

# TESLA'S WIRELESS ENERGY EXPLAINED

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**N**ikola Tesla's discovery of pulsed propagation of energy does not resemble the standard transverse electromagnetic waves so familiar to electrical engineers everywhere. Many engineers and physicists have dismissed Tesla's wireless energy transmission as unscientific without examining the unusual characteristics and benefits of longitudinal waves. As a result of sponsoring the Tesla Energy Science Conference & Expo one decade ago (Nov. 8-9, 2003) in the only known public recognition of the Centennial of the Wardencllyffe Tower (1903-2003), our institute and the group of scientists in attendance agreed that an explanation of Tesla's superior energy transmission discovery is warranted to help educate the public. An anthology, *Harnessing the Wheelwork of Nature: Tesla's Science of Energy (Adventures Unlimited, 2002)*, edited by this author, was published in time for the Centennial. It documents the unusual method of pulsing a broadband Tesla coil at a repetition rate of 7.5 Hz to resonate with the earth-ionosphere Schumann cavity as Dr. James Corum explains, in one of his papers in the book (p. 198) entitled, "Tesla & the Magnifying Transmitter: A Popular Study for Engineers," that a mechanical analog of the lumped circuit Tesla coil is an easier model for engineers to understand. From mechanical engineering, the "magnifying factor" can be successfully applied to such a circuit. "The circuit is limited only by the circuit resistance. At resonance, the current through the circuit rises until the voltage across the resistance is equal to the source voltage. This circuit was a source of deep frustration to Edison because voltmeter readings taken around the loop did not obey Kirchoff's laws!" As a result, Edison claimed such a circuit was only good for electrocution chairs. This article gives the highlights of the discoveries of Tesla found in the *Harnessing the Wheelwork of Nature* book.

"All that is necessary," says Corum, "is that his transmitter power and carrier frequency be capable of round-the-world propagation." In fact, Tesla stated, "With my transmitter I actually sent electrical vibrations around the world and received them again, and I then went on to develop my machinery" (L.A. Times, Dec., 1904), which was verified by Corum.

The power loss experienced by this pulsed, electrostatic discharge mode of propagation was less than 5% over 25,000 miles. Dr. Van Voorhies says (p. 151), "...path losses are 0.25 dB/Mm at 10 Hz", which often is difficult for engineers to believe, who are used to transverse waves, a resistive medium, and line-of-sight propagation modes. The capacitive dome of the Wardencllyffe Tower is a key to the understanding of Tesla's unique longitudinal or scalar waves. Dr. Rauscher quotes

Tesla (p. 236), "Later he compared it to a Van de Graaff generator. He also explained the purpose of Wardencllyffe...one does not need to be an expert to understand that a device of this kind is not a producer of electricity like a dynamo, but merely a receiver or collector with amplifying qualities."

Nikola Tesla, the father of AC electricity, is famous for recognizing that an atmospheric and a terrestrial storage battery exists here on earth, just waiting to be tapped for the good of mankind. This is the wheelwork of nature that Tesla was referring to. The visionary scientists who have contributed to the *Harnessing the Wheelwork* book offer a collective argument of what Tesla meant by that phrase. The first section of the anthology offers some historical Niagara Falls material and biographical information about the life of Nikola Tesla with the contributions of William Terbo, the grand-nephew of Tesla, Keith Tutt, author of *The Scientist, the Madman, the Thief & Their Light Bulb*, and Dr. Andrija Puharich, whose unpublished biographical manuscript is rich with personal insights. Puharich, a Yugoslavian, also develops with great care, the background and unexpected uses for Tesla's Magnifying Transmitter (TMT). The second section is devoted to Tesla's wireless transmission of electrical power, as distinguished from wireless telegraphy for which he is also famous. It is surprisingly practical, even today, as the brilliant minds in this book prove. Tesla was at least a century ahead of his time, however, so people stole his ideas, left him penniless, and ignored his saintly concern for the human race. I pray that as global community consciousness expands in the 21st century, Tesla's ideas about sharing energy with the whole world will be more understood and appreciated. The third and last section has miscellaneous articles about a few of Tesla's less well-known inventions, including the two-rotor belted homopolar generator and an ozone generator.

