ISSN (Online) 2321–2004
ISSN (Print) 2321–5526

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING
Vol. 3, Issue 6, June 2015

# SOLAR POWERED LED STREETLIGHT WITH AUTOMATIC INTENSITY CONTROL

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**Abstract:** As we all know that energy consumption has increased a lot and sources of energy are limited so in order to meet the increasing demand of energy use of renewable sources of energy is a must. Keeping this in mind in this paper we are discussing about SOLAR LED STREET LIGHT WITH AUTO INTENSITY CONTROL.This street light is driven by solar energy and apart from this it also controls its intensity from dusk to dawn depending upon the brightness. A case study is also done to show advantages of solar led street light compare to that of traditional street light. This street light can save a large amount of electricity compared to the tradition one which are alight to their maximum intensity at all times after they are switched on.

**Keywords:** Lux, lumens, efficacy, colour retentation.

## I. INTRODUCTION

The main function of the streetlight is to illuminate the street at dark hours. Earlier, the street lighting was very simple and also accounted for less investment as the number of streets were less . But, with rapid urbanization the number of streets increased rapidly and this led to increase in number of street lights and investment associated with them.**[1].** For designing a proper street light various factors are to be considered which includes its efficiency to provide proper lighting on the street, its harmful environmental effect, installation and running cost etc. So before designing a street light all these factors should be considered properly and efforts should be made to incorporate technologies which are mosrecost effective like the one we have discussed here "SOLAR LED STREET LIGHT WITH AUTOMATIC INTENSITY CONTROL".**[2]**There are various types of street lights according to the lamp used such as incandescent light, mercury vapour light, metal halide light, high pressure sodium light, low pressure sodium light, fluorescent light, compact fluorescent light, induction light and LED light..For the past several years high and low pressure sodium lamps have been used for street and security lighting but improved LED technology and their lower prices have the potential to replace them in future. The efficacy and life span of various street lighting technologies are shown in table1.[3]

TABLE 1: COMPARISON OF EFFICACY AND LIFE SPAN

| Type of lamp | Luminous efficacy (lm/w) | Colourretentation property | Lamp life (in hr) |
|---|---|---|---|
| High pressure sodium | 50-150 | Fair | 15,000-24000 |
| Low pressure sodium | 100-190 | Very poor | 18,000-24,000 |
| High pressure mercury vapour | 35-65 | Fair | 10,000-15,000 |
| Metal halide | 70-130 | Excellent | 8,000-12,000 |
| Low pressure mercury flurescent lamp | 30-90 | Good | 5,000-10,000 |
| Energy efficient tubular flurescent lamp | 100-120 | Very good | 15,000-20,000 |
| Light emmitimg diode | 70-160 | Good | 4,000-90,000 |

Led can easily replace traditional street light lamps because they have higher efficacy and longer life apart from this they are compact, robust and requires comparatively less power. They are very flexible towards new technology so concept of automatic intensity control is easily applicable to them. Automatic intensity control is a simple and beneficial concept in which street light controls its intensity according to the brightness of the surrounding. Street light is automatically switched ON when the sunlight goes down and is automatically switched OFF when there is sufficient sunlight. This function is done by a sensor called Light Dependant Resistor (LDR) which senses the light actually like our eyes. This system removes manual work of switching ON and OFF of street light.

## II. A CASE STUDY FOR REPLACING CONVENTIONAL STREET LIGHTING SYSTEM (HPS) BY SOLAR LED STREET LIGHT.[4]

A comparative study between traditional HPS street light and LED street (for 1km) was done at three different locations in Gr.noida. Table below shows wattage of HPS bulb and LED array for same lux.**[5].** Table 2 gives wattage comparison of HPS and Led array for the same lux and pole length.

