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Date: May 27, 2011

To: The SCE ISP evaluation team
Southern California Edison (SCE)

From: Dennis Rowan PE, Mark Hinrichs, and Andy Anderson
ASW Engineering Management Consultants

Re: Investigations of Energy Efficiency Measures and Industry Standard Practice (ISP)
[Efficient Transport System Report Project ISP-0014]

After reviewing the Industrial Energy Efficiency Project (IEEP), supporting documents, expert opinions, and research, ASW recommends this project as Industry Standard Practice (ISP). Employing a mechanical material transport system with Variable Frequency Drives (VFDs) is considered to be the standard method to move bulk material. Pneumatic systems occupy a niche within the material transport industry and are well known to be energy intensive. Mechanical transport systems are preferred, regardless of increased maintenance and cleanliness of operation, due to the energy savings.

PROJECT DISCUSSION

At a cement production facility, cement is offloaded from rail cars to storage silos and then to trucks. Prior to the IEEP, the plant used a pneumatic system to move the cement to pressure vessels located underground. The cement was moved from the pressure vessels to trucks for road transport using compressed air. The pneumatic material transport system used a 500 Hp compressor for compressed air in combination with numerous small motors totaling 35 Hp. The plant operated with two rail car unloading stations with a combined unloading rate of approximately 200 tons of cement per hour. Plant personnel stated that the air compressor would operate 24 hours a day during peak loading operations.

The IEEP involved the installation of a conveyor-type mechanical cement transportation system to reduce energy consumption, as well as, improve product delivery time. With the new system, the cement is dropped beneath the rail track to a hopper. The cement is transported using screw conveyors driven by two 60 Hp motors equipped with VFDs. These VFDs are linked together with a control system. From the hopper, the cement is transported to a bucket lift to the top of the approximate 140 ft tall newly erected storage silo. Trucks drive beneath the silo to load cement. This process enables the plant to eliminate the large 500 HP air compressor, reduce the amount of auxiliary motors, and reduce the number of rail car unloading stations to 1. Presently, the new unloading station has an unloading rate of approximately 500 to 600 tons per hour. The new cement transport system is estimated to save the plant 3,339,775 kWh per year with a peak demand savings of 19 kW.

Energy efficiency measures that are typically installed in the absence of energy efficiency programs are referred to as industry standard practice (ISP). SCE has requested that ASW Engineering Management Consultants (ASW) determine if the Efficient Transport System replacement is considered to be ISP.

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METHODOLOGY

To determine if the Efficient Transport System replacement is considered to be ISP, ASW analyzed the project information, researched project technology, and conducted phone interviews with field experts. Gathered information, expert opinions, and other relevant sources are used to determine the industry standard practice.

The Plant was contacted to determine the motivation behind the replacement of the pneumatic transport system with the new conveyor-type transport system. Plant personnel stated that the existing pneumatic transport system was expensive to operate and maintain. The new conveyor system was commissioned to provide energy savings, as well as, to save cement transport time from the rail car to the storage silo.

The vice president of logistics at a global cement manufacturer and distribution facility was contacted. The respondent indicated that mechanical cement transport systems are ISP due to the well known energy savings when compared to pneumatic cement transport systems. New transport systems are typically designed to be mechanical unless cement is required to be moved over long distances, or the application is temporary. Transport time and transport cleanliness are not significant factors when deciding between a mechanical and pneumatic transport system since mechanical systems can meet the same air quality and transport time requirements as pneumatics while saving a large amount of energy. In addition, maintenance of mechanical cement transport systems has become less of an issue due to the advancement of material technology and system design. For example, sealed bearings and non-corrosive materials are now used in the construction of mechanical cement transport systems to reduce bearing maintenance and part replacement. The respondent also stated that pneumatic systems occupy a niche market within the cement transport industry and that an incentive to replace these systems with mechanical transport systems would influence the replacement decision.

A phone survey was conducted with the U.S. sales representative of a major cement transportation equipment supplier. The representative was in favor of mechanical material transport system solely due to the electric energy savings. Mechanical material transport systems are preferred over the pneumatic transport system primarily for the energy savings. Typical mechanical systems employ screw conveyors with bucket elevators, however, vertical screw conveyors can also be used depending on the vertical distance. The representative stated that mechanical transport systems can typically move more material than pneumatic transport systems. When asked about a potential SCE incentive, the respondent indicated that an incentive would help alleviate the burden of the cost, however, this burden is more of a result of the economic condition and not necessarily due to lengthy equipment payback.

A local cement plant operator was contacted regarding typical transportation methods employed within the industry. The contact stated that their facility uses a combination of conveyor systems and trucks to move cement within the facility grounds. To the best of his knowledge, he did not know of another cement company that uses a pneumatic system to transport cement. He considers conveyor systems to be the standard transportation method within the industry.