Today we are faced with the consequences of the fateful decision in 1905 by J. P. Morgan to abandon Tesla's Wardencllyffe Tower project on Long Island, once he learned that it would be designed mainly for wireless transmission of electrical power, rather than telegraphy. He is reported to have complained that he would not be able to collect money from the customer in any feasible way. This mercenary attitude by the world's richest man forced the nation to pay for thousands of miles of transmission line wires, just so an electrical utility meter could be placed on everyone's house. Today the U.S. Energy Association in Washington, DC trains representatives from the former Russian states how to reliably do the same in their countries.

No one, except for the few great physicists like Drs. Rauscher, Corum, Bass, and Van Voorhies found in this book (and recently, Nick Simos from Brookhaven Labs), has realized that Tesla was very practical when he proposed the resonant generation and wireless transmission of useful electrical power, after returning from his experiments at Colorado Springs in 1900. For example, Professor Rauscher shows that the earth's ionosphere and magnetosphere contains sufficient potential energy (at least 3 billion kilowatts each) so that the resonant excitation of the earth-ionosphere cavity can reasonably be expected to increase the amplitude of natural "Schumann" frequencies, facilitating the capture of useful electrical power. Tesla knew that the earth could be treated as one big spherical conductor and the ionosphere as another bigger spherical conductor, so that together they have parallel plates and thus, comprise a "spherical capacitor." Dr. Rauscher calculates the capacitance to be about 15,000 microfarads for the complete earth-ionosphere cavity

capacitor. W.O. Schumann is credited for predicting the “self-oscillations” of the conducting sphere of the earth, surrounded by an air layer and an ionosphere in 1952, without knowing that Tesla had found the earth’s fundamental frequency fifty years earlier.

In comparison to the 3 billion kW available from the earth system, it is possible to calculate what the U.S. consumed in electricity. In 2000, about 11 Quads (quadrillion Btu) were actually used by consumers for electrical needs, which is equal to 3.7 trillion kWh. Dividing by the 8760 hours in a year, we find that only 425 million kW are needed on site to power our entire country. This would still leave 2.6 billion kW for the rest of the world, which only needs 1.7 billion kW (by 2001 US DOE estimates). In the US, out of the total electrical power generated using wire transmission (about 31 Quads), a full 2/3 is totally wasted in “conversion losses.” (Ref.: Electricity Flow Chart 1999, which contains US DOE/EIA data, updating the Toby Grotz article in this book.) No other energy production system of any kind in the world has so much wastefulness. Instead of trying to build 2 power plants per week (at 300 MW each) for the next 20 years (only to have a total of additional 6 trillion kWh available by 2020), as former V.P. Dick Cheney wanted to do, we simply need to eliminate the 7 trillion kWh of conversion losses in our present electricity generation modality. Tesla’s wireless transmission of power accomplishes this goal, better than any distributed generation.

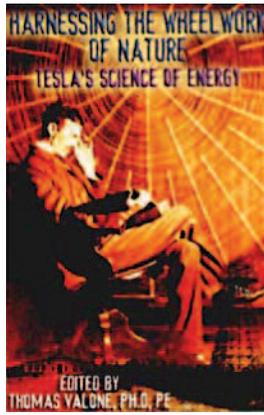
As Tesla himself said,

“In the near future we shall see a great many uses of electricity...we shall be able to disperse fogs by electric force and powerful and penetrative rays...wireless plants will be installed for the purpose of illuminating the oceans...picture transmission by ordinary telegraphic methods will soon be achieved...another valuable novelty will be a typewriter electrically operated by the human voice...we shall have smoke annihilators, dust absorbers, sterilizers of water, air, food and clothing... it will become next to impossible to contract disease germs and country folk will go to town to rest and get well...”

“If we use fuel to get our power, we are living on our capital and exhausting it rapidly. This method is barbarous and wantonly wasteful and will have to be stopped in the interest of coming generations. The inevitable conclusion is that waterpower is by far our most valuable resource. On this humanity must build its hopes for the future. With its full development and a perfect system of wireless transmission of the energy to any distance, man will be able to solve all the problems of material existence. Distance, which is the chief impediment to human progress, will be completely annihilated in thought, word, and action. Humanity will be united, wars will be made impossible, and peace will reign supreme.”

The same article which contains this prophetic quotation from Tesla also notes that his “World System” was conceptually based on three inventions of his:

1. The Tesla Transformer (Tesla coil)
2. The Magnifying Transmitter (transformer adapted to excite the earth)
3. The Wireless System (economic transmission of electrical energy without wires)



Tesla states, “The first World System power plant can be put in operation in nine months. With this power plant it will be practicable to attain electrical activities up to 10 million horsepower (7.5 billion watts), and it is designed to serve for as many technical achievements as are possible without due expense.” (Note that Tesla’s calculated power levels are conservatively estimated, compared to Rauscher’s calculations.)