TABLE 2: HPS vs LED WATTAGE

| Area | Hps | Led array | Pole length |
|---|---|---|---|
| Highway | 250 W | 110 W | 20 m |
| Service Lane | 150 W | 90 W | 15 m |
| Sector | 70 W | 40 W | 10 m |

Fig 1 is graphical representation of table 2

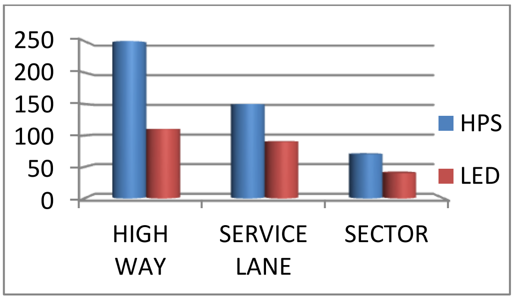


FIG:3 WATTAGE COMPARISON

ISSN (Online) 2321–2004
ISSN (Print) 2321–5526
IJIREEICE
*INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING*
*Vol. 3, Issue 6, June 2015*

A plot for lux vs distance from the pole on either side is shown in Fig. 2. It is showing the distribution pattern of lux.

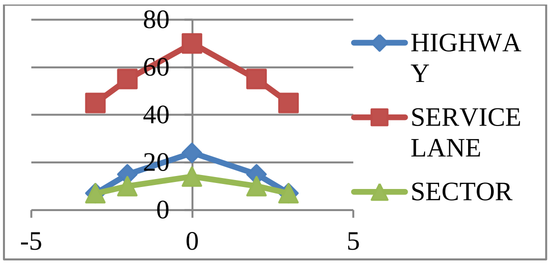


FIG:2 LUX VS DISTANCE FROM THE POLE

**A. CASE STUDY 1**

**NOIDA-GR.NOIDA EXPRESS WAY**

Noida-Gr.noida express way was inaugurated in 2002. It was built at a cost of Rs.400 crore. It begins at sector 15 and ends at Alpha commercial belt in Gr.noida. It has six lanes and extends upto 24.53 km**[6].**250 watt hps bulbs are used in these streetlights and there are 50 streetlights in 1Km**.**

A1. COST CALCULATION FOR FIRST YEARi.e ELECTRICITY BILL+ INSTALLATION COST[7]

Table 3 gives the installation cost of 50 HPS street light along with the total electricity bill for one year.

TABLE 3: TOTAL COST FOR FIRST YEAR

| | |
|---|---|
| TOTAL POWER NOT DRAWING FROM GRID IN KW | 12.5 |
| IF WE TAKE A CONNECTION OF 12.5 @0.9 p.f(KVA) | 13.88888889 |
| FIXED CHARGE PER KVA IS@ 150(A) | 25000 |
| ENERGY PER YEAR AT pf 0.9=kWh/0.9=kVAh | 60833.33333 |
| ENERGY CHARGE PER kVAh IS @5.85=(B) | 355875 |
| TOD SURCHARGE ON ENERGY CHARGES@ 20%=(C) | 71177 |
| SURCHARGE ON FIXED CHARGE@8%=(D)=(A*0.08) | 2000 |
| SURCHARGE ON ENERGY CHARGE@8%=((B+C)*0.08) | 34164 |
| ELECTRICITY TAX@5% ON ENERGY CHARGE=(F)=((B+C+E)*0.05) | 23060.7 |
| TOTAL BILL FOR ONE YEAR=(T)=(A+B+C+D+E+F) | 511274.7 |
| INSTALLATION COST FOR 1 STREETLIGHT | 5000 |
| INSTALLATION COST FOR 50 STREETLIGHTS=(I) | 250000 |
| TOTAL COST FOR FIRST YEAR=(T+I) | 761274.7 |

A2.ELECTRICITY BILL FOR 25 YEARS CONSIDERINGAN YEARLY INFLATION OF 5% IN ELECTRICITY CHARGE**.**

In table 4 we have calculated the total amount which is to be paid in 25 years assuming 5% inflation in electricity cost. We have calculated this so that wecan show that in long run solar led street light will be efficient both in performance and cost.

