In Partnership with

Frito Lay

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Sud Associates is a consulting engineering firm that provides engineering study, design, and research services. Our offices in Durham and Asheville are staffed by LEED Accredited Professionals, professional engineers, certified energy managers, and staff members with postgraduate degrees. The experience of our staff combined with a management philosophy of providing high quality output and partnership with the Owner fosters an environment that creates an unbeatable team. Because of those successful partnerships, most of our work is with repeat clients, many of which have been our clients for over 30 years. Along with our experience of our staff, we also bring a multi-language company. We have individuals who speak Hindi, Spanish, German, and Shona (Zimbabwe).

Our expertise includes engineering assessments and design for the industrial, institutional and commercial sectors, with an emphasis on energy efficiency, HVAC and infrastructure. Sud Associates, P.A. has focused on sustainable design since our inception as an energy conservation consulting firm over 30 years ago. Each of our projects incorporates that experience, our expertise in energy modeling, a creative approach to sustainable technologies, and rigorous oversight during the construction period to produce a product that works efficiently through the life of the building. Our experience includes several LEED rated buildings (from Certified to Platinum). We keep up with latest tools and software. We currently have REVIT MEP 2014), AutoCAD MEP 2014, earlier versions of AutoCAD/REVIT, Trace, GLHEPRO – Geothermal Well Sizing, KYPIPE Pipe Network Analysis Software, and eQuest Quick Energy Simulation Tool.

Sud Associates, P.A. has partnered with Frito Lay since 2001 in the areas of heat recovery and plant utilities (boilers, chillers, distribution systems, heating/cooling, etc.) The services that we have provided include study and planning, engineering design, and construction administration. Significant projects that we have undertaken for Frito-Lay include heat recovery from Potato Chip (PC) Fryers and Tortilla Chip (TC) Toaster Ovens, installation of adsorption and conventional chillers, etc

Currently, we are working on assisting plants in identifying potential energy savings in heating, ventilating and air conditioning (HVAC). Potential energy savings may be obtained from:

1. Relatively low cost operation and maintenance measures or equipment upgrades. Examples of these would include reprogramming of control systems and replacement of starters with variable speed drives.
2. Equipment replacements with more efficient equipment and installing centralized control systems.
3. Long term plans to making fundamental changes to the approach to providing the HVAC requirements of the plant (e.g. gradual phase out of multiple packaged roof-top units with chilled water systems)

The next few pages summarize the significant projects where we have partnered with Frito Lay. A more detailed description of several of the projects follows the summaries.

Charlotte, North Carolina

Heat Recovery from Potato Chip Fryer

The potato chip (PC) fryers are a major energy user in a Frito Lay plant. A significant percentage of the energy used to fry the chips is discharged into the atmosphere in the form of steam/water vapor that is driven off of the potatoes as they cook. This provides an opportunity to recover this waste heat and, in turn, utilize it in the facility to satisfy other thermal loads.

In its first four years of operation this system has exceeded its operational and conservation objectives. It has virtually eliminated any requirement for steam usage for building heat, it provides 150 tons of cooling through an adsorption chiller, and provides 30,000 gallons of 180^{o}F water for CIP at the beginning of sanitation cycles.

150 Ton Adsorption Chiller Installation

The chiller plant at the Charlotte plant consisted of two centrifugal chillers for building comfort conditioning and one 100 ton air-cooled packed chiller for process loads. The capacity and configuration of this system had significant drawbacks that needed to be addressed.

The need to address the chiller plant issues above, along with the availability of free hot water from the PC heat recovery system, made this an excellent opportunity to install an adsorption chiller. This chiller is driven almost entirely by hot water with very few electrical loads; therefore, the operating costs when utilizing recovered heat are virtually zero.

Steam and Condensate Pipe Heat Loss Study

The Charlotte Frito Lay plant has a considerable amount of steam and condensate piping that has been added, modified, or repaired over the years. As a result of these changes and general deterioration, much of this piping system was not in good condition. Sud Associates was requested to evaluate the piping system for missing or damaged insulation, assess the rate of steam and condensate leaks, and determine potential energy savings and implementation costs to improve the system.

TC (Tortilla Chip) Toaster Oven Heat Recovery

The intent of the heat recovery system is to recover heat from the oven stacks to produce steam that can be fed into the process steam header. This recovered heat would then be available for any process steam need in the building.

Lauzon, Quebec

Heat Recovery from PC Fryer

The project takes advantage of the heat recovery opportunity from the potato chip (PC) fryer in the Lauzon, Quebec plant. A study was performed by Sud Associates to analyze the feasibility of, and identify the potential loads for, PC Heat Recovery at this plant.

This installation was started up in February 2007 and is performing well. It heats the CIP tank in a short period of time, and is able to satisfy all plant space heating loads down to an outdoor air temperature of below 0^{o}F.

Cambridge, Ontario

Heat Recovery from PC Fryer

The project takes advantage of the heat recovery opportunity from the potato chip (PC) fryer in the Cambridge, Ontario plant. A study was performed by Sud Associates to analyze the feasibility of, and identify the potential loads for, PC Heat Recovery at this plant.

The measures designed for implementation included all items which showed a simple payback of less than 7 years. All items with a payback of over 3 years were designed as bid alternates.

Frankfort, Indiana

Heat Recovery from PC Fryer – Phase II

Sud Associates was requested to review the existing heat recovery system and determine how to cost effectively enhance its performance and serve additional thermal loads. We determined that the existing system can largely be kept intact. Additional loads can be served by speeding up the exhaust fans, reconfiguring and adding piping, and installing additional process heat exchangers.