The essay by Toby Grotz on the wireless transmission of power is a great introduction to this wireless power system of Tesla. It contains all of the details for a preliminary test of the system. His Figure 5 also illustrates the transmission of a high voltage pulse of electricity equally around the world where it rebounds at the opposite side and returns to its source, repeating the cycle many times. Grotz also worked with Dr. Corum on “Project TESLA,” which was a business venture designed to implement the wireless transmission of electricity.

Dr. Corum notes in his introductory article on the ELF (extremely low frequency) oscillator of Tesla’s that the tuned circuit of Tesla’s magnifying transmitter was the whole earth-ionosphere cavity. His second article presents probably the most complete article on Tesla’s magnifying transmitter that has ever been written. He explains in great detail the meaning of magnification as Tesla intended, with examples and equations. Even if not an engineer, I believe the reader will still appreciate the enthusiastic style with which the Corums describe Tesla’s developments regarding the TMT.

There are two diagrams produced at the turn of the century to help explain in simple terms Tesla’s wireless transmission of electrical power. The first is a mechanical “Analogy” that is described in Corum’s ELF disclosure article. The second is the “Realization” which illustrates the usefulness of the power transmission concept.

Tesla wrote, “That electrical energy can be economically transmitted without wires to any terrestrial distance, I have unmistakably established in numerous observations, experiments and measurements, qualitative and quantitative. These have demonstrated that it is practicable to distribute power from a central plant in unlimited amounts, with a loss not exceeding a small fraction of one per cent in the transmission, even to the greatest distance, twelve thousand miles – to the opposite end of the globe.”

As Tesla experimented with a 1.5 MW system in 1899 at Colorado Springs, he was amazed to find that pulses of electricity he sent out passed across the entire globe and returned with “undiminished strength.” He said, “It was a result so unbelievable that the revelation at first almost stunned me.” This verified the tremendous efficiency of his peculiar method of pumping current into a spherical ball to charge it up before discharging it as a pulse of electrical energy, a “longitudinal” acoustic-type of compression wave, rather than an electromagnetic Hertzian-type of transverse wave.

It is also understood that Tesla planned to include stationary resonant wave creation as part of the wireless transmission of power. Examining the pair of 1900 patents #645,576 and #649,621 each using the same figure on the first page, we find in the first patent that Tesla has designed a quarter-wave antenna (50 miles of secondary coil wire for a 200 mile long wavelength). More importantly is the sphere on the top which is supposed to be a conductive surface on a balloon raised

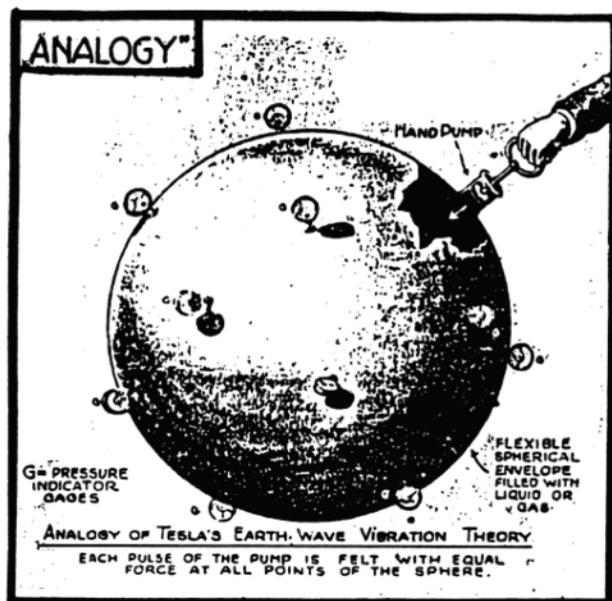
high enough to be radiating in “rarefied air.” As Tesla states,

“That communication without wires to any point of the globe is practical with such apparatus would need no demonstration, but through a discovery which I made I obtained absolute certainty. Popularly explained it is exactly this: When we raise the voice and hear an echo in reply, we know that the sound of the voice must have reached a distant wall, or boundary, and must have been reflected from the same. Exactly as the sound, so an electrical wave is reflected, and the same evidence which is afforded by an echo is offered by an electrical phenomena known as a ‘stationary’ wave – that is, a wave with fixed nodal and ventral regions. Instead of sending sound vibrations toward a distant wall, I have sent electrical vibrations toward the remote boundaries of the earth, and instead of the wall, the earth has replied. In place of an echo, I have obtained a stationary electrical wave, a wave reflected from afar.”