TABLE 4: 25 YEAR ELECTRICITY BILL

| Year | Previous year bill | Inflation=B =(A*0.05) | NEXT YEAR BILL=(A+B) |
|---|---|---|---|
| 2 | 511274.7 | 25563.74 | 536838.435 |
| 3 | 536838.4 | 26841.92 | 563680.3568 |
| 4 | 563680.4 | 28184.02 | 591864.3746 |
| 5 | 591864.4 | 29593.22 | 621457.5933 |
| 6 | 621457.6 | 31072.88 | 652530.473 |
| 7 | 685157 | 34257.85 | 719414.8465 |
| 8 | 719414.8 | 35970.74 | 755385.5888 |
| 9 | 755385.6 | 37769.28 | 793154.8682 |
| 10 | 793154.9 | 3965.74 | 832812.6116 |
| 11 | 832812.6 | 41640.63 | 874453.2422 |
| 12 | 874453.2 | 43722.66 | 918175.9043 |
| 13 | 918175.9 | 45908.8 | 964084.6995 |
| 14 | 964084.7 | 48204.23 | 1012288.935 |
| 15 | 1012289 | 50614.45 | 1062903.381 |
| 16 | 1062903 | 53145.17 | 1116048.55 |
| 17 | 1116049 | 55802.43 | 1171850.978 |
| 18 | 1171851 | 58592.55 | 1230443.527 |
| 19 | 1230444 | 61522.18 | 1291965.703 |
| 20 | 1291966 | 64598.29 | 1356563.988 |
| 21 | 1356564 | 67828.2 | 1424392.188 |
| 22 | 1424392 | 71219.61 | 1495611.797 |
| 23 | 1495612 | 74780.59 | 1570392.387 |
| 24 | 1570392 | 78519.62 | 1648912.006 |
| 25 | 1648912 | 822445.6 | 1731357.6 |

Apart from electricity bill there will also be maintenance cost for every year with some inflation. Total cost for each year will be sum of electricity bill and maintenance cost. Similarly, we have done the same calculation for LED array sreet light for same lux. From the table above we know that250 watt HPS bulb can be replaced by 110 watt LED array for same lux. As solar led streetlight is driven by solar energy so there is no electricity bill. The entire cost for first year is only the installation cost. Table 5 shows the installation cost involved in 50 Solar LED array street lights.

TABLE 5: INSTALLATION COST

| | |
|---|---|
| COST OF 110watt LED array | Rs.7500 |
| COST OF 50 SETS(A) | Rs.375,000 |
| ELECTRICITY COST | Rs.0.0 |
| INSTALLATION COST OF 1 STREETLIGHT | Rs.13,000 |
| INSTALLATION COST OF 50 STREETLIGHTS(B) | Rs.650,000 |
| TOTAL COST=(A+B) | Rs.1025,000 |

Similarly, 25 year bill is calculated which is shown in table 6**.**There will be no electricity cost . So only cost which have to be paid is maintence cost at the given inflation rate (let it be 5%)

