BuildTrack® | SMART AUTOMATION

HIGH BAY SENSORS DELIVER EXCELLENT ROI FOR WAREHOUSE ENERGY EFFICIENCY PROJECTS

CASESTUDY

SUMMARY

This case study illustrates the significant energy saving opportunities captured within a large industrial warehouse space in Kerala, India through the application of Wired High Bay Microwave Sensor Technologies. The solution was adopted to eliminate manual controls of lights in the aisle areas and achieve energy efficiency through automated operation. The differences achieve in energy consumption were quite stark and accounted for about 55% of energy savings for lighting areas controlled by these sensors. The payback for the investment was rapid, and just around 6-7 months, making the ROI exceptional.

INTRODUCTION

Energy Efficiency in buildings is of prime importance and is possible in every type of space by adopting the appropriate energy conservation measures. The objective of this deployment was to control the lighting systems through energy conservation measures. In the case of storage facilities and warehouses, lighting in aisles does constitute a significant portion of the total load consumption, thereby offering a great opportunity to create efficiencies.

SITUATION

The facility being considered was a high bay warehouse which had 40 aisles for material storage, with each aisle having racks on either side, where the material is carried and stored on multiple levels with the help of pallet carriers and other Material Handling Equipment (MHE). The ceiling height for each aisle was 10m and aisle width between racks was 5m. Every aisle had five (5) light LED Flood Lights (150W x 5).

The fixtures in every aisle were operated with a help of a SINGLE switch located on entrance of the aisle. One out of the 5 lights in every aisle were termed as an emergency light which was always (24 hours) ON. The workers moving into the aisle could turn ON the lights manually and similarly they could turn them OFF while exiting. But it was well documented that in practice, these switches were hardly used by the workers, which always kept the lights ON in the aisles. As a result, the electricity bills were very high as the lights were not consistently turned OFF by all the workers.

The monthly electricity bills for the warehouse facility averaged around Rs.4.5 lakhs, about Rs.2.5 lakhs of which pertained to lighting in the aisles and the rest attributable to the administrative areas.

DEPLOYMENT

The ceiling height of 10m requires the use of **BuildTrack's High Bay Microwave Sensors** for any motion detection in the aisles. Traditional Passive Infrared Sensors (PIR) cannot be used at such heights as they are not effective, hence the use of High Bay microwave sensors. In the current scenario it was optimal to draw cables from the position where High Bay Microwave Sensors would be installed (on the aisle ceilings) all the way down to the switch board location for each aisle. Thus, the implementation of wired High Bay Microwave Sensors and the 20 Amp. BuildTrack Node Controller. The Node Controller was placed behind the existing switch board. The Node Controller also had the capability of Sensor bypass, which means that in the ON position the switch actually overrides the sensor. This was done because it was required by the clients for situations where they wanted to leave the lights ON when some extended loading/unloading was going on in the aisle. Typically in smaller warehouses used for e-commerce logistics, this bypass is not preferred, instead the ON position of a switch allows control of lights by the sensor only . Given that there were multiple light fixtures, and one switch at the end of the aisle, this type of motion sensing technology was the best solution both for ease of deployment, maintenance and resulting ROI. This sensor actuates the high bay lights based on the motion sensed by the sensor when the switch is in the OFF position.

