

APSE Future Focus 2019

6th June 2019

ADAPTIVE STREET LIGHTING

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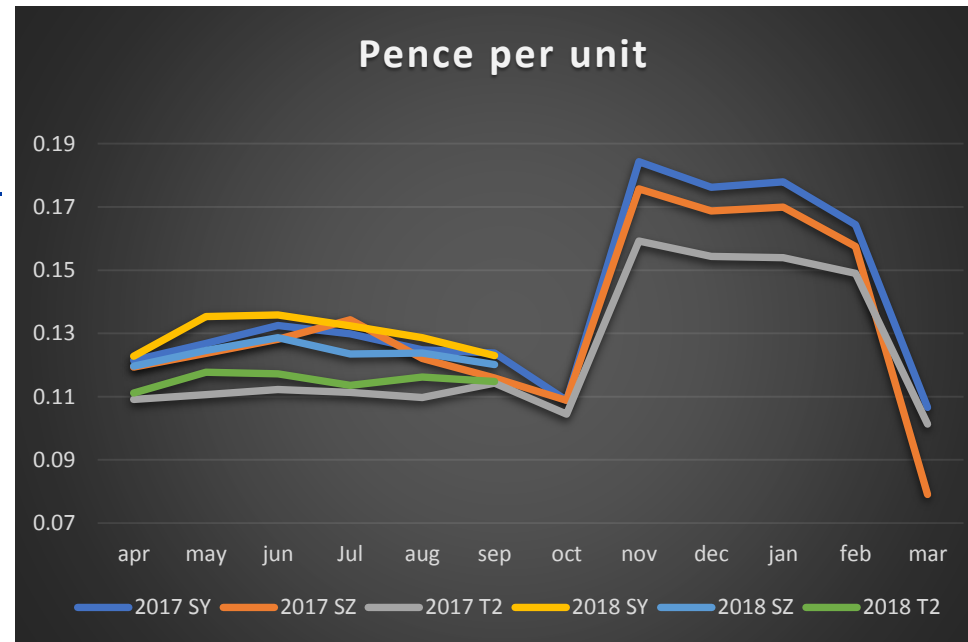
Suffolk County Council

To be covered

- Changing views on street lighting
- Could traffic adaptive street lighting save 65-70% energy consumption?
- Using street lighting infrastructure to effect wider savings for highways-related services and be regarded as 'social infrastructure'

An illuminating spotlight

- A duty to maintain but not provide in the first place
- 25% of Suffolk's revenue budget – and growing
- Climate change and light pollution
- Convert street lighting stock to LED
- Is switching off (whole or part-night) responsible?



- Switching off at low risk locations from 00:00hrs to 05:30hrs - the impact on crime and the fear of crime
- Trimming – changing 'switch on' level (standard on at 70lux, off at 35 lux)
- Dimming – reducing the lumen output of a light depending on circumstances

Dimming – logic behind theory

- Standards of street lighting illuminance/luminance (brightness) are set in-line with ACoP and EN13201 and BS5489
- Street lighting installations are designed for the maximum anticipated usage traffic volume / usage
- Adapting lighting levels to suit traffic volume / usage through CMS system at predetermined times with available traffic flow data.

Traffic flow	Slow vehicles, cyclists and pedestrians	v≤30 mph	v≤30 mph
	E1 – E4	E1 or E2	E3 or E4
Busy	5.0 lux	7.5 lux	10 lux
Normal	3.0 lux	5.0 lux	7.5 lux
Quiet	2.0 lux	3.0 lux	5.0 lux

lightingreality

Overview of EN13201:2015

Comparable Classes of Lighting

Table 1 – M Classes

Class	Day Conditions	Min. Coefficient	Max. Coefficient	Intensity class	Lighting of the surround
M1	2.00	0.40	0.70	0.10	10
M2	1.40	0.40	0.70	0.10	10
M3	1.00	0.40	0.60	0.10	10
M4	0.70	0.40	0.50	0.10	10
M5	0.50	0.30	0.40	0.10	10
M6	0.30	0.20	0.30	0.10	20

