Charleston Stone & Beneficial Electrification

Kim Leftwich
President/ CEO

Peter Liu
Professor & Assistant Chair,
School of Technology

Introductions

Kim Leftwich- President/ CEO, Coles-Moultrie Electric Cooperative

Peter Liu- Professor & Assistant Chair, School of Technology

Eastern Illinois University

Jim Wallace- Director Of Operations & Engineering

Coles-Moultrie Electric Cooperative

Tajdar Ahmed, Tanmat Pant, Ayaz Khamisani- Eastern Illinois University Students

Performed research for the project under the auspices of

The Center for American Rural Energy (CARE)

Project: Fully Collaborative Effort
Sycamore Engineering
CHARLESTON STONE COMPANY
Aggregate Processing
Electric Cooperati
USDA
TOTH
THE CENTER FOR
AMERICAN

Charleston Stone Motivation to Seek Improved Crushing Performance

- Charleston Stone mines on both sides of the Embarrass River, moving the trailer mounted primary rock crusher from side to side as needs dictate.
- Primary rock crusher was a diesel powered motor with an electric generator to power secondary and tertiary crushing.
- Trailer mounted primary crusher required more and more maintenance and repair to remain operational.
- Owner John Tarble had experience with electric primary rock crushing at his Marshall, Illinois plant.

EASTERN ILLINOIS UNIVERSITY

COLES-MOULTRIE Electric Cooperative

Your Touchstone Energy® Partner

Early Project Development

- July 2016, Sycamore Engineering, the consulting engineers for Charleston Stone, contacted CMEC
- Sycamore Engineering initially recommended Charleston Stone construct a 69 kV/12.47 kV substation, own 12.47 infrastructure on the mine site and add additional infrastructure to both sides of the Embarrass.
- August 2016, determined that a substation/infrastructure build would be prohibitively expensive, and Charleston Stone really didn't want to own the primary electric service.
- CMEC, assisted by Toth and Associates, its consulting engineers, studied the development and concluded there was far less expensive means to provide robust and reliable service.

EASTERN ILLINOIS UNIVERSITY

COLES-MOULTRIE Electric Cooperative

Your Touchstone Energy® Partner

Early Project Development cont.

- September 2016, CMEC/Toth proposed to provide 3 phase services to both sides of the river;
- Dead end the primary line at a Gang Operated Air Break (GOAB) with feed to Charleston owned switchgear/disconnect and primary cable to Aggregate Processor trailer mounted transformer.
- Providing primary metering at the take–off point with 3-phase service to both sides of the river is the most cost effective solution.
- Ensures one Service Availability Charge, a single demand component, and all kWh on one meter.
- Accompanying the upgrade, CMEC reconductored 13 spans of 3-phase conductor from our substation to the plant, all work completed prior to the new infrastructure deployment.
- Jim Wallace can talk with you after the presentation if you would like more details.

EASTERN ILLINOIS UNIVERSITY

COLES-MOULTRIE Electric Cooperative
Your Touchstone Energy® Partner

Project Benefits to CMEC

- Charleston Stone is among our largest members and their development is important to the region.
- CMEC, like many electric distribution companies, has seen sales level off as a result of energy efficiency efforts and distributed energy resources (DER), so new opportunity is welcomed
- CMEC has made a concerted effort to work closely with its C&I members to provide service and pricing to support their competitiveness as these employers are crucial to the success of our communities.
- Another appealing prospect of the project: It is an exceptional example of Beneficial Electrification
- Through BE, we can invariably improve efficiency, process, and overall cost.
- The Charleston Stone project was the platform to perform an in-depth BE analysis.

Beneficial Electrification Outcomes

- Charleston Stone would save on energy costs replacing a 35% efficient diesel motor with a 95% efficient electric primary rock crusher: savings vary depending on diesel prices.
- Reduced crusher and trailer maintenance with significantly diminished downtime was the biggest gain.
- Coupling Charleston Stone bank financing with, USDA Rural Economic Development Loan & Grant program, it opened an opportunity to purchase additional crusher options that permit different crushing levels and new product – the result is new market opportunities that they were unable to qualify for previously.
- Finally, an environmental and social benefit was realized as some 20,000 gallons of diesel fuel emissions were eliminated from the immediate area.