TABLE 6: 25 YEAR ELECTRICITY BILL

| Year | Inflation in electricity cost | Electricity cost | Total cost(rs/km) |
|---|---|---|---|
| 2nd | 0 | 0 | M.C(1.05)^1 |
| 3rd | 0 | 0 | M.C(1.05)^2 |
| 4th | 0 | 0 | M.C(1.05)^3 |
| 5th | 0 | 0 | M.C(1.05)^4 |
| 6th | 0 | 0 | M.C(1.05)^5 |
| 7th | 0 | 0 | M.C(1.05)^6 |
| 8th | 0 | 0 | M.C(1.05)^7 |
| 9th | 0 | 0 | M.C(1.05)^8 |
| 10th | 0 | 0 | M.C(1.05)^9 |
| 11th | 0 | 0 | M.C(1.05)^10 |
| 12th | 0 | 0 | M.C(1.05)^11 |
| 13th | 0 | 0 | M.C(1.05)^12 |
| 14th | 0 | 0 | M.C(1.05)^13 |
| 15th | 0 | 0 | M.C(1.05)^14 |
| 16th | 0 | 0 | M.C(1.05)^15 |
| 17th | 0 | 0 | M.C(1.05)^16 |
| 18th | 0 | 0 | M.C(1.05)^17 |
| 19th | 0 | 0 | M.C(1.05)^18 |
| 20th | 0 | 0 | M.C(1.05)^19 |
| 21th | 0 | 0 | M.C(1.05)^20 |
| 22nd | 0 | 0 | M.C(1.05)^21 |
| 23rd | 0 | 0 | M.C(1.05)^22 |
| 24th | 0 | 0 | M.C(1.05)^23 |
| 25th | 0 | 0 | M.C(1.05)^24 |

 DOI 10.17148/IJIREEICE.2015.3606 

ISSN (Online) 2321–2004
ISSN (Print) 2321–5526

IJIREEICE

*INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING*
*Vol. 3, Issue 6, June 2015*

## B.CASE STUDY 2
## SERVICE LANE

This is done for service lane. Service lanes are local roads that run parallel interstate highway or expressway and it provides access to the property bordering it. 150 watt HPS bulbs are used in service lane streetlights and there are 42 streetlights in 1km.

B1.COST CALCULATION FOR FIRST YEAR i.e ELECTRICITY BILL+INSTALLATION COST HPS
Table 7 gives the installation cost of 42 HPS street light along with the total electricity bill for one year.

TABLE 7: TOTAL COST FOR FIRST YEAR

| | |
|---|---|
| TOTAL POWER NOT DRAWING FROM GRID IN KW | 6.3 |
| IF WE TAKE A CONNECTION OF 6.3 @0.9 p.f(KVA) | 7 |
| FIXED CHARGE PER KVA IS@ 150(A) | 12600 |
| ENERGY PER YEAR AT pf 0.9=kWh/0.9=kVAh | 30660 |
| ENERGY CHARGE PER kVAh IS @5.85=(B) | 179361 |
| TOD SURCHARGE ON ENERGY CHARGES@ 20%=(C) | 35872.2 |
| SURCHARGE ON FIXED CHARGE@8%=(D)=(A*0.08) | 1008 |
| SURCHARGE ON ENERGY CHARGE@8%=((B+C)*0.08) | 17218.656 |
| ELECTRICITY TAX@5% ON ENERGY CHARGE=(F)=((B+C+E)*0.05) | 11622.5928 |
| TOTAL BILL FOR ONE YEAR=(T)=(A+B+C+D+E+F) | 257682.4488 |
| INSTALLATION COST FOR 1 STREETLIGHT | 4000 |
| INSTALLATION COST FOR 42 STREETLIGHTS=(I) | 168000 |
| TOTAL COST FOR FIRST YEAR=(T+I) | 425682.4488 |

B2.ELECTRICITY BILL FOR 25 YEARS CONSIDERING AN YEARLY INFLATION OF 5% IN ELECTRICITY CHARGE.
In table 8 we have calculated the total amount which is to be paid in 25 years assuming 5% inflation in electricity cost. This is done in similar way as we have done earlier.
In the above calculation we have not considered the maintenance cost of each year but there will be maintenance cost also with some inflation each year.

