Nikola Tesla, the Russians and Witricity: Wireless power transmission revived

Steve Taranovich - June 28, 2014

On July 10, 2014, it will be Nikola Tesla’s 158th birthday celebration celebrated at the Shoreham-Wading River High School auditorium---close to the site where his Wardenclyffe laboratory still stands today on Long Island, NY.

Dr. Nikolaos Simos, a scientist from Brookhaven National Laboratory on Long Island, NY will be at this event to describe the science behind what Tesla was trying to accomplish right there at Wardenclyffe. I attended an IEEE-sponsored seminar by Dr. Simos in 2012.

The Wardenclyffe Laboratory (Still standing on the site today) and the Tower behind the lab (demolished by dynamite in 1917 by the U.S. government, the 187 foot mammoth tower never got a chance to transmit)

TeslaTower working principles

Tesla’s energy transmission system used the earth as a “wire” in order to transmit energy large distances. Visit the Global Energy Transmission site for an in-depth analysis and treatment of the
The Tesla Tower is a helically-formed quarter-wave resonator grounded by one tail with distributed parameters, and additional capacity being located in the upper end of the helix. This resonator is oscillated by means of reference generator (sinusoidal signal, oscillation frequency value is lower than 20 kHz if based on Tesla's patents such as US787412 and US1119732). (Image courtesy of Global Energy Transmission)

Edison’s DC concept

Edison’s DC transmission concept was similar to this when he implemented DC power transmission in NY city in the 1870s to 1891. DC was transmitted to consumers via one wire and the ground was used as the second wire return to the power source.
The long-legged Mary Ann type early DC dynamo created by Edison (Image courtesy of the Edison Tech Center)

The difference in Tesla’s design was transmission of large power through the earth over long distances with enormous efficiency due to coupling of resonance circuits (The Tesla Towers) Another marked difference from Edison was that Tesla was using AC.

Professor Dr.-Ing Meyl

Professor Dr.-Ing. Konstantin Meyl developed a concept of a Potential vortex. Prof. Meyl chooses Faraday’s law of induction, as a hypothetical factor and proves that the electric vortex is a part thereof. This potential vortex propagates scalar-like through space and is a longitudinal electric wave whose properties have already been established a century ago by Nicola Tesla.
Meyl’s book includes a solution to the puzzle of scalar waves prompted by a NASA report¹.
(Image courtesy of Meyl’s website)

**Demo kit**

There is an experimental and demo kit available from Meyl’s website that enable one to research the characteristics of Tesla coils, dependency of the resonant frequency regarding the position and size of the ball electrode and the many types of systems resonance depending on changes of the distance between transmitter and receiver. His main goal here is to achieve reproducible measurements, which cannot be done by a simple instruction guide.

Since doubters will only believe in results of measurements acquired by their own devices, this is a means in which they can see for themselves how the technology actually works. Connection possibilities for external measuring devices are provided as well. These are small-scale demonstration devices operated at an electric potential of 2 V, in contrast to potentials in the range of 60 kV as Tesla used in his large equipment.
Meyl’s demo kit consists of a waveform generator from 4 MHz to 8 MHz and two Tesla pancake coils with different resonance. A complete scalar transmission line can be set up as a demo. (Image courtesy of Meyl’s website)

Experimental kit

Meyl’s experimental kit has an extended waveform generator from 135 kHz to 10 MHz, a frequency counter and two additional pairs of Tesla pancake coils with half and twice the wire length.

Russian scientists

Russian scientists are now trying to carry on Tesla’s work to completion with an $800,000 crowdfunding effort on IndieGoGo. These scientists use Meyl’s experimental demo kits as a means to understand the main working principle of a system with two Tesla Towers (The Earth surface acts as a “wire” and the Towers serve as balls (charge integrators). The Tower/transmitter creates an AC charge in its integrator. The current is evoked into the ground around the Tower and scatters away from the Tower. These same currents make the second Tower/Receiver resonate with energy it received.

