In honor of the recent news that the not-for-profit Tesla Science Center at Wardenclyffe has signed a letter of intent to acquire Tesla’s lab and property on Long Island, NY, EDN celebrates one of Tesla’s few triumphs in a life and career that was filled with ridicule, rejection by his peers, and ultimately debt at the time of his death: his polyphase alternating current system electricity.

Read on for photos and commentary on the inventions behind the War of Currents, Tesla’s World’s Fair success, and more.

*From Frank Chadwick’s “Space 1889” blog:* “Were we to seize and to eliminate the results of Mr. Tesla's work, the wheels of industry would cease to turn, our electric cars and trains would stop, our towns would be dark, our mills would be dead and idle.” -BA Behrend, quoted in Liberty, February, 1937.

**Tesla's first success**

*The following paragraphs are Courtesy of Corrosion Doctors.*

In 1893 Tesla and Westinghouse got the contract to install all the electrical and lighting systems for the Chicago World’s Fair. This was the first World’s Fair with electricity and would prove that alternating current was the electrical system of the future. After the World’s Fair everybody believed in Tesla's alternating current and soon the whole country had switched to Tesla's system.

Westinghouse won the coveted contract to harness Niagara, bidding half of what Edison bid for the installation of a DC system. Tesla's success on the World's Fair was a factor in winning the contract to install the first power machinery at Niagara Falls, which bore Tesla's name and patent numbers.

In 1895, the Niagara AC power system enjoyed a flawless inauguration, transmitting electricity to Buffalo 22 miles away, a complete impossibility in the suddenly outmoded world of direct current.

No longer a curious luxury reserved for the urban upper class, electric power in the home would now be commonplace. For the first time in his life, Nikola Tesla was an indisputable success.

All images are courtesy of the Tesla Society except where noted.
The World Columbian Exposition in Chicago in 1893 was the World's Fair commemorating 400 years since Christopher Columbus set foot in the New World. This was the first great victory of Tesla's Alternating Current Electricity. Tesla and George Westinghouse made the Exposition a spectacular display of lights and energy.
World's Columbian Exposition in Chicago 1893
The Great Victory of Tesla's Polyphase Alternating Current Electricity
Court of Honor at the Columbian Expo (Courtesy of PBS)

The Dream City at the Columbian Expo
Tesla 500 HP polyphase generator at the Westinghouse Exposition

Four of the 12 1000 horse-power, two-phase generators at the Alternating Current Power Plant at World's Fair, Chicago, 1893. (Courtesy of Neuronet)

**Perfect partnership**

*Tesla AC polyphase generators as part of the Westinghouse World’s Fair Exhibit (Adopted from "A Life of George Westinghouse," by Henry G. Prout, 1921.)*

Quite apart from the lighting plant, the Westinghouse Company showed at the World's Fair a complete polyphase system. A large two-phase induction motor, driven by current from the main
generators, acted as the prime mover in driving the exhibit.

The exhibit, then, contained a polyphase generator with transformers for raising the voltage for transmission; a short transmission line; transformers for lowering the voltage; the operation of induction motors; a synchronous motor; and a rotary converter which supplied direct current, which in turn operated a railway motor.

In connection with the exhibit were meters and other auxiliary devices of various kinds. The apparatus was in units of fair commercial size and gave to the public a view of a universal power system in which, by polyphase current, power could be transmitted great distances, and then be utilized for various purposes, including the supply of direct current. It showed on a working scale a system upon which Westinghouse and his company had been concentrating their efforts; namely, the alternating-current and polyphase system.

It has been maintained with some plausibility that the most important outcome of the Centennial Exposition of 1876 was that the people of the United States there discovered bread. So it may be maintained with even more plausibility, that the best result of the Columbian Exposition of 1893 was that it removed the last serious doubt of the usefulness to mankind of the polyphase alternating current.