TABLE 8: 25 YEAR ELECTRICITY BILL

| Year | Previous year bill(A) | Inflation=B =(A*0.05) | Next year billL=(A+B) |
|---|---|---|---|
| 2 | 25768.45 | 12884.12 | 270566.5712 |
| 3 | 270566.6 | 13528.33 | 284094.8998 |
| 4 | 284094.9 | 14204.74 | 298299.6448 |
| 5 | 298299.6 | 14914.98 | 313214.627 |
| 6 | 313214.627 | 15660.73 | 328875.3584 |
| 7 | 328875.4 | 16443.77 | 345319.1263 |
| 8 | 345319.1 | 17265.96 | 362585.0826 |
| 9 | 362585.1 | 18129.25 | 380714.3367 |
| 10 | 380714.3 | 19035.72 | 399750.0536 |
| 11 | 399750.1 | 19987.5 | 419737.5563 |
| 12 | 419737.6 | 20986.88 | 440724.4341 |
| 13 | 440724.4 | 22036.22 | 462760.6558 |
| 14 | 462760.7 | 23138.03 | 485898.6886 |
| 15 | 485898.7 | 24294.93 | 510193.623 |
| 16 | 510193.6 | 25509.68 | 535703.3042 |
| 17 | 535703.3 | 26785.17 | 562488.4694 |
| 18 | 562488.5 | 28124.42 | 590612.8928 |
| 19 | 590612.9 | 29530.64 | 620143.5375 |
| 20 | 620143.5 | 31007.18 | 651150.7143 |
| 21 | 651150.7 | 32557.54 | 683708.2501 |
| 22 | 683708.3 | 34185.41 | 717893.6626 |
| 23 | 717893.7 | 35894.68 | 753788.3457 |
| 24 | 753788.3 | 37689.42 | 791477.763 |
| 25 | 791477.8 | 39573.89 | 831051.6511 |

Similarly, we have done the same calculation for LED array sreet light for same lux.

Table 9 shows the installation cost involved in 42 Solar LED array street lights. 150 watt HPS bulb can be replaced by 90watt LED array for same lux. As solar led streetlight is driven by solar energy so there is no electricity bill. The entire cost for first year is only the installation cost.

TABLE 9: INSTALLATION COST

| | |
|---|---|
| COST OF 90watt LED array | Rs.4500 |
| COST OF 42 SETS(A) | Rs.189000 |
| ELECTRICITY COST | Rs.0.0 |
| INSTALLATION COST OF 1 STREETLIGHT | Rs.10,000 |
| INSTALLATION COST OF 42 STREETLIGHTS(B) | Rs.420000 |
| TOTAL COST=(A+B) | Rs.609000 |

Similarly, 25 year bill is calculated which is shown in table 10.There will be no electricity cost . So only cost which have to be paid is maintenance cost at the given inflation rate (let it be 5%)

TABLE 10: 25 YEAR ELECTRICITY BILL

| Year | Inflation in electricity cost | Electricity cost | Total cost(rs/km) |
|---|---|---|---|
| 2nd | 0 | 0 | M.C(1.05)^1 |
| 3rd | 0 | 0 | M.C(1.05)^2 |
| 4th | 0 | 0 | M.C(1.05)^3 |
| 5th | 0 | 0 | M.C(1.05)^4 |
| 6th | 0 | 0 | M.C(1.05)^5 |
| 7th | 0 | 0 | M.C(1.05)^6 |
| 8th | 0 | 0 | M.C(1.05)^7 |
| 9th | 0 | 0 | M.C(1.05)^8 |
| 10th | 0 | 0 | M.C(1.05)^9 |
| 11th | 0 | 0 | M.C(1.05)^10 |
| 12th | 0 | 0 | M.C(1.05)^11 |
| 13th | 0 | 0 | M.C(1.05)^12 |
| 14th | 0 | 0 | M.C(1.05)^13 |
| 15th | 0 | 0 | M.C(1.05)^14 |
| 16th | 0 | 0 | M.C(1.05)^15 |
| 17th | 0 | 0 | M.C(1.05)^16 |
| 18th | 0 | 0 | M.C(1.05)^17 |
| 19th | 0 | 0 | M.C(1.05)^18 |
| 20th | 0 | 0 | M.C(1.05)^19 |
| 21th | 0 | 0 | M.C(1.05)^20 |
| 22nd | 0 | 0 | M.C(1.05)^21 |
| 23rd | 0 | 0 | M.C(1.05)^22 |
| 24th | 0 | 0 | M.C(1.05)^23 |
| 25th | 0 | 0 | M.C(1.05)^25 |

## C.CASE STUDY 3
## SECTOR ALPHA 1

This is done for a sectorin Gr.noida-ALPHA 1. Sector Alpha 1 is situated near PariChowk.70watt HPS bulbs are used in street lights installed here and there are 33 streetlights in 1Km.