An Engineering firm specializing in bulk material handling was contacted. They primarily recommend a system design based on the transport distance, capacity requirements, and energy savings. Mechanical material transport systems offer a large transport capacity over short and long distances and electricity savings, however, initial system cost is greater than a pneumatic material transport system. They also commented on the use of VFDs. VFDs allow better speed control for the transport process on mechanical systems. They are typically employed at the beginning of the transport system to apply proper load on the belt feeder, which lowers maintenance cost as well as energy cost. Their opinion is that VFDs are a standard practice for the major motors of these mechanical systems. When asked if an SCE incentive would encourage energy efficient

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projects, this firm indicated that distribution terminals would benefit most since primary electricity use is attributed to material transport. On the other hand, in a material production facility, demand related to material transport is insignificant when compared to the actual material production demand.

ASW has evaluated ISP criteria for the material transport system replacement and VFD installation separately.

ASW presents the following matrix of factors for your consideration regarding the pneumatic compared with the mechanical material transport system replacement of the Efficient Transport System Project:

Table 1: Factors indicating Industry Standard Practice

Factors Indicating Industry Standard Practice	Significance (1 – 3) 1=low, 3=high	Significance Explanation
Air compressors run continuously to move product, therefore, they continuously use energy unlike conveyor-type systems	3	Energy consumption is a primary factor when designing a material transport system and mechanical systems are widely used within the industry for this reason
Maintenance costs associated with mechanical material transport systems have decreased due to advancement in bearing and materials technology	2	Maintenance is a significant factor when comparing pneumatic and mechanical material transport systems
The project incentive is only about 3% of the project installation cost	2	Since the incentive is such a small portion of the installed cost, it is not considered a significant factor in the decision to implement the project, thereby indicating the technology is ISP

Table 2: Factors indicating Non-Industry Standard Practice

Factors Indicating Non-Industry Standard Practice	Significance (1 – 3) 1=low, 3=high	Significance Explanation
Pneumatic material transport systems transport material faster and cleaner	1	Mechanical material transport systems can be designed to meet, or exceed the same air quality and transport time as pneumatic material transport systems
The initial cost of the pneumatic material transport systems is lower than mechanical material transport systems	2	The life cycle cost of a mechanical material transport system, including maintenance, is much lower than a pneumatic material transport system due to energy savings

The factors in Table 1 indicating that the Energy Efficient Transport System is ISP outweigh the factors in Table 2 indicating the Energy Efficient Transport System is not ISP. The primary consideration being that mechanical material transport systems are widely known to provide significant energy savings while

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transporting material at higher capacities and within a similar timeframe as pneumatic systems. Furthermore, this technology is cost effective without the need of financial incentives.

ASW presents the following matrix of factors for your consideration regarding the VFD aspect of the Efficient Transport System Project:

Table 3: Factors indicating Industry Standard Practice

Factors Indicating Industry Standard Practice	Significance (1 – 3) 1=low, 3=high	Significance Explanation
VFD installation is a known energy efficiency option	1	VFDs are not installed primarily to save on electric costs, but to optimize material transport on mechanical systems.
VFDs are widely used in mechanical material transport systems for transport speed control	3	VFDs are typically used, regardless of incentives, to reduce strains on the mechanical material transport system.
VFDs are typically used, regardless of incentives, to optimize and reduce strain on the mechanical material transport system	2	The inclusion of this technology is consistently reported to be concurrent with these mechanical systems

Table 4: Factors indicating Non-Industry Standard Practice

Factors Indicating Non-Industry Standard Practice	Significance (1 – 3) 1=low, 3=high	Significance Explanation
VFD units do not fit every application and cannot be described as Industry Standard Practice	1	Mechanical systems can be designed to operate without VFDs to modulate their transport rates

The factors in Table 3 indicating that the installation of VFDs are ISP outweigh the factors in Table 4 indicating that VFDs are not ISP. VFDs are widely used within the material transport industry to optimize bulk material handling rates and ease load on equipment. The customers will typically install a VFD in the absence of the incentives.

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CONCLUSIONS

ASW recommends that SCE consider the installation of a mechanical material transport system as ISP. Mechanical material transport systems are widely known to be energy efficient while transporting material at adequate capacities and timeframes when compared to pneumatic material transport systems. In addition, this technology results in a much lower cost over the life of the system due to energy savings.

ASW recommends that SCE consider the installation of VFDs on the larger motors of the mechanical material transport system to be ISP. VFDs are widely used throughout the industry, not particularly for energy savings, but for process optimization and system strain relief. Mechanical material transport systems employ VFDs without any significant impact on the project economics from the financial incentives.