This energy happens just like a standard transmission like via a wire. The big difference here is Tesla only needed one wire, instead of two. The surface layer of the Earth acts as a “wire” and is about 100 to 1000 meters deep (together with the Earth’s Ionosphere as a waveguide). The Tower/Transmitter oscillates the currents flowing away from the Tower through the Earth’s surface
and the Tower/Receiver collects the energy from this current. See the Global Energy Transmission website for a detailed explanation of this effect.

The Wardenclyffe Tower is shown on the left of this image (weighing 60 tons) and the Russian scientists proposed tower (weighing 2 tons) is on the right (Image courtesy of scientists Leonid and Sergey Plekhanov and advisor Alex Fedotov)

Advanced electronics by the Russians

The scientists have integrated advanced electronics into Tesla’s original design with the hopes of transmitting large amounts of energy through the earth ground across significant distances safely and with no apparent losses. Check out their video.

Witricity

As reported in a CNN interview, Dr. Katie Hall, CTO from Witricity, is also working on Tesla’s concept. Hall explains that she is putting a magnetic field in the air, not electricity, using a very similar technique that Wi-Fi routers are using today. This is a highly Resonant Wireless Power Transfer Technology. Dr. Hall is beginning with implementing this technology in the home as a first major step. Ultimately, Witricity wants to take the next step after that in long distance transfer of energy.
The Witricity design has the power source (seen on the left side) connected to AC power. The blue lines are the magnetic near field induced by the power source. The yellow lines show the flow of energy from the source to the capture coil that is shown powering the light bulb. Notice that the magnetic field (blue lines) which are able to wrap around a conductive obstacle between the power source and the capture coil. (Image courtesy of Witricity)

The WPT community

The Wireless Power Transfer (WPT) community has developed arrays of energy harvesters to enable the theoretical transfer of giga-watts of power from space all the way down to tiny charge pumps capable of extracting usable energy from less than 5 mW of incident power. The choice of rectifying element(s), along with intelligent design and layout of the energy-harvesting circuit, helps to achieve maximum conversion efficiencies an excess of 90%. Utilizing microwave frequencies keeps these devices small and takes advantage of antenna array techniques, although reducing efficiency.

A WPT system is made up of an RF/microwave generator and transmit antenna(s) on the base station side. The RF-to-dc conversion part of the system is made up of one or many receive antennas, matching networks, rectifying circuits, and low-pass filters. (Image courtesy of Reference 2)

100W wireless power design
An experimental design for transmission of 100 W of wireless power that used two 1 meter square coils on these wooden forms. The forms were separated by 1 meter distance. The image inset is of two full-bridge class D amplifier boards. (Image courtesy of Reference 3)

100W wireless power transfer block diagram

A block diagram of the midrange 100 W wireless power transfer system in Reference 3
(Image courtesy of Reference 3)

Happy Birthday Nikola!

References


Dr. Meyl postulated in his talk given at the August 2004 Extraordinary Technology Conference
that conventional linear (i.e., nonspherical) transmitting antennas emit scalar waves at the
surface of the antenna. A vortex shape energy flow then transforms the longitudinal scalar
waves into conventional (Hertzian) transverse waves as the energy traverses the "critical"
distance from the near-field to the far-field, which is the wave length divided by 2 π.

Note: For this reason, Dr. Meyl is deeply concerned that cell phone users are directly coupling
scalar waves from the phone's near-field directly into their brains, potentially causing brain
damage. Many researchers and engineers are not even aware of the existence of scalar waves.
Conventional measuring techniques and measurements at greater than the critical distance,
where only transverse waves occur, do not indicate the presence of scalar waves.

At the receiving antenna, another set of energy vortices forms and transforms the transverse
waves back into scalar waves that enter the antenna, (i.e., essentially the inverse of what happens
at the transmitter). However, when spherical antennas are used for the transmitter and receiver
(Tesla's method), the scalar waves do not transform into transverse waves.

2 Harvesting Wireless Power, Christopher R. Valenta, Gregory D. Durgin, IEEE Microwave
Magazine, June 2014.

3 Wireless Power Transmission: From Far Field to Near Field, Jaime Garnica, Student Member
IEEE, Raul A. Chinga, Student Member IEEE, and Jenshan Lin, Fellow IEEE, Vol. 101, No. 6, June
2013 | Proceedings of the IEEE