

CASE STUDY ENERGY SAVING IN ESCALATORS

ABSTRACT

This case study explores the installation of energy saving apparatus in escalators at the Tel Aviv central bus station. Benefits include reduction of operational costs by 23% - 26% and a return on investment of around two years.

CLIENT PROFILE

Tel-Aviv's central bus station is the largest central bus station in the world, with a built area of 230,000 m² and a total area of 44,000 m². The station opened to the public in 1993 and features a public retail shopping mall over seven floors, serviced by 29 escalators, 13 elevators and featuring more than 1,000 shops and restaurants.



BUSINESS NEED

Ever increasing electricity prices and business demands for increased profitability, led the Tel Aviv central station's managers to seek energy saving solutions.

The station has 19 escalators which operate 19 hours per day. These escalators are designed to

OVERVIEW

PRODUCT USED

SinuMEC – Sinusoidal Motor Efficiency Controller

CLIENT PROFILE

The Tel-Aviv central bus station

BUSINESS NEED

Reducing energy costs and enhancing equipment lifetime.

SOLUTION AND BENEFITS

Installation of PowerSines' Sinusoidal Motor Efficiency Controller designed to reduce motor voltage according to escalator load improved motor efficiency and lifetime.

The SinuMEC saved 23%-26% of energy with an ROI of around 2 years, in addition to improving motor lifetime.

support their maximum load, which means up to two persons on each stair. As in many similar locations, the escalators run most of the time with no load or very low load, a fact which offers significant potential for energy savings.

SOLUTION

The Tel Aviv central station implemented PowerSines innovative SinuMEC (Sinusoidal Motor Efficiency Controller) to induce energy savings. The SinuMEC, utilizes known phenomena whereby reducing the supplied voltage to partially loaded motors, their efficiency increases. The uniqueness of the SinuMEC lies in its patented technology which provides pure sine wave.

While the escalator control voltage was kept unchanged, the power voltages were supplied through the SinuMEC which constantly measured the power demand and changed the provided voltage accordingly. In addition to the two voltage levels supplied by the SinuMEC, the escalator control included a star/delta connection (operated during upstairs operation mode only) which together provided up to four voltage levels. The outcome was that the most efficient voltage level was provided to the escalator, allowing optimal utilization of the escalator motor and softer starting.

RESULTS

In order to allow a uniform comparison basis, the following results are for an unloaded escalator. In normal load operation, the escalator works in delta connection for both directions. As such, the saving calculations were based on the average between star and delta operation. The results are listed in the following tables:

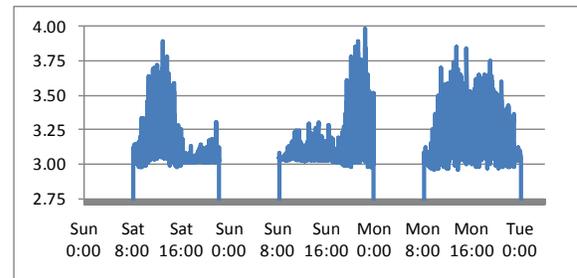
Downstairs Escalator

SinuMEC Mode	Bypass	Save	Saving
kW	2.54	2.11	17%
Amp	13.5	7.8	42%
PF	0.28	0.39	40%
kVAr	8.85	4.93	44%
Motor V	393	307	

Upstairs Escalator

Connection Mode	Delta Bypass	Star Bypass	Star Save	Average Saving
kW	2.97	2.60	2.37	15%
Amp	13.9	5.6	4.4	55%
PF	0.31	0.68	0.78	58%
kVAr	9.04	2.82	1.88	42%
Motor V	387	228	178	

The following chart shows typical escalator load in kW during the weekend and week day, which means the average kW is approx. 3.3kW:



BENEFITS

The direct benefits from the SinuMEC operation were as follows:

- Reduced direct kWh reading by 15% to 17%
- Reduced network losses by 70% to 80% or 5% to 6% from kW (assuming 7% losses)
- Reduced capacitor losses by 43% or 2% from kW (assuming self losses and harmonics increase due to the use of capacitors of 5%)
- Reduced motor waste heat, reduces air conditioning costs by 15% to 17% or 1% (assuming motor efficiency in low load of 80% and chilling COP of 3.0)
- Increased motor life expectancy
- Reduced startup current and motor stress

The station is opened 19 hours a day, 6 day a week, which means 5450 hours a year. The average kW during kWh price is €0.09 / \$0.14. The total energy per year per escalator is 17,985kWh. With total expected saving of 23% to 26%, it will save €372/\$580 to €420/\$655 per year with ROI of around two years, in addition to increased motor life expectancy.

Similar benefits were measured in other SinuMEC installations in low or variable load motors, such as conveyors, plastic molding machines, compressors and mixers.