It is also worth calling attention to Corum’s disclosure article on the operation of an ELF oscillator, he proposes that Tesla’s x-ray patents were designed for the switching of high voltages in the charging and discharging of the dome of the Wardencllyffe tower (patent #1,119,732). Dr. Bass’ article elaborates on the details of longitudinal waves that would be created by such discharges. They have superior properties of transmission which normal radio and television waves today do not possess. Nikola Tesla was very familiar with their benefits and designed the tower accordingly.

As Tesla states, “As to the transmission of power through space, that is a project which I considered absolutely certain of success long since. Years ago I was in the position to transmit wireless power to any distance without limit other than that imposed by the physical dimensions of the globe. In my system it makes no difference what the distance is. The efficiency of the transmission can be as high as 96 or 97 per cent, and there are practically no losses except such as are inevitable in the running of the machinery. When there is no receiver there is no energy consumption anywhere. When the receiver is put on, it draws power. That is the exact opposite of the Hertz-wave system. In that case, if you have a plant of 1,000 horsepower (750 kW), it is radiating all the time whether the energy is received or not; but in my system no power is lost. When there are no receivers, the plant consumes only a few horsepower necessary to maintain the vibration; it runs idle, as the Edison plant when the lamps and motors are shut off.”

These incredible facts are explained by Dr. Corum and Spainol elsewhere, “...the distinction between Tesla’s system and ‘Hertzian’ waves is to be clearly understood. Tesla, and others of his day, used the term ‘Hertzian waves’ to describe what we call today, energy transfer by wireless transverse electromagnetic (TEM) radiation...no one wants to stand in front of a high power radar antenna. For these, E and H are in phase, the power flow is a ‘real’ quantity (as opposed to reactive), and the surface integral of  $E \times H$  (Poynting vector) is nonzero. The case is not so simple in an unloaded power system, an RF transformer with a tuned secondary, or with a cavity resonator. In these situations, the fields are in phase quadrature, the circulating power is reactive and the average Poynting flux is zero – unless a load is applied. They deliver no power without a resistive load. These are clearly the power systems which Tesla created. The polyphase power distribution system was created by him in the 1880s and inaugurated at Niagara Falls in 1895. The RF transformer was invented and patented by him in the 1890s. Terrestrial res-



onances he experimentally discovered at the turn of the century. And, for the next 40 years he tried to bring through to commercial reality this global power system. Today, millions of us have working scale models of it in our kitchens, while the larger version sits idle.” Even our cars have been using miniature Tesla coils to power the spark plugs.

In the same “Cavity Q” article, the authors also settle the most common criticism of the Tesla wireless power system regarding biological effects. Calculating the circulating reactive power, they find a density of a microVAR per cubic meter at 7.8 Hz to be quite small, while it is well-known that the frequency is very biologically compatible. The authors also look at the present 100 V/m field and again find that raising it by a factor of 4 to 10 will pose no ill effects. (Thunderstorms do it all of the time around the world.)

In 1925, an electrical engineer, John B Flowers, developed a proposal to test and implement Tesla’s Wireless Power System. He drafted the entire scheme for the Wardencllyffe project and presented it to H. L. Curtis, physicist, and J. H. Dillinger, head of the Radio Laboratory at the Bureau of Standards in Washington, DC. In a carefully worded 10-page document, complete with schematic drawings of the earth imbued with Tesla standing waves, Flowers unveiled a plan for operating cars and planes powered by wireless electricity (Sketch A). The plan was declined even though the mechanical test in Sketch B actually worked. Below is a report on the test results of the mechanical model of Tesla’s wireless system:

“Using the concepts in Sketch B, a mechanical oscillator arm was fastened to the tied opening of a rubber balloon 20 inches in diameter. The oscillator arm was operated with an electrical motor at 1750 RPM by means of an eccentric on the motor shaft. The balloon hung free in the air. The rubber surface of the balloon represented the earth’s conducting surface and the air inside its insulating interior. The waves were propagated in the rubber surface at the rate of 51 feet per second, the frequency of transmission was 29 cycles per second and the wavelength was 21 inches. The mechanical oscillator was used in place of Tesla’s electrical oscillator as it presents an almost perfect analogy. Standing



or stationary waves of the rubber surface replace the electromagnetic waves of Tesla's system. By the test of this analog, the operation of Tesla's system can be forecast. When the oscillator arm was set in motion by operating the motor, there were three standing waves having six loops on the 'earth's surface' all having the same amplitude of vibration! When the finger was pushed against one or more loops, all the loops were reduced in amplitude in the same proportion showing the ability to obtain all the power out at one or more points! The waves extended completely around the 'world' and returned to the sending station."

Recommended Study Method for *Harnessing the Wheelwork of Nature* Textbook and Reader

This author's "Introduction to Tesla's Science of Energy" chapter is intended to start scientists thinking in the direction of pulsed, electrostatic discharge (longitudinal) acoustic type of compression wave which is presented on pages 14-19. That is why the Wardencllyffe Tower has a sphere on top like Tesla's patent #645,576. (Use [www.google.com/patents](http://www.google.com/patents) for a free PDF copy of Tesla's patents.) A conductive sphere charged to millions of volts will have an E field radially outward. If we pulse the sphere with a high voltage, the Poynting vector (S) and the E field are in the same direction. S still is in the direction of propagation but now the wave is a nonlinear, compressed bunch of charges moving radially outward. Some physicists who have analyzed this phenomenon, rarely known in EM physics (even though the solutions appear in Maxwell's equations), report that the magnetic B field is spiraling in a helical fashion around the radial direction, since the moving charges constitute a radial current pulse. This behavior is quite different than Hertzian, transverse waves that most engineers know about.

It is recommended that engineers and technical readers study Chapter 12 of *Harnessing the Wheelwork*, which is Dr. James Corum's primer for engineers: In particular, the voltage magnifier section is important, the transmission line resonator section as well, and the cavity resonator--potential magnification section will get you prepared for the MONOCHROMATIC carrier "Case I" section and the Beat Frequency modulation section "Case II." Creating standing waves with zero envelope velocity (Appendix of Corum's paper on p. 212) hopefully will start you thinking along different lines.

Chapter 13 is also by the Corum(s). It explains the charging cycle for the Wardencllyffe Tower on p.226 very well. On p. 227 we find the important conclusion that the "tuned circuit of his magnifying transmitter was the whole earth-ionosphere cavity resonator." Very few scientists have studied James and Kenneth Corum who present a wealth of knowledge about Tesla.

Now, for the culmination of this 3-part thesis on Tesla's wireless is the paper by Dr. Elizabeth Rauscher in Chapter 14. (That is why I published them in this order.) Rauscher not only explains Tesla's theory very well on p.233-237 but also introduces the concept of PHONON (longitudinal) wave interactions. She performs the crucial calculations that convinced me to write the book on p. 238-9. With terawatts of potential energy stored in the earth-ionosphere capacitor and terawatts stored in the magnetosphere, she also explains the stationary waves (standing waves) that Tesla created with two wavelengths. Furthermore, she answers the question you raised about the static potential energy of the ionosphere by explaining the resonant oscillator, step-down transformers which make transducing the energy so much more efficient. Rauscher and Bise have measured much of the ELF pulsations of the

Schmann cavity themselves, as shown in her Appendix. Rauscher uses soliton theory to help explain the transmission of energy.

At the Tesla Energy Science Conference & Exposition, Dr. Konstantin Meyl was also there, who has developed pulsed discharge spherical antenna communication kits for sale. He is a physics professor in Germany who I have met at two conferences and also has an interesting theory of longitudinal, scalar wave propagation. Integrity Research Institute also resells his book entitled, *Scalar Waves*. Visit his website for more information - <http://www.meyl.eu/>

Toby Grotz reports in his article that, in the 1980's, about 1/3 of the generated electrical power in this country was lost in transmission. Today, a couple of decades later, we have shamefully doubled our dependence on foreign oil and also doubled our electrical transmission grid inefficiency. From 31 Quads generated, a full 2/3 is totally wasted in "conversion losses." We simply need to eliminate the 7 trillion kWh of conversion losses in our present electricity generation modality. This book scientifically proves that Tesla's wireless transmission of power will accomplish electrical distribution, better than centralized or even, dispersed generation.