C1.COST CALCULATION FOR FIRST YEAR i.e ELECTRICITY BILL+INSTALLATION COST HPS
Table 11 gives the installation cost of 33 HPS street light along with the total electricity bill for one year.

TABLE 11: TOTAL COST FOR FIRST YEAR

| | |
|---|---|
| TOTAL POWER NOT DRAWING FROM GRID IN KW | 2.31 |
| IF WE TAKE A CONNECTION OF 2.31 @0.9 p.f(KVA) | 2.566666667 |
| FIXED CHARGE PER KVA IS@ 150(A) | 4620 |
| ENERGY PER YEAR AT pf 0.9=kWh/0.9=kVAh | 11242 |
| ENERGY CHARGE PER kVAh IS @5.85=(B) | 65765.7 |
| TOD SURCHARGE ON ENERGY CHARGES@ 20%=(C) | 13153.14 |
| SURCHARGE ON FIXED CHARGE@8%=(D)=(A*0.08) | 369.6 |
| SURCHARGE ON ENERGY CHARGE@8%=((B+C)*0.08) | 6313.5072 |
| ELECTRICITY TAX@5% ON ENERGY CHARGE=(F)=((B+C+E)*0.05) | 4261.61736 |
| TOTAL BILL FOR ONE YEAR=(T)=(A+B+C+D+E+F) | 94483.56456 |
| INSTALLATION COST FOR 1 STREETLIGHT | 3000 |
| INSTALLATION COST FOR 50 STREETLIGHTS=(I) | 15000 |
| TOTAL COST FOR FIRST YEAR=(T+I) | 109483.564 |

ISSN (Online) 2321–2004
ISSN (Print) 2321–5526
INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING
Vol. 3, Issue 6, June 2015

**C2.ELECTRICITY BILL FOR 25 YEARS CONSIDERING AN YEARLY INFLATION OF 5% IN ELECTRICITY CHARGE.**

In table 12 we have calculated the total amount which is to be paid in 25 years assuming 5% inflation in electricity cost. This is done in similar way as we have earlier.

In the above calculation we have not considered the maintenance cost of each year but there will be maintenance cost also with some inflation each year.

TABLE 12: 25 YEAR ELECTRICITY BILL

| Year | Previous year bill (A) | Inflation=(B) =(A*0.05) | Next year bill=(A+B) |
|---|---|---|---|
| 2 | 94483.56 | 4724.178 | 99207.74 |
| 3 | 99207.74 | 4960.387 | 104168.1 |
| 4 | 104168.1 | 5208.406 | 109376.5 |
| 5 | 109376.5 | 5468.827 | 114845.4 |
| 6 | 114845.4 | 5742.268 | 120587.6 |
| 7 | 120587.6 | 6029.382 | 126617 |
| 8 | 126617 | 6330.851 | 132947.9 |
| 9 | 132947.9 | 6647.393 | 139595.3 |
| 10 | 139595.3 | 6979.763 | 146575 |
| 11 | 146575 | 7328.751 | 153903.8 |
| 12 | 153903.8 | 7695.189 | 161599 |
| 13 | 161599 | 8079.948 | 169678.9 |
| 14 | 169678.9 | 8483.945 | 178162.9 |
| 15 | 178162.9 | 8908.143 | 187071 |
| 16 | 187071 | 9353.55 | 196424.5 |
| 17 | 196424.5 | 9821.227 | 206445.8 |
| 18 | 206245.8 | 10312.29 | 216558.1 |
| 19 | 216558.1 | 10827.9 | 227386 |
| 20 | 227386 | 11369.3 | 238755.3 |
| 21 | 238755.3 | 11937.76 | 250693 |
| 22 | 250693 | 12534.65 | 263227.7 |
| 23 | 263227.7 | 13161.38 | 276389.1 |
| 24 | 276389.1 | 13819.45 | 290208.5 |
| 25 | 290208.5 | 14510.43 | 304718.93 |