The conclusive demonstration at Niagara was yet to be made, but the World’s Fair clinched the fact that it would be made, and so it marked an epoch in industrial history. Very few of those who looked at this machinery, who gazed with admiration at the great switchboard, so ingenious and complete, and who saw the beautiful lighting effects could have realized that they were living in an historical moment, that they were looking at the beginning of a revolution."
George Westinghouse and Nikola Tesla. Seeking to make a long distance electric power transmission a reality, they combined their skills, their genius, and their belief in a new technology: alternating current. Together they started a revolution that electrified the world -- A Perfect Partnership.
This is the electricity building where the Westinghouse Expo was held.
The Tesla/Westinghouse display at Electricity Hall. Tesla Polyphase Alternating Current Sign on display, Westinghouse Expo.
Another view of Tesla's AC exhibit
Nikola Tesla’s personal exhibit at the World’s Fair in Chicago, 1893. The Egg of Columbus centered in this photograph.
In 1888, Tesla presented to the world his brilliant creation of the AC polyphase system. Before Tesla’s invention, the naturally flowing alternating current was converted into one direction by means of an inefficient device called the commutator (a series of wire brushes). This loss of energy was enormous, and because of it, generators could only transport electricity about a mile, and then...
only to illuminate homes.

Tesla’s AC concepts revolutionized future lighting/energy and simplified motors/generators while Westinghouse gained seven major inventions and 40 patents!

After Tesla’s invention, electrical power as well as mere energy for lighting homes could be transported hundreds of miles; for the inventor had conceived of a way to organize two (or more) currents out of phase with each other in such a way that they generated a single electromagnetic field that rotated in space. A receiving magnet placed within this field could now turn a motor without the use of a commutator. He also explained the effect mathematically. Virtually overnight, Tesla's invention created a quantum leap in the electrical arts.

A few years earlier, Tesla had offered the new system to Thomas Edison, whom he had worked for after immigrating to America. Unfortunately, Edison was a DC man and wary of working with what he perceived to be the contrary and dangerous high frequencies of AC. However, George Westinghouse, an Edison competitor and dabbler in AC devices realized the importance of Tesla's creation and thereupon purchased the invention for a reported million dollars plus royalties.

Westinghouse did not merely acquire a device which did away with a commutator, he obtained the rights to an entire power system which was so complex that it had to be broken down into seven major inventions and 40 patents! Included in this package were such inventions as the Tesla coil, the alternating current generator and dynamo, synchronous and load dependent induction motors, and the rotating magnetic field, an entirely new principle behind the polyphase system.
One of the original AC Tesla Induction Motors on display in the British Science Museum in London.

This motor was referenced in TC Martin's book as loaned by Tesla to Prof Ayrton in England. In 1892, Tesla delivered his famous lecture before the Institution of Electrical Engineers and the Royal Institution of Great Britain, in London, where he gave his original induction motor to Prof Ayrton. (Photo by Jim Morford From Tesla Memorial Society of New York, which is grateful for Morford’s educational photographs and texts.)
of the rotating field in one of the elements of the motor by currents differing in phase and energizing the other element by direct currents. The armatures are of the two and three phase type. It is a model of a motor shown in an enlarged view in Fig. 298. This machine, together with that shown in Fig. 299, was exhibited at the same lecture, in May, 1888. They were the first rotating field motors which were independently tested, having for that purpose been placed in the hands of Prof. Anthony in the winter of 1887–88. From these tests it was shown that the efficiency and output of these motors was quite satisfactory in every respect.

It was intended to exhibit the model shown in Fig. 296, but it was unavailable for that purpose owing to the fact that it was some time ago handed over to the care of Prof. Ayrton in England. This model was originally provided with twelve independent coils; this number, as Mr. Tesla pointed out in his first lecture, being divisible by two and three, was selected in order to make various connections for two and three phase operations, and during Mr. Tesla’s experiments was used in many ways with from two to six phases. The model, Fig. 298, consists of a magnetic frame of laminated iron with four polar projections between which an armature is supported on brass bolts passing through the frame. A great variety of armatures was used in connection with these two and other fields. Some of the armatures are shown in front on the table, Fig. 297, and several are also shown enlarged in Figs. 300 to 310. An interesting exhibit is that shown at L, Fig. 297. This is an armature of hardened steel which was used in a demon-
Thomas Commerford Martin was an author who wrote about Tesla's accomplishments and also worked with Edison on many of his inventions.

