



Industrial Power System Solutions

INTRODUCTION

Safe, reliable electric power can be a critical component of your industry's successful operation. But getting your facilities the power they need requires professional planning and innovative design to overcome site and budget constraints, short schedules and rapidly changing needs.

You need comprehensive services from your engineering consultant to install safe, dependable and cost-efficient electric power systems and facilities. Drawing on more than 90 years of electric power transmission and distribution experience with industry and electric utilities, Burns & McDonnell's engineers, architects, economists, scientists, construction managers and technicians collaborate to guide your project from conceptual planning to energization.

CASE HISTORIES

ARCHER DANIELS

This project consisted of a 34.5-kV substation at the cogeneration plant and six (6) 34.5-kV distribution feeder circuits to five (5) plant site substations and one (1) investor owned electric utility interconnection point. Burns & McDonnell's responsibilities included route selection, substation design, distribution line design, and construction administration assistance.

Continuous service, expandability and airborne contaminants were the design criteria for ADM's 34.5-kV cogeneration substation. Burns & McDonnell implemented a reliable breaker and a half scheme with special insulation design coordination to satisfy the design requirements. Burns & McDonnell was responsible for structural steel and foundations design, technical specifications and drawings for materials, equipment, relay control boards, transformers and power circuit breaker contracts.

Burns & McDonnell assisted ADM in selecting a line route that would have the least impact on present and future plant operations and expansion while providing circuit availability for expected substation additions. Structures were spotted in a complex maze of overhead and underground utilities, railroad tracks, roadways, cooling towers and storage tanks.

**WE TAILOR OUR
APPROACH TO MEET THE
UNIQUE REQUIREMENTS
OF YOUR COMPANY**

AK STEEL CORP. – MIDDLETOWN WORKS

The substation and transmission lines were needed to provide power for AK's new oxygen plant at their steel works in Middletown, Ohio. This was a design-build (turnkey) project with New River Electric Corp. serving as the construction contractor. Equipment procurement, design, construction, and testing of this project was completed within nine months.

The design was for a new 132/13.2-kV substation, with a 132-kV SF6 breaker and a 132/13.2-kV 25 MVA transformer feeding a line-up of 15-kV 750 MVA outdoor metalclad switchgear. This project included equipment removal and structure modifications in an existing 132-kV substation, and modification of three existing 13.2-kV substations. Burn & McDonnell was responsible for site grading design including a transformer oil containment, foundation design, grounding, ductbank design, specifications for the steel structures and construction, and coordination of the transformer, PCB, and switchgear electrical connection diagrams.

The transmission line design consisted of single-circuit 132-kV steel poles from an existing AKS substation to the new substation. Burn & McDonnell was responsible for transmission line routing, structure location and conceptual design, foundation design, material specifications, steel structure specifications, and construction specification.

KOCH REFINING COMPANY

This project included expansion of one 69-kV substation, complete rebuilding of a second 69-kV substation and relocation of a third substation in conjunction with a major refinery expansion. Burns & McDonnell's responsibilities included complete electrical system studies, conceptual design, 30 percent design, cost estimating, equipment specifications, detailed and construction management.

Burns & McDonnell performed extensive electrical power system modeling, analysis, and design for this project. Alternative arrangements were developed to improve reliability of the existing power system and allow for additional load due to several refinery expansion projects. Each alternative was evaluated in terms of cost, reliability, maintainability and constructability.

Substation design included the complete replacement of a conventional air insulated 69-kV substation with a new gas insulated substation (GIS) due to space limitations, expansion of a 138-kV/69-



kV substation, and relocation of a substation in the center of the refinery is being relocated to reclaim the space for a future process expansion.

The primary distribution system consists of 15-kV shielded power cables installed in cable tray and duct banks throughout the refinery. New duct banks were required to determine the most suitable routes. Cable trays are being installed on existing piperacks.

ICI EXPLOSIVES

This project consisted of updating existing drawings, short circuit study, and relay coordination study for the 69-kV and 5-kV primary distribution system at an explosives manufacturing facility. The 69-kV system consisted of a 69-kV overhead loop around the plant connected to four primary distribution substations. The four substations consisted of one or more step down transformers and medium voltage switchgear. The 5-kV distribution system consisted of overhead and underground distribution circuits supplying more than forty substations.

A.E. STALEY MANUFACTURING COMPANY

This project consisted of the complete rebuilding of an existing 50+ year old 50,000kVA, 34.5-kV substation. This substation provided the 13.8-kV primary power distribution system at the process plant. Multiple outages occurred each year due to equipment failures, misoperations and faults caused by small animals. Burns & McDonnell provided complete design services from the initial studies to final startup of the new substation. Space was very limited requiring the new substation to be built around the original substation while it remained energized. All the distribution circuits were transferred to the new equipment in a single 60-hour plant shutdown.



UPS REPLACEMENT PROJECT

Uniterruptible power supplies (UPS) maintain electric power to critical processes during a loss of normal power. UPS's are typically designed to have sufficient energy available to allow for an orderly shutdown of critical processes during a loss of power. Burns & McDonnell is currently engineering the replacement of several UPS's for Koch Refining in Corpus Christi. The UPS's serve critical loads in both process and utility areas of the plant.