Executive Summary

The winter months provide a unique challenge to the third rail traction system of any transit organization. To reduce its electrical bill and energy consumption, the New York City Transit agency initiated the Third Rail Remote Heater project in partnership with the New York Power Authority. Rather than running the heaters continuously from October through May, the new wireless automated system allows the operators to remotely turn individual heating elements on or off as needed from an operations center rather than onsite.

This saves more than $15,000 in energy costs per day, and between $3 and $4 million over the course of the year. Just as important, it improves worker safety and train reliability.
The winter months provide a unique challenge to the third rail traction system of any transit organization. New York City Transit is no exception, facing freezing ice and snow accumulations on its third rail equipment. The third rail supplies the trains with the 600 Volts DC propulsion power needed to operate. During the colder months of the year, it is not uncommon for ice to accumulate on the third rail after rain, sleet or snow events, especially when temperatures drop quickly.

The ice build-ups may cause the trains’ contact shoes to lose their ability to provide 600 Volts DC to the train, which can result in stalled trains. These ice and snow accumulations can also cause major train delays, as the third rails must be de-iced in order for the trains to be supplied with electricity and continue to run safely and reliably. Due to the size of the New York City Transit system and the amount of customers – almost six million daily – who rely on a safe, comfortable, and dependable transportation system, it was imperative that the organization find a more reliable solution that would reduce the instances of ice accumulation and decrease delays and the possibility of stranded trains.

The common practice of activating and deactivating third rail heaters required workers, under flagging protection, to install or remove fuses at over 1,300 locations throughout the transit system. These heaters are left on throughout the months of October through May. Employees never knew the status of the equipment once they left the location. This practice costs the organization millions in energy dollars, as the heaters would run continuously whether or not there was ice on the third rail. This also provided no sense of confidence that the heaters were truly working. Activating the third rail heaters every October and deactivating them every May required the reassignment of personnel from other critical maintenance and inspections. In an attempt to provide a more reliable way of activating/deactivating and monitoring the rail heater elements during the winter months, the Third Rail Remote Heater project was introduced in 2009.
The Third Rail Heater project was developed from a concept established in early 2003 in coordination with the New York Power Authority (NYPA), the largest state power company, and NYC Transit’s Power Energy Management group. NYPA is always on the lookout for energy savings project opportunities. NYCT and NYPA have a pre-approved agreement that promotes energy savings by encouraging the use of newer and more modern equipment to cut energy costs.

NYCT and NYPA realized that the Third Rail Heater project had the potential to reduce future electric billing enough that these energy savings would essentially pay for the required equipment over time. After recognizing the benefits the project could provide for the third rail heaters, it was introduced to Third Rail management. The venture was initially viewed as a potential project for the rail yards, according to NYPA’s Jim Leitner. Leitner also pointed out that the project was originally meant to provide energy savings through a decrease in electric usage.

This idea provided the organization an opportunity to remotely control and monitor over 1,300 250-ft long, 30 Watts per foot, third rail heater elements costing $2,500 each, using a combination of 900MHz radios, radio antennas mounted to substations and Ethernet connections distributed throughout the outdoor portions of the system. This new practice would allow NYC Transit to remotely monitor the heaters and turn them on and off from a centralized location at 38th Street Yard in Brooklyn, the first location where the control points were installed. This ensured that the heaters were powered on only when needed, which would increase the life span of the heaters, but would also provide a tremendous energy savings for NYC Transit. The agency determined where to install these control points based on the lines with the most problems during the winter months and locations where the trains mainly switched from one track to another.
NYCT came up with a plan to reduce the annual third rail heater energy costs by 90%. The idea was to install wireless control points in different outdoor areas of the system. The control points were made up of three boxes: the power box, a high-voltage box, containing the power supplies and two relays used to control a heater element, a low-voltage box housing the radio and a remote high power box, which contained two additional relays to control two more heater elements. To date, there are 507 remote control point locations installed, which control 1,084 third rail heater elements. The control points send remote signals to turn the heaters on and off, eliminating the need for crews to physically be there.