Tesla discovered the evidence for charge clusters (as patented by Ken Shoulders and Hal Puthoff), the overunity effects of air arcs (as experimentally verified by Dr. Peter Graneau and George Hathaway), and the overunity effects of plasma glow discharge (as experimentally verified and patented by Dr. Paulo Correa).

J. Pierpont Morgan declared in 1901: "It has been stated that Morgan simply gave Tesla \$150,000 with no strings attached. Actually, there were plenty of strings attached. Morgan delayed his check for a few months. Finally it came with the stipulation that fifty-one percent of the patents relating to wireless telephony and telegraphy, not only those to be used in the present but the ones to be developed – all were to be in Morgan's name. The \$150,000 was well-secured...On March 1, 1901, Tesla sent to Morgan his contract, signing over the fifty-one percent interest in his patents and inventions and in any future ones relating to electric lighting and wireless telegraphy or telephony...Morgan's \$150,000 was woefully inadequate when Tesla considered all that must be done, but it was a start. He secured a tract of land on Long Island, about sixty miles from New York City, though an arrangement with James S. Warden. Tesla had pictured to Warden a glowing and convincing real estate boom in that site, employing several thousand people who would build their homes on the adjacent land. Warden cooperated to the extent of offering two hundred acres of land for the use of the scientist, twenty acres already cleared and with a well one hundred feet deep. By July 23, 1901, work had started on the project with the roads cleared and the right of way in order. Thus, within a little less than five months after the contract with Morgan was signed, work was started on Tesla's giant project." The rest of the horror story is history, as only the tower frame was erected in the next year. No more money was forthcoming for the project that Morgan initiated, even when the equipment cost alone cost about \$200,000. Morgan believed that he would "have nothing to sell except antennas (and refused) to contribute to that charity." Tesla tried and tried for years until in 1917 the U.S. government blew up the abandoned Wardencllyffe tower



because suspected German spies were seen "lurking" around it. With Edison as his willing ally, Morgan even publicly discredited Tesla's name, so that all of the five school textbook publishers of the time removed any reference to him. Any wonder why even today, 100 years later, hardly anyone knows who Tesla is?

Upon reading the rest of this book, all of us who contributed to this book know that the engineers and physicists of the 21st century will come to appreciate the benefits of the tremendously efficient (about 95%) wireless transmission of power. In terms of today's systems theory, Tesla understood that it is vital to "increase human energy" in order to maximize the quality of life worldwide. (See the Puharich biographical chapter for a detailed analysis of this Tesla theme.) In terms of economic theory, many countries will benefit from this service. At first, receiving stations will be needed. Just like television and radio, only an energy receiver is required, which may eventually be built into appliances, so no power cord will be necessary! Just think, monthly electric utility bills will be optional, like "cable TV."

Tesla was an electrical genius who revolutionized our world in a way that DC power could never have accomplished, since the resistance of any transmission lines, (except perhaps, superconductive ones), is prohibitive for direct current. He deserved much better treatment from all three of the tycoons described above, than to spend the last 40 years of his life in abject poverty. However, he was too much of a gentleman to hold a grudge. Instead, regarding the magnifying transmitter, Tesla wrote in his autobiography, "I am unwilling to accord to some small-minded and jealous individuals the satisfaction of having thwarted my efforts. These men are to me nothing more than microbes of a nasty disease. My project was retarded by laws of nature. The world was not prepared for it. It was too far ahead of time. But the same laws will prevail in the end and make it a triumphal success."

The Wardencllyffe Tower Centennial, (1903-2003) to many, signified an extraordinary cause to remember and resurrect. Now a decade later, let us fulfill this prophesy of Tesla, making it a triumphal success, by supporting a philanthropic, international wireless power station to benefit the whole world. The scientists who contributed to the *Harnessing the Wheelwork* anthology are available to make such a global wonder a reality. More Tesla fans are being attracted every day eager to learn what was left out of most textbooks. The benefits, immediately alleviating electric power shortages everywhere, are too numerous to count. (For example, in Tesla's homeland, the Electric Power Company of Serbia raised their monthly rates by 50% on the day the *Harnessing the Wheelwork* book went to the publisher, which was a foreboding synchronicity.) Are you willing to help make a world of difference? Start supporting any Tesla organization of your choice. More information is available at [IntegrityResearchInstitute.org](http://IntegrityResearchInstitute.org).

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