Transmission Efficiency Initiative:
Host Demonstration Project
Application and Evaluation of Advanced Tools and Techniques to
Dynamically Monitor Transmission Lines at NYPA

- Evaluate application of advanced, dynamic rating tools.
- Monitor before and after energy losses and utilization and document the results.
- Benefits include reduced losses, increased system utilization, and reduced carbon footprint.

**Project Scope**
The project proposed will help develop and assess instrumentation, software, and methodologies for optimizing (thermally) the power flow capacity of operating transmission lines. Ultimately, the project will integrate dynamic ratings into transmission system engineering, operations, and planning. The principal objective of this project is to demonstrate how EPRI’s Dynamic Thermal Circuit Rating (DTCR) technology can be effectively deployed and practically integrated into NYPA’s transmission system engineering, operations, and planning. Another objective is to assess the technical and operational feasibility of the dynamic rating technologies and the expected improvement of system and market efficiency due to increased circuit utilization and reliability, particularly during periods when power from wind turbines is high. This will support the reduction of the industry’s carbon footprint by reducing congestion and facilitating transmission access to lower-emitting generation sources such as wind.

In addition to verifying the increased system utilization, analysis will be performed to determine whether line resistive losses can be reduced by deploying dynamic rating. Dynamic rating increases the capacity of lower-voltage lines, which in turn allows more power flow on the high-voltage lines before exceeding contingency limits. Therefore, resistive losses might be reduced.

The New York Power Authority (NYPA) will evaluate numerous tools and technologies developed to monitor the thermal state of transmission lines and provide the required real-time data needed for dynamic thermal rating. The tools will include EPRI’s DTCR software and other instrumentation, such as EPRI backscatter sensors for measuring conductor temperature and current, video sagometers to monitor the conductor position (sag), and the thermal rate system to measure equivalent perpendicular wind speed. This demonstration project should serve as a good model for other transmission utilities in the New York Independent System Operator Region and other areas in the United States.

Initial instruments and systems will be fully configured and installed on a test line for evaluation before application on the NYPA system. After the system is configured and operating acceptably, it will be shipped to the line sites. Each instrumentation vendor will provide their own on-site assistance during installation, and EPRI will coordinate these activities. The NYPA line crew will perform the actual hands-on installation of all on-site materials, and personnel from EPRI or equipment vendors will provide technical direction. The survey involves measuring the height of the conductors at several locations.
In addition to documenting the lessons learned during the installation and operation of the advanced dynamic rating system, the project will quantify the impact on lifecycle carbon footprint, increased utilization of transmission system, and impact on system losses.

Based on preliminary analysis, it is expected that the demonstration of this technology is expected to increase line transmission capacity in the range of 10 - 20%. Through a consistent measurement and verification (M&V) process, this expected benefit will be quantified and validated during the course of the project.

As a first step, DTCR will run on a stand-alone server away from the operations center and separate from the energy management system (except for the possibility of procuring real-time load data). The DTCR and the input/output data will be verified, and training will be provided to one or more NYPA engineers. As a second step, the DTCR server will be moved to an operations environment where further testing can be performed and where training will be provided to engineering and operations personnel. EPRI will provide ongoing support as needed.

**Expected Benefits**

One or more of the following benefits might be realized through the application of this technology:

- Reduce transmission system losses by increasing the capacity of lower voltage lines and increasing the power transfer on the lower-loss, higher-voltage lines before contingency violation.
- Increase utilization of the NYPA transmission system.
- Reduce overall carbon footprint by reducing congestion and facilitating greater integration of wind energy.

**Approach for Measurement and Verification**

A key objective of EPRI’s Transmission Efficiency Initiative is to verify and validate the “actual” benefits realized by the application of the technology using a consistent M&V methodology that will be developed as part of EPRI’s transmission efficiency research portfolio.

The detailed methodology of M&V will be developed during the course of the project using the following general approach:

- Demand, energy, and CO₂ savings will be determined based on transmission load flow cases for the studied system before and after the installation of the dynamic rating system.
- Line load and losses will be measured and compared over a one-year period and compared to the calculations. This will lead to an industry-accepted methodology for projecting savings from advanced dynamic rating systems.
- A life cycle carbon footprint methodology will be developed for the advanced dynamic rating system.

**Project Schedule**

The schedule of the project tasks is as follows:

1. Identify good candidate lines for the study and specific sites to be instrumented.
2. Study system load flows for three months, including transmission demand, energy, and transmission-related CO₂ losses.
3. Conduct detailed design of instrumentation mounting, integration, power, and communications.
4. Purchase, configure, test, and install field instrumentation.
5. Perform initial DTCR setup and verifications.
6. Conduct physical modeling of lines and development of sag-temperature equations.
7. Perform setup, operation, and integration at NYPA.
8. Monitor power flows and transmission-related losses for 12 months, completing in September 2011, and document the results using the EPRI demonstration protocol.
9. Calculate the change in performance.