The genius who lit the world
NIKOLA TESLA
The Genius Who Lit the World

Father of the Polyphase alternating current system electricity and A-C Induction Motor

Tesla’s discovery of rotating magnetic field.

A Glorious Moment

Fundamental Principle in physics and one of the greatest discoveries of all times.

In February 1882 Tesla was walking with a friend through the city park in Budapest, Hungary reciting stanzas from Goethe’s Faust. The sun was just setting. Suddenly, the solution of rotating magnetic field, which he had been seeking for a long time flashed through his mind. At this very moment he saw clearly in his mind an iron rotor spinning rapidly in an rotating magnetic field produced by the interaction of two alternating currents out of step with each other. One of the ten greatest discoveries of all times was born at this glorious moment. In summer of 1883, while in Strassburg, France, he built his first actual induction motor and saw it run. Tesla’s A-C induction motor is widely used throughout the world in industry and household appliances. It started the Industrial Revolution at the turn of the century.

Poster by Dr. Ljubo Vujovic, president, Telsa Memorial Society of New York, describing how the rotating magnetic field was discovered by Tesla in Budapest, 1882.
Nikola Tesla was inducted into the National Inventor’s Hall of Fame for his invention of the Electro-Magnetic Motor- Alternating Current in 1975.

**Nikola Tesla**  
Born Jul 10 1856 - Died Jan 7 1943

**Electro-Magnetic Motor**  
**Alternating Current**  
Patent Number(s) 381,968

**Inducted 1975**

Nikola Tesla invented the induction motor with rotating magnetic field that made unit drives for machines feasible and made AC power transmission an economic necessity.

In 1887 and 1888 Tesla had an experimental shop at 89 Liberty Street, New York, and there he invented the induction motor. He sold the invention to [Westinghouse](#) in July 1888 and spent a year in Pittsburgh instructing Westinghouse engineers.

**Invention Impact**

Alternating current (AC) became the premier form of electrical energy after it overcame objections by Thomas Edison who designed direct current (DC). Tesla also showcased his invention at the 1893 Chicago World’s Fair where he and Westinghouse won the bid to illuminate the International Exhibition. Alternating current captivated the public with its efficient lighting and lessened heat.

AC has an electric current whose direction reverses cyclically rather than staying in a constant direction like DC. The waveform of AC is also more efficient than the DC. AC is the form in which electricity is carried to homes and businesses.

Nikola Tesla was inducted into the National Inventor’s Hall of Fame for his invention of the Electro-Magnetic Motor- Alternating Current in 1975.
Tesla's Alternating Current Motor found at the Smithsonian Institution in Washington DC. (For more information see: Smithsonian Institute (Museum) in Washington DC pays tribute to Nikola Tesla)

Tesla's impact
By 1895 Tesla's invention was successfully utilized in Switzerland, Germany, and England, at the
Chicago World's Fair, and Niagara Falls. It was also the means for the creation of the electric railway system. Today, virtually every electrical power station on the planet owes its existence to Tesla, as his creation has remained unchanged a full century after its conceptualization. As a single individual, Tesla altered the course of history in a dramatic way.

Nikola Tesla was recently celebrated at the DESIGN East presentation "Steampunk Design: How to Engineer Science into Art (or vice versa)." The impact of the technologies invented by Tesla are a recurring theme in the steampunk genre of alternate technology science-fiction. See an excerpt of Mark Landsberg's DESIGN East presentation below:

For more on Tesla and his work, see:

- Tesla - Connecting the dots
- Nikola Tesla is born, July 10, 1856
- Nikola Tesla slideshow: Images and articles from Tesla's writings
- Nikola Tesla Collection