Columbia, Missouri

Heat Recovery from Air Compressors

The Columbia, Missouri Frito-Lay plant facility staff has identified an opportunity to recover waste heat from the air compressors to heat an adjacent space. A study performed by Sud Associates identified feasible approaches to recovering the waste heat from air compressors and transferring the heat to meet space heating requirements.

Perry, Georgia

Heat Recovery from TC Toaster Oven

The toaster ovens and fryers on the Tostitos/Doritos line are a major energy user in a Frito Lay plant. A significant percentage of the energy used to toast the chips is discharged into the atmosphere through the stacks. This provides an opportunity to recover this waste heat and utilize for other thermal requirements in the plant.

This project took advantage of this heat recovery opportunity on three ovens in the Perry, Georgia plant. Each of the TC lines consists of an oven and a fryer. Each oven has two stacks with stack draft fans controlled by variable speed drives. The oven stack temperature is between 750°F and 800°F. The intent of the heat recovery system is to recover heat from the oven stacks to produce steam which could be fed back into the plant's steam system.

HVAC System Study

HVAC systems use a significant amount of energy at Frito Lay plants and play an important role in both occupant comfort and product quality. Building pressurization, heating and air conditioning, ventilation, and system control are all critical to proper building operation. This study included an extended site visit to review and analyze all the facility's HVAC systems. The review included both the big picture strategy for HVAC

planning and identification of specific measures. The result was the development of both low cost projects that could be implemented in-house and provide immediate performance and efficiency upgrades, and larger capital projects with longer term implications.

San Antonio, Texas

Heat Recovery from Toaster Oven

The toaster ovens and fryers on the Tostitos/Doritos line are a major energy user in a Frito Lay plant. A significant percentage of the energy used to toast the chips is discharged into the atmosphere through the stacks. This provides an opportunity to recover this waste heat and, in turn, utilize it to preheat the oil for the chip fryer.

Sud Associates provided design services to implement a TC heat recovery project for this plant. The design utilized a heat exchanger in the oven stack to preheat the oil for the TC Fryer.

Orlando, Florida

Feasibility Study and Design of an 1800 ton Central Chiller Plant

Feasibility study and design of an 1800 ton central chiller plant to be installed in multiple phases.

The Frito Lay plant consists of a 210,000 SF facility located on an 11.7 acre site. The space cooling requirements for the plant are currently met by a combination of two air cooled chillers and 34 packaged rooftop and split systems.

The existing cooling requirements were evaluated and a long term plan was developed to address the problems being experienced by the current approach of adding individual units to cool specific areas, lower maintenance and energy costs and increase reliability.

The long term plan is to provide a new central chiller plant which will be installed in three phases. Phase 1 consists of a new steel structure, one 600 ton centrifugal chiller and associated auxiliaries (cooling tower, chilled and condenser water pumps, piping, electrical, etc.) Phase two consists of the completion of the steel structure, a second 600 ton centrifugal chiller and associated auxiliaries. Phase 3 consists of a third 600 ton centrifugal chiller and associated auxiliaries.

HVAC System Study

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Fayetteville, Tennessee

Heat Recovery Study

A study was performed by Sud Associates to analyze the feasibility of, and identify the potential loads for, PC Heat Recovery at this plant.

Design of PC Heat Recovery

The potato chip (PC) fryers are a major energy user in a Frito Lay plant. A significant percentage of the energy used to fry the chips is discharged into the atmosphere in the form of steam/water vapor that is driven off of the potatoes as they cook. This provides an opportunity to recover this waste heat and, in turn, utilize it in the facility to satisfy other thermal loads.

The project takes advantage of this heat recovery opportunity in the Fayetteville, TN plant. A condensing heat exchanger in the fryer stack recovers heat to produce hot water. A Rubicon heat exchanger from the PC fryer stack captures waste heat for use in CIP, corn cook, building heating, etc.

Lethbridge, Canada

Study - Heat Recovery from TC Ovens

The exhaust from the stacks for the TC 2.0 ovens at the Lethbridge plant exceeds 600^{o}F. This exhaust contains up to 2 million BTU/hr of recoverable heat. Sud Associates conducted a detailed study to analyze the feasibility of recovering this heat to preheat water for process and building heating needs.

Kentville - Nova Scotia, Canada

Feasibility Study - Heat Recovery from PC Fryer

The concept for the project is to install a heat exchanger in the discharge stack of the PC Fryer line in the plant. The Kentville plant has one PC32 fryer. The heat that is recovered will be used to serve various heat loads in the plant as well as provide hot water to the adjacent chicken processing plant operated by ACA Cooperative, Ltd. Some of the potential uses include:

- PC kitchen make-up air unit
- Sanitation water heating
- PC and Miss Vickies make-up oil preheat
- PC combustion air pre-heat
- Warehouse heat
- ACA-tank make up water heating
- ACA-sanitation water heating
- ACA-boiler make up water preheating

Heat would be recovered from the PC stack by using a shell and tube type heat exchanger. A system of piping, pumps, storage tanks, and heat exchangers would be provided for the various end uses in the plant. In addition, piping and a heat exchanger would be installed to connect the Frito-Lay plant and the ACA plant to provide hot water for the chicken plant. Reconfiguration of heat transfer and piping systems in the ACA plant would also be required to effectively utilize the recovered heat.