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Engineering 24
December 11, 2000

The Power Struggle

At the close of the nineteenth century, the world marveled at the advantages electricity provided. Just as the Industrial Revolution made agricultural tasks easier, the Electrical Revolution made industrial tasks easier. Electricity lit up the nighttime sky and powered trolley cars in the cities. But despite the advantages of electricity, the disadvantages of its preliminary distribution, direct current, made electricity a burden just as much as it was a godsend. Championed by Thomas Edison, direct current lines were the standard of the late 19th century. But Nikola Tesla's introduction of an alternating current motor revolutionized the electrical industry.

Edison's power stations were a public sensation from the start when he opened the central station in New York in 1881. But, Edison's direct current system provided no practical method to change the voltage. Transmission of electricity, therefore, was very inefficient. Electricity was generated, transmitted, and used at about 100 volts. So, a customer who needed 4,000 kilowatts would need a large amount of copper conductors to draw 40,000 amps. To counter the losses in transmission and the large amount of copper, Edison built generating stations every few blocks.

George Westinghouse recognized the inefficiency of the direct current system in transmitting electricity. To combat such losses in transmission, Westinghouse advocated using gas pipelines that used high pressure to transmit electricity efficiently and then used

low pressure to use the electricity safely. But, this system used transformers that relied on alternating current. Luckily for Westinghouse, Tesla had just developed an alternating current motor. In 1888 Tesla demonstrated a commutator-less, one-half horsepower ac motor to the (AIEE). Two months later, Westinghouse purchased the rights to the motor for one million dollars and royalties. Based on the increase in the consumer price index since 1888, Tesla received the equivalent of more than a half-billion dollars for his invention, all of which was tax-free. Also, Tesla was hired on by Westinghouse to serve as a consultant. In addition to this, Tesla and Westinghouse established the frequency standard of the ac system at 60 hertz to compromise for lights flickering at low frequencies and for the lag of current relative to voltage at high frequency. Westinghouse and Tesla were now ready to challenge Edison.

But to challenge Edison, meant to challenge an institution already established as the pioneer in electricity. Ever since the light bulb, Edison and electricity were synonymous to each other. Americans revered Edison for lighting their homes. And, Edison's belief that "Invention is one percent inspiration and 99 percent perspiration," suited ideologically with America's belief in the Puritan work ethic. And, as mentioned before, generating stations using the dc system were already established in New York. Westinghouse and Tesla faced a daunting foe.

Edison and Tesla had never been on the best of terms. In 1884 Tesla arrived in America looking for a job in Edison's corporation. Armed with a letter from the head of the European branch of Edison's operations, Charles Batchelor, Tesla presented himself before the great American inventor. Edison immediately challenged the Serbian, asking him to fix a ship's lighting system (that had been installed by Edison). After successfully repairing the ship Tesla was offered a job. However, Tesla's stay at the company did not last long. Edison told the young inventor that if he could make his power plant run more efficiently using an alternating current system, then he would reward him with a fifty

thousand dollar prize. Yet, even though Tesla was able to improve the plant, Edison refused to pay him, saying that it was just American humor. Tesla angrily quit and decided to branch out on his own, believing that alternating current was a much more efficient way of transmitting electricity.

Tesla based his hope on his ideas for a generator that used induction to build and reverse rotor fields. The motor Tesla would invent would use two sets of stationary electromagnets supplied with current from two sources that were ninety degrees out of phase. However, it would take several years of financial hardship and experimentation before he could get his ideas to be used by an entrepreneurial giant such as Westinghouse.

Upon being taken into the Westinghouse company, Tesla was ready to fight a war with Edison to make alternating current king. However, Edison fought the war by staging graphic demonstrations to show the potential danger of alternating current. These graphic displays included the electrocution of farm animals, elephants and even a human. In 1890 the first electric chair to execute a condemned man. This man was to be the convicted axe-murderer William Kemmler. On August 6, 1890 the man was put to death in such a shocking display that witnesses claimed that he actually ignited in flames. Yet, Tesla needed no such demonstrations; he felt that the dangers of direct current were starkly apparent and that they demonstrated themselves. In the Great Blizzard of March 11-14, 1888, four hundred people died due to electrocution by wires that fell to the ground.

Despite Edison's negative advertising campaign, Tesla would win the war in single battle, the event of the 1893 World's Fair. The Westinghouse Company underbid General Electric, of which Edison was now a part, by five hundred thousand dollars. Westinghouse was able to bid so low because alternating current did not require the huge amount of copper wire involved in transferring direct current. The Westinghouse company used this opportunity to put on quite a display of the potential of electric power and more

specifically, alternating current. With the push of a button over a hundred thousand light bulbs were illuminated. However, this display almost did not happen when General Electric made a court forbid the use of Edison's light bulbs. Westinghouse was forced to create a two-piece light bulb just before the exhibition. However, with the success of the fair, Tesla had shown to the world the superiority of alternating current. He had won the war.

With alternating current now the current of choice for America, Tesla wanted to use it to fulfill one of his life long dreams. From childhood he had envisioned harnessing the power of Niagara Falls to produce electricity. Several months after the World's Fair, Westinghouse was commissioned to build the first two alternating current generators of the Niagara power station. With patents on both an AC motor and a method of distribution Tesla was ready to fulfill his dream. Tesla's system allowed for the power to be distributed over a wider area, illustrated through its flow to Buffalo, New York which was over twenty miles away. In November of 1896, this feat was accomplished when power was finally transmitted to Buffalo. This solidified alternating current as the most effective way to transmit current. After this, the United States was electrified and it was done through AC power generation and distribution.

Tesla invented many things during his long career. However, alternating current is the field in which he most clearly proved his genius to the masses. Yet Tesla's achievements are still somewhat overshadowed in the public eye by those of Edison. Despite beating the American inventor in the war of the currents, he lost the long-term struggle of having his achievements remembered by history. Things such as alternating current were difficult for the average man to understand and grasp the importance of. However, something tangible like the light bulb was easy for people to come to terms with and praise. Despite his relative anonymity, Nikola Tesla stands as one of the greatest inventors and scientific geniuses of all-time.