now more integrated into the public consciousness. Only a few years ago, it would have been a difficult task convincing a bureaucrat or person responsible for the distribution of funding that wireless power by magnetic

¹ M. Soma, D.C. Galbraith, and R.L. White. “Transmission of time-varying magnetic fields through body tissue,” *J. Biol. Phys.*, vol. 3, pp. 95-102, Jun. 1975.

² A. Kurs, A. Kralis, et. al. “Wireless Power Transfer via Strongly Coupled Magnetic Resonances,” *Science* 317, 83, July 2007.

³ <http://www.witricity.com>

resonances was a very real phenomenon. Personally, I have been trying for seven years with little success, but as the public becomes more susceptible and acquainted with this kind of technology and how it is safe, the market will explode.

A consortium in Europe, cleverly titled the *Wireless Power Consortium*, is a collection of companies whose ambitions are to research this work. However, its founder has certain presumptive notions about the limits of the technology which are incorrect. It is uncertain how this group will remain going forward, but it puts them at a distance from us and while we succeed, could put them squarely in our sights as partners and potential customers.

Concluding remarks and proposal

Wireless power transfer and the technologies which make it possible are very diverse and require a detailed and intimate understanding which is complex. It cannot be developed by persons who are unfamiliar with even one of the paradigms in the long chain of reasoning. Personally, it has taken me fifteen years of consistent work to comprehend the multitude of possibilities, honing the concepts, and melding together what is reasonable into a framework which is reliable and replicable. Presently, we have miniature oscillators driving inductive and resonant loops at a potential of five volts delivering just over one ampere of current at a distance. This is enough to drive an incandescent lamp. When objects are placed in the path, they are not affected by the currents as they are what is called “off-resonant”. This means that your hand will not absorb the currents if it comes into direct contact with the machine. It is safe to use in the home or in the office or in any commercial context where it is desirable to deliver power at a distance without wires. The possibilities are endless, as Tesla envisioned; the only limit being the imagination.

I propose a start-up company, Cartheur Technology Research, investigate and define the scope, application, and reliability of such technology by taking my proof-of-concept model to the prototype phase demonstrating a proposed series of products in cleverly-advertised showings engineered to instill a mental image of its application in a quasi-futuristic, if not altogether utopian setting. I would be the technical lead the company and direct its research and development operations. I have a vested interest in the success of this project for career reasons including the completion of my dissertation on the subject. My work has led me to believe that such technology has lain vastly dormant over the history of electrical engineering which could dramatically improve the lives of many people across many economic groups within a reasonably short period of time.

I have filed one non-provisional utility and two provisional utility patents in the United States and have priority established through the patent cooperation treaty (PCT) over any like patents filed in the UK, EU, Australia, and Japan. I can offer portions of the intellectual property to be shared with investors. The investment will fund the research and development of prototypes where meeting roundtables will decide which application is best to market pending further investment to manufacture the full product. The money will also be used to cover the expenses in the filing of patents of which there will be many more.

This opportunity is new and potentially vast considering the involvement of Siemens and the members of the Wireless Power Consortium. By the momentum generated, it is reasonable to assume a mass-consumer market can be created given the tone of public demonstrations and intelligent product lines of modest cost. A similar strategy to Apple products seems compatible given the seemingly mythical properties assigned to wireless power in the public imagination. When I have demonstrated the prototype, the first thing they say is: “*this is a mirage: it is science-fiction.*”

Going wireless has always been cool. Let’s take it to the next level.

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