This not only saves over $12,000 per day, but it also reduces train delays. It eliminates the need for assigning crews throughout the system, setting up flagging protection, and activating and deactivating heaters manually. It also allows groups that normally supported this work, but were not budgeted to do so, to get back to their critical maintenance and inspections. It increases safety by reducing the time the crews spend on the tracks, especially during the winter months. Crews can now spend time testing the system and addressing any maintenance issues during the summer so that the system is 100% reliable for the winter. Faulted heater elements or components are reported back to DYNAC’s® SCADA GIS software map interface and Alarm Banner, so that crews can better pinpoint and schedule their repairs. Today, New York City Transit can gladly say that they are saving energy, reducing energy costs, working smarter, and working safer.
TIGGER, The Transit Investments for Greenhouse Gas and Energy Reduction Program, helped NYCT to save energy. It is a stimulus award program started by President Obama in 2009 and overseen by the Department of Transportation’s Federal Transit Administration. The FTA awarded NYC Transit a $2 million grant, which was one of the largest given nationwide. The requirements to receive the grant included that proposed projects reduced energy costs and/or reduced greenhouse gas emissions. Three rounds of grants were given. NYCT obtained its grant in the second round, when Congress adopted $75 million for more projects. With the granted $2 million in funding, NYCT paid the labor costs required to install the control points for the heaters in Phase 1 of the project.

NYPA saw the potential in reducing costs, and has been a huge supporter. NYPA helped with the costs related to the financing and materials (such as the control points and wireless backbone) needed for this project. The agency provided the funding and bidding for this project. They saw the potential in helping to reduce energy costs for NYC Transit through the first four phases. NYPA still continues to fund this NYCT project as it enters Phase 4b and Phase 5 towards its goal of controlling 100% of the third rail heaters remotely. In addition, they plan to add the system to the Division of Track’s guarded curve and flange way heaters.

As mentioned earlier, the Third Rail Heater System was previously run manually through the whole period of winter, typically on in fall, off in spring. The previous system required incredible amounts of energy. It was also virtually impossible to oversee the state of the heater equipment, which was a big threat to the operational effectiveness of the system. So, when NYCT came up with the Third Rail Heater Remote Control Project, the key objective was to reduce energy cost, along with maintaining a smooth flow of operation with a reliable and efficient system, which was successful.

Robert Schmitt, ACEO Electrical Power of NYCT states, “For over twenty years the NYCT Energy Management group has been working in partnership with other NYCT departments to reduce energy consumption while at the same time improving NYCT’s infrastructure. The Third Rail Heater remote control project has to stand out as one of the most successful of the dozens of energy savings projects ever undertaken. Using new technology in an innovative way, this project proves that all parties win when we cooperate. The Energy Management group realizes sustained energy savings which means budget savings. The Third Rail Operations group who were managed by Assistant Chief Edward Brennan realized instant status updates on the performance of their third rail heater system and does not have their employees walking on live tracks to turn heaters on and off. It can now be done remotely and safely from an office environment. In the end, the riding public realizes a transit system that is less impacted by inclement weather.”
The technical support for this project was provided by Phoenix Contact USA and Kapsch TrafficCom USA Inc. Their joint initiative developed a supervisory control and data acquisition (SCADA) network system using wireless technology that allows New York City Transit to control and monitor the heating system remotely. This is one key feature of the Third Rail Heater Project, as the heaters can be controlled from anywhere, such as a personal computer stationed somewhere other than 2 Broadway and/or 38th Street Yard. The SCADA system driven by software named DYNAC®, created by Kapsch, allows the user to run routine diagnostics from a single Human Machine Interface (HMI).

Some of the key features of this automation process are that it allows NYCT to use its external data warehousing features so that historical data related to the heaters operation can be used to make comparisons to a prior time and establish trends. The DYNAC® HMI application contains a mapping feature knotted to satellite images, so the entire system can be seen along with color codes to reflect different conditions of the heaters. The communication between the control points and the DYNAC® system are done through radio frequency. As of now, third rail has four Master Towers located in 38th Street Yard, Coney Island Yard, the Rockaway’s, and East New York, Brooklyn, along with nine repeater towers for radio communications. The antenna located at 38th Street Yard is the main source of signal. A spectrum analyzer is used during preliminary path studies to determine how to deal with any potential outside signal interference. The DYNAC® primary redundant servers are located at 38th Street Yard, which is a third rail operation field office and the location of the very first control points commissioned; 2 Broadway serves as a secondary server location. Regarding the success of this project, Phoenix Contact’s Dick March stated, “It was a collaborative partnership effort with all the teams involved.”
At this time, NYC Transit is waiting for approval from NYPD for Phase 4b and Phase 5 of this automation process. This will include the equipment and logistic support for the next 153 controls points, as well as adding another Master Tower at East 180th Street. Assistant Chief Edward Brennan states that if NYC Transit can implement the upcoming Phases of this automation process, the total number of the control points will be close to 700 controlling almost 1,500 third rail heater elements in known rail icing locations. That’s a big step toward the process of remotely controlling the entire Third Rail Heater System that currently stand at almost 1,600 third rail heater elements. Upon completion of this project, NYC Transit will save $15,000 per day, or approximately $3 to $4 million per annum, along with providing a reliable and safe transportation system for its valued customers.