Similarly, we have done the same calculation for LED array sreet light for same lux.

Table 13 shows the installation cost involved in 33 Solar LED array street lights.

70 watt HPS bulb can be replaced by 40watt LED array for same lux. As solar led streetlight is driven by solar energy so there is no electricity bill. The entire cost for first year is only the installation cost

TABLE 13: INSTALLATION COST

| | |
|---|---|
| COST OF 40watt LED array | Rs.3000 |
| COST OF 33 SETS(A) | Rs.99000 |
| ELECTRICITY COST | Rs.0.0 |
| INSTALLATION COST OF 1 STREETLIGHT | Rs.8,000 |
| INSTALLATION COST OF 50 STREETLIGHTS(B) | Rs.264000 |
| TOTAL COST=(A+B) | Rs.363000 |

Similarly, 25 year bill is calculated which is shown in table 14.There will be no electricity cost . So only cost which have to be paid is maintence cost at the given inflation rate (let it be 5%)

TABLE 14:25 YEAR ELECTRICITY BILL

| Year | Inflation in electricity cost | Electricity cost | Total cost(rs/km) |
|---|---|---|---|
| 2nd | 0 | 0 | M.C(1.05)^1 |
| 3rd | 0 | 0 | M.C(1.05)^2 |
| 4th | 0 | 0 | M.C(1.05)^3 |
| 5th | 0 | 0 | M.C(1.05)^4 |
| 6th | 0 | 0 | M.C(1.05)^5 |
| 7th | 0 | 0 | M.C(1.05)^6 |
| 8th | 0 | 0 | M.C(1.05)^7 |
| 9th | 0 | 0 | M.C(1.05)^8 |
| 10th | 0 | 0 | M.C(1.05)^9 |
| 11th | 0 | 0 | M.C(1.05)^10 |
| 12th | 0 | 0 | M.C(1.05)^11 |
| 13th | 0 | 0 | M.C(1.05)^12 |
| 14th | 0 | 0 | M.C(1.05)^13 |
| 15th | 0 | 0 | M.C(1.05)^14 |
| 16th | 0 | 0 | M.C(1.05)^15 |
| 17th | 0 | 0 | M.C(1.05)^16 |
| 18th | 0 | 0 | M.C(1.05)^17 |
| 19th | 0 | 0 | M.C(1.05)^18 |
| 20th | 0 | 0 | M.C(1.05)^19 |
| 21th | 0 | 0 | M.C(1.05)^20 |
| 22nd | 0 | 0 | M.C(1.05)^21 |
| 23rd | 0 | 0 | M.C(1.05)^22 |
| 24th | 0 | 0 | M.C(1.05)^23 |
| 25th | 0 | 0 | M.C(1.05)^24 |

From the above three case studies we came to know that though the initial investment is much higher in case of solar LED street lights compared to traditional HPS street light , but as we know that solar streetlight is driven by solar energy so no electricity bill has to be paid as a result of this the extra investment made is received back within 3 to 4 years after that it is only saving. In our calculation we have not included the automatic intensity control part when that is included it would become even more effective.

## III. PROTOTYPE DESCRIPTION

Keeping in view the advantages of SOLAR LED STREET LIGHT WITH AUTOMATIC INTENSITY CONTROL a prototype of this streetlight have been made.