Table 2 – C classes

Class	Min. (E _{min})	Max. (E _{max})
C0	10	0.40
C1	10	0.40
C2	20.0	0.40
C3	10.0	0.40
C4	10.0	0.40
C5	7.00	0.40

Table 3 – P classes

Class	Horizontal Illuminance (lx)	Additional requirement of horizontal illuminance
P1	10.0	3.00
P2	10.0	2.00
P3	7.00	1.5
P4	4.00	1.00
P5	2.00	0.50
P6	2.00	0.40
P7	Not Determined	

Table 4 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 5 – DC classes

Class	Same Cylindrical Illuminance
DC1	10.0
DC2	7.00
DC3	4.00
DC4	3.00
DC5	2.00
DC6	1.00
DC7	1.00
DC8	0.70
DC9	0.50

Table 6 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 7 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 8 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 9 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 10 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 11 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 12 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 13 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 14 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 15 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 16 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 17 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 18 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 19 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 20 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 21 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 22 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 23 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 24 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 25 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 26 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 27 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 28 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 29 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 30 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 31 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 32 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 33 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 34 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 35 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 36 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 37 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 38 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 39 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 40 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 41 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 42 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 43 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 44 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 45 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 46 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 47 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 48 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 49 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 50 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 51 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 52 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 53 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 54 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 55 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 56 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 57 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 58 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 59 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 60 – EV classes

Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 61 – EV classes

Class	Vertical illuminance
EV1	50
EV2	30
EV3	10.00
EV4	7.00
EV5	4.00
EV6	4.00

Table 62 – EV classes

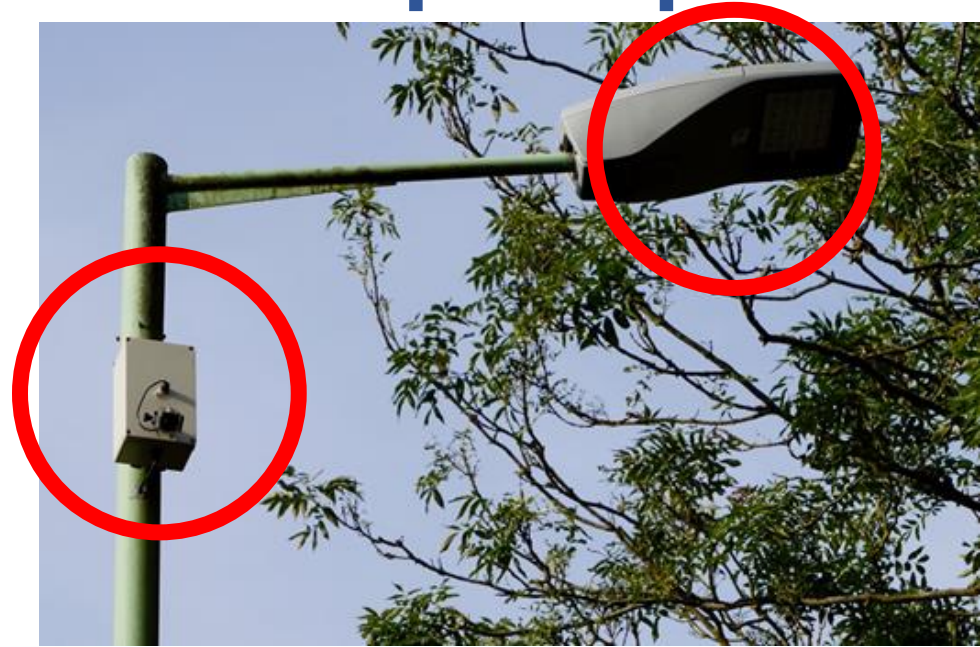
Class	Horizontal Illuminance
H1	6.00
H2	4.00
H3	1.00
H4	Not Determined

Table 63 – EV classes