The challenge in installation of motion sensor in the aisle was the control area of the sensors. The aisle was located were close to each other and hence a wired ceiling mount sensor would result in the accidental capture the movements in the adjoining aisles. Therefore, BuildTrack Ceiling Mount High Bay Microwave sensor's sensitivity had to be carefully adjusted so that it covered the required area of the aisles and prevent accidental triggering by people walking in the adjacent aisle. They were placed as shown in Figure 1.
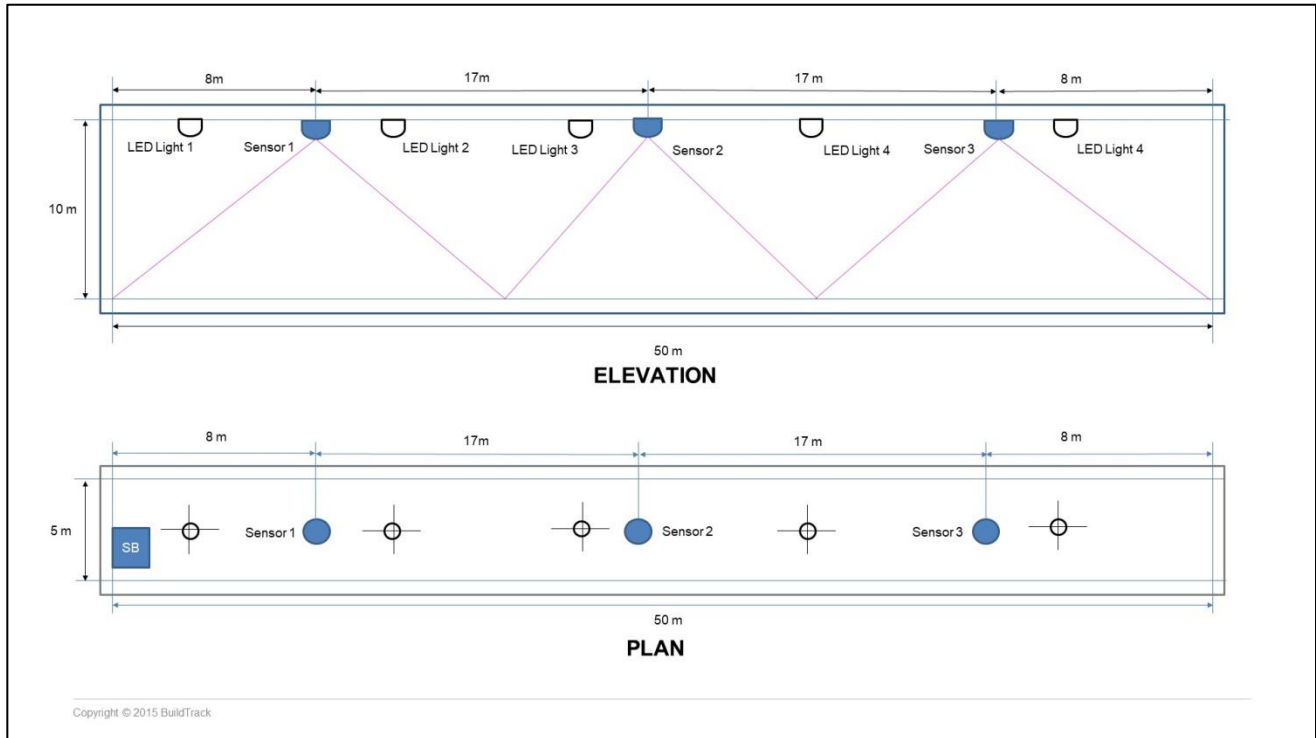
Figure-1: Plan and Elevation View of Aisle, displaying placement of light and motion sensors and range of motion sensors.

BuildTrack controllers were placed at the back of Switch Board in each aisle and they were connected to the switch to enable the sensor-driven control (when switch is in OFF position) as well as the bypass operation (when the switch is put in the ON position). The bypass operation would just disable the sensors feed to the switch and keep all the lights ON (that are connected to this switch). To turn ON the lights based on the motion sensor input the switch needs to be placed in the OFF position. Connection diagram of this system is as shown in Figure 2. While this still allows the work
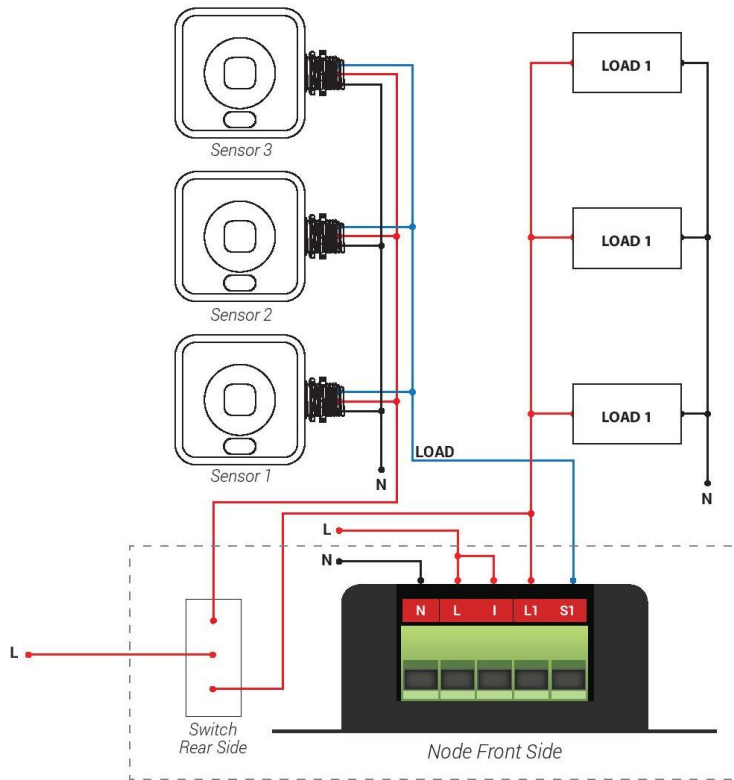
Figure-2: Connection diagram of the system shown for one (1) aisle that includes three (3) sensors, one controller and a two-way switch.