**D.CIRCUITS INVOLVED**

1. POWER SUPPLY

Fig4: POWER SUPPLY

Power supply is a reference to a source of electrical power. It is used to provide power to the system. Here in our application we need a 5v DC power supply for all electronics involved in the project. This requires step down transformer, rectifier, voltage regulator, and filter circuit. Transformer reduces the voltage level from 220V AC to 12V AC. Rectifier converts this AC voltage to equivalent DC voltage. Capacitor working as filter removes ripple from the output of rectifier. 7805 voltage regulator is used which gives a constant 5V at its output.

2. CONTROL CIRCUIT

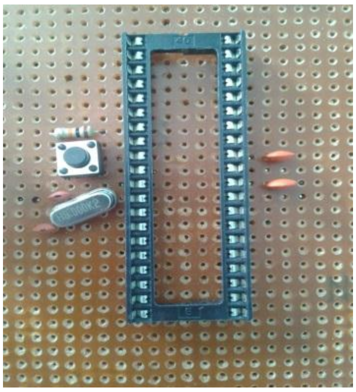

Fig:5: CONTROL CIRCUIT

Working of model is based on pulse width modulation. Crystal oscillator is used to generate frequency. Microcontroller ATMEGA16 is used to generate pulse based on the signal provided by LDR, it has analog to digital converter incorporated in it. Switch is used to reset the microcontroller.

3. LIGHT DEPENDENT RESISTOR(LDR)

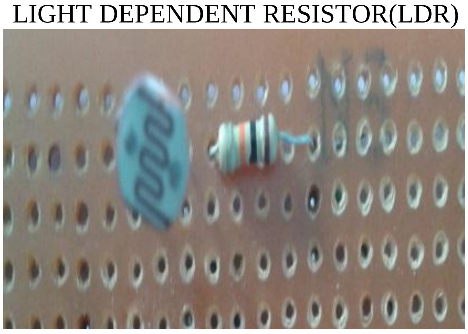

FIG:6 LDR

Photo resistor or light dependent resistor (LDR) is a resistor whose resistance decreases with increasing incident light intensity; in other words, it exhibits photo conductivity. Photo resistors are made of semiconductor materials , when light falling on them is of enough frequency , the photons absorbed by the semiconductor makes the bound electrons to reach in conduction band .As a result of this conduction increases resistance decreases.

LDRs are made of cadmium sulphide which has very few or no free electrons. Its resistance is quite high. When it absorbs photons free electrons increases and so its conductivity also increases. The approximate relationship between the resistance and illumination is $R = AE\sim^{a}$ where E is illumination in lux, R is resistance in ohms, A and a , are constants.

## IV. ADVANTAGES[8]

1) Solar street light is independent of grid as a result of this operating cost is much low.
2) Maintenance cost is much low compared to conventional street light.
3) Intensity of LED can be controlled effectively without changes in its light colour which is not possible in case of HPS.
4) Risk of accidents is very low.
5) It is environmental friendly, no harmful emissions.
6) Longer life compared to conventional streel lights.
7) Power consumption is much lower.

## V. DISADVANTAGES

1) Initial investment is very high.
2) Rechargeable batteries have to be replaced from time to time
3) Non-availability of sunlight during rainy and winter seasons is a problem.
4) Dust accumulation on the surface of panel creates a problem.

## VI. CONCLUSION

Solar energy is a non-coventional , non-polluting and reliable source of energy. This paper shows how effectively we can use this energy to drive the street light apart from this automatic intensity control using LDR helps to save a large amount of electric power which is wasted in conventional HPS street lights. Though the initial investment is very high but the case study done shows that this investment is received back in 3 to 4 years after that the only investment needed is maintenance cost which is very less. Considering the above facts we come to know that solar led street light with automatic intensity control is better than any traditional street light in terms of energy saving and cost effectiveness. This technology is being improved and full conversion will help to save a large amount of energy.

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