EASTERN ILLINOIS UNIVERSITY

COLES-MOULTRIE Electric Cooperative
Your Touchstone Energy® Partner

Sample Data

State	Diesel Prices ($/gallon)	Electricity Price (cent/kwh)	Diesel Equivalent ($/gallon)	Diesel Equivalent with Typical Efficiencies ($/gallon)	Savings
Illinois	2.26	6.48	2.61	1.12	1.14

Explanations:

- The price of diesel is $2.26 per gallon, as of May 2017.
- The average electricity rate used for calculation is 6.48 cent per kwh, as of May 2017.
- If electricity is used to power the same amount of mechanical work, the equivalent diesel price would be $2.61 per gallon, assuming 100% efficiency for both electric and diesel motors.
- Considering the realistic efficiency for both electric motor and diesel engine, if electricity is used to power the same amount of mechanical work, the equivalent diesel price will be $1.12 per gallon.
- If electricity is used to power the same amount of mechanical work, the cost saving per gallon of diesel (to be replaced) is $1.14.

Info on the Project

Rock crushing equipment

Existing equipment: a 300 to 350 hp diesel unit that also powers a 100kW generator to run several motors
New equipment: The new unit has the following motors: (1) 400 hp for the crusher, (1) 60 hp for the feed conveyor, (1) 40 hp for the outtake conveyor, (2) 10 hp for additional conveyors, (1) 20 hp motor for adjustments, and (1) 40 hp motor for the jackhammer.

Net impact on energy costs:

Charleston Stone is expected to save nearly $500/month on energy.

EASTERN ILLINOIS UNIVERSITY

COLES-MOULTRIE Electric Cooperative
Your Touchstone Energy® Partner

Charleston Stone Data

Energy use and energy costs before the upgrade.

Average monthly KWH usage for the last 12 months – 51,280 KWH (revenue - $4,273), average monthly demand for the last 12 months – 524 KW (revenue - $5,140)

Projected energy use in kWh and KW

KWH (energy) – 117,780 (figuring 7 hours a day, 20 days a month), KW (demand) – 1,000 (figuring 490 volts, 520 HP full load, 90% power factor). This is calculating the additional load plus the averages in the previous line. The manufacturer will have more accurate loading information.

Projected energy costs for energy and demand

Energy - $8,716 ($.074/KWH), Demand - $8,000 ($8.00/KW). Again, these numbers may be high since they are based on full load.

EASTERN ILLINOIS UNIVERSITY

COLES-MOULTRIE Electric Cooperative

Your Touchstone Energy® Partner

Business & Technology Strategies

TechSurveillance

This article was developed in partnership by:

NRECA America's Electric Cooperatives | THE CENTER FOR AMERICAN RURAL ENERGY

C&I CASE STUDIES IN
BENEFICIAL ELECTRIFICATION

Rock Crushing Equipment

Coles-Moultrie Electric and Charleston Stone

BY **PATRICK KEEGAN**, COLLABORATIVE EFFICIENCY, OCTOBER 2017

SUBJECT MATTER EXPERT FOR QUESTIONS ON THIS TOPIC

Keith Dennis, NRECA Assoc. Director, Strategic Initiatives: *keith.dennis@nreca.coop*

Robbin Christianson, NRECA Sr. Manager, Engagement & Strategy: *robbin.christianson@nreca.coop*

INTRODUCTION

The wise use of electricity, *Beneficial Electrification*, has sparked widespread re-thinking of policies that encourage or mandate less electricity use and promote infrastructure planning. Advancements in electric technologies continue to create new opportunities to use electricity as a substitute for on-site fossil fuels like natural gas, propane, gasoline and fuel oil, with increased efficiency and control. It also offers local economic development and enhances the quality of the product used by the customer.

Electrifying industrial and commercial processes is a proven method to help local businesses stay competitive. Beneficial electrification strengthens the cooperative presence in the community and offers benefits to the electric system, such as environmental performance. Cooperatives working with C&I customers to assess need is a good place to start. To provide examples of various approaches to working with C&I customers on beneficial electrification initiatives, NRECA is developing a **series of case studies**.

This case study focuses on a cooperative in Illinois and its quarry system member. Electrification of the quarry system reduced the member's costs, enhanced productivity and reliability, and improved its product to open new market opportunities.

Questions?
EASTERN
ILLINOIS
UNIVERSITY
COLES-MOULTRIE
Electric Cooperative
Your Touchstone Energy® Partner