The energy conservation measures adopted to control the lighting are with the following approach.

- Four lights in an aisle were connected in series with the Three (3) wired microwave sensors.
- 20 Amp. Controller were placed at the back of the switch board and this will help control the light fixture on motion sensing as the manual control is still maintained.

The sensors were installed in such a position that they will be sensing the movement though out the aisle. Any sensor detecting the motion in the particular aisle will switch ON all four lights in the aisle. The delay time of the sensor was set to 1 minute which will keep the light fixtures ON for a minute after a motion is detected & if there is no motion detected, then it will switch OFF the lights after 1 minute.

High Bay Microwave Sensors are particularly recommended for such a solution as in this case the material is carried and stacked with the help of material handling equipment (MHE) and also being at high height the temperature dependency is an issue. Temperature dependency here refers to the sensing of human temperature, which is done typically by Passive Infrared (PIR) Sensors, but from a high height, the sensors in this case being installed at the roof level where the surrounding temperature will be high, such PIR type sensors which are based on the human body temperature won't be effective to detect the motion of the MHE. PIR sensors are best suited ONLY for the aisles with low ceiling height and

where there is largely human movement in the aisle and not MHE that is in motion. An image of a typical BuildTrack High Bay Microwave Motion Sensor and the BuildTrack Node are shown in Figure 3.

Figure-3: BuildTrack High Bay Microwave Motion Sensor and Node Controller

Another thing to note here is the switches have the option to be turned ON and disable the sensors. We do not recommend this typically but in this case, it was a requirement by the client for their special needs. The hope was that the warehouse staff would get used to the automated sensor-based lighting control and never feel the need for touching the switches, especially when using the MHE for transportation of goods.

THE RESULTS

Energy Saving for a single aisle

Block type	Space type	Light Fixture Type	Light Fixture	Light Fixture Count	Emergency Fixture Count	Operating Hours/ Day	Monthly Energy Consumption (kWh)	Monthly Energy Cost (Rs.)	Number of Switches	High Bay Microwave Sensor Count	BT Controller	Monthly Energy Savings (kWh)	Monthly Energy Cost Savings (Rs.)
Block 1	Aisles/ Racks	150W LED	150	4	1	18	432	6048	1	3	1	243	3402
Total (for 1 aisle)							432	6048	1	3	1	243	3402

	For 1 aisle
Energy Charges per kWh	14
Monthly Energy Consumption for the above considered load parameters (kWh)	432
Monthly Energy Cost for the above considered load parameters (Rs.)	6048
Monthly Energy Savings (kWh)	243
Monthly Energy Cost Savings (Rs.)	3402

Products and resulting costs per aisle

Sr. No.	Product	Count
1	Buildtrack High Bay Microwave Sensor	3
2	BuildTrack Node (i.e. Controller)	1
	Estimated Cost per aisle, including implementation	**Rs22,000 to Rs25,000**

Payback Calculation

Based on the energy savings and total cost of deployment per aisle

Payback Period	**6.5 to 7.5 months**

The ongoing bill for Aisle electric consumption was reduced by 55% accounting for the total cost of installing of the BuildTrack High Bay Microwave Sensors in series with LED fixtures and controller which resulted in a payback period of 6.5-7.5 months, i.e. much less than 1 year.

The indicated values above were checked on ground by extending the installation to 10 Aisles and the results were much better. Without the use of the motion sensors the lights were ON for an average of 18 hours per day, and with the motion sensors they were ON only 4-5 hours which resulted in the 55% reduction in energy consumption.