



Reduced Energy Lighting – White Light Sources

Whole Life Cost Assessment for Motorway Upgrade Schemes

Quality Management			
Project No	CS047499	Document Date	16th March 2011
Client	Highways Agency		
Project Title (1)	Reduced Energy Lighting		
Project Title (2)	White Light Sources		
File Name	WLC Assessment Version 3.0		
File Path	G:\139\CS047499 HA White Light (399)\Documents\012 - Whole Life Cost Assessment (motorways		
Prepared by	TP	Signature	Signed Electronically
Checked by	DA	Signature	Signed Electronically
Approved by	HS	Signature	Signed Electronically

Document History					
Revision	Description	Prepared By	Checked By	Approved By	Date of Issue
1.0	Draft	TP	DA	HS	04/02/2011
2.0	Amended following HA comments	TP	DA	HS	18/02/2011
3.0	Info on Elexon charge codes added	TP	DA	HS	16/03/2011

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Task 399 Reduced Energy White Light Whole Life Cost Assessment for Motorway White Light Upgrade Schemes

Assessment based on one-for-one luminaire replacement of 250 W SON-T plus electromagnetic ballast with 140 W Cosmo plus dimmable electronic ballast

WORKS COST ESTIMATES

SEE NOTE

Input Data

Twin central

140 W Cosmo luminaire+lamp cost	£ 260.00	W1
250 W SON-T lamp cost	£ 7.00	S1
TM cost per night	£ 1,000.00	T1
Labour+plant cost per night (1 gang)	£ 350.00	L1
No. luminaires replaced per hour (1 gang)	6.0	X1
No. lamps replaced per hour (1 gang)	8.0	Y1
Length of night shift (hours)	6.0	H
Luminaires per km	60	N1

ENERGY COST ESTIMATES

SEE NOTE

Input Data

140 W Cosmo power consumption (W)	157.0	WP
250 W SON-T power consumption (W)	279.0	SP
Burning hours per annum	4143.0	B
Electricity price (p/kWh)	10.0	P
CO2 rate of production (kg/kWh)	0.50	k
CO2 cost (£/tonne)	£ 12.00	t

Note re circuit watts:

Elexon charge codes give the assumed load for unmetered billing purposes. These are:
157W for 140W Cosmo and **279W** for 250W SON.
 Alternatively, Philips catalogue data states:
151W for 140W Cosmo and **274W** for 250W SON.

NOTE: INPUT DATA SUPPLIED BY HA NETSERVE AND CAPITA SYMONDS - MACS TO SUBSTITUTE THEIR OWN FIGURES WHERE NECESSARY.

Derived Data for 1 km stretch

Twin central

No. luminaires replaced per night (1 gang)	36.0	$X2=X1*H$
No. nights	2	$N2=roundup(X2/N1)$
TM cost	£ 2,000.00	$T2=T1*N2$
Labour+plant cost	£ 700.00	$L2=L1*N2$
Luminaire cost	£ 15,600.00	$W2=W1*N1$
Total cost for luminaire replacement	£ 18,300.00	$W3=T2+L2+W2$
No. lamps replaced per night (1 gang)	48.0	$Y2=Y1*H$
No. nights	2	$N3=roundup(Y2/N1)$
TM cost	£ 2,000.00	$T3=T1*N3$
Labour+plant cost	£ 700.00	$L3=L1*N3$
Lamp cost	£ 420.00	$S2=S1*N1$
Total cost for lamp replacement	£ 3,120.00	$S3=T3+L3+S2$
Additional cost for replacing luminaires instead of lamps per km	£ 15,180.00	$C=W3-S3$

Derived Data per luminaire and for 1 km stretch

140 W Cosmo annual kWh	650.5	$WE=WP*B/1000$
140 W Cosmo annual electricity cost	£ 65.05	$WC=WE*P/100$
140 W Cosmo annual carbon cost	£ 3.90	$Wk=t*k*WE/1000$
250 W SON-T annual kWh	1155.9	$SE=SP*B/1000$
250 W SON-T annual electricity cost	£ 115.59	$SC=SE*P/100$
250 W SON-T annual carbon cost	£ 6.94	$Sk=t*k*SE/1000$
White light annual saving per luminaire	£ 53.58	$E1=(SC+Sk)-(WC+Wk)$
White light annual saving per km	£ 3,214.64	$E2=E1*N1$

Task 399 Reduced Energy White Light
Whole Life Cost Assessment for Motorway White Light Upgrade Schemes

Assessment based on one-for-one luminaire replacement of 250 W SON-T plus electromagnetic ballast with 140 W Cosmo plus dimmable electronic ballast

FINANCIAL CALCULATIONS

SEE NOTE

Input Data

Annual discount rate (from Treasury)	3.50%	DR	
Annual energy and carbon cost inflation rate	10.00%	EIR	
Cost per 1 km luminaires replaced (from Costs wksht)	£ 15,180.00	C	
Energy saving per 1 km (from Costs wksht)	£ 3,214.64	E2	Note: includes carbon costs

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NPV Calculations per kilometre

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Year n
Cumulative Discount Factor	1.000	0.966	0.934	0.902	0.871	0.842	0.814	0.786	0.759	0.734	$DF=DF(prev)/(1+DR)$
Cumulative Energy/Carbon Cost Inflation Factor	1.000	1.100	1.210	1.331	1.464	1.611	1.772	1.949	2.144	2.358	$EIF=EIF(prev)*(1+EIR)$
Change to White Light in 2011											
PVC(2011) for replacing 1 km of luminaires instead of lamps	£ 15,180.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -	Cn
PVB(2011) for each year per km (WL energy saving)	£ 3,214.64	£ 3,416.52	£ 3,631.09	£ 3,859.13	£ 4,101.49	£ 4,359.07	£ 4,632.82	£ 4,923.78	£ 5,233.00	£ 5,561.64	$En=C*DF*EIF$
NPV(2011) for change to white light	-£ 11,965.36	£ 3,416.52	£ 3,631.09	£ 3,859.13	£ 4,101.49	£ 4,359.07	£ 4,632.82	£ 4,923.78	£ 5,233.00	£ 5,561.64	En-Cn
Cumulative NPV for change to white light	-£ 11,965.36	-£ 8,548.84	-£ 4,917.76	-£ 1,058.63	£ 3,042.86	£ 7,401.92	£ 12,034.75	£ 16,958.52	£ 22,191.52	£ 27,753.16	Sum(NPV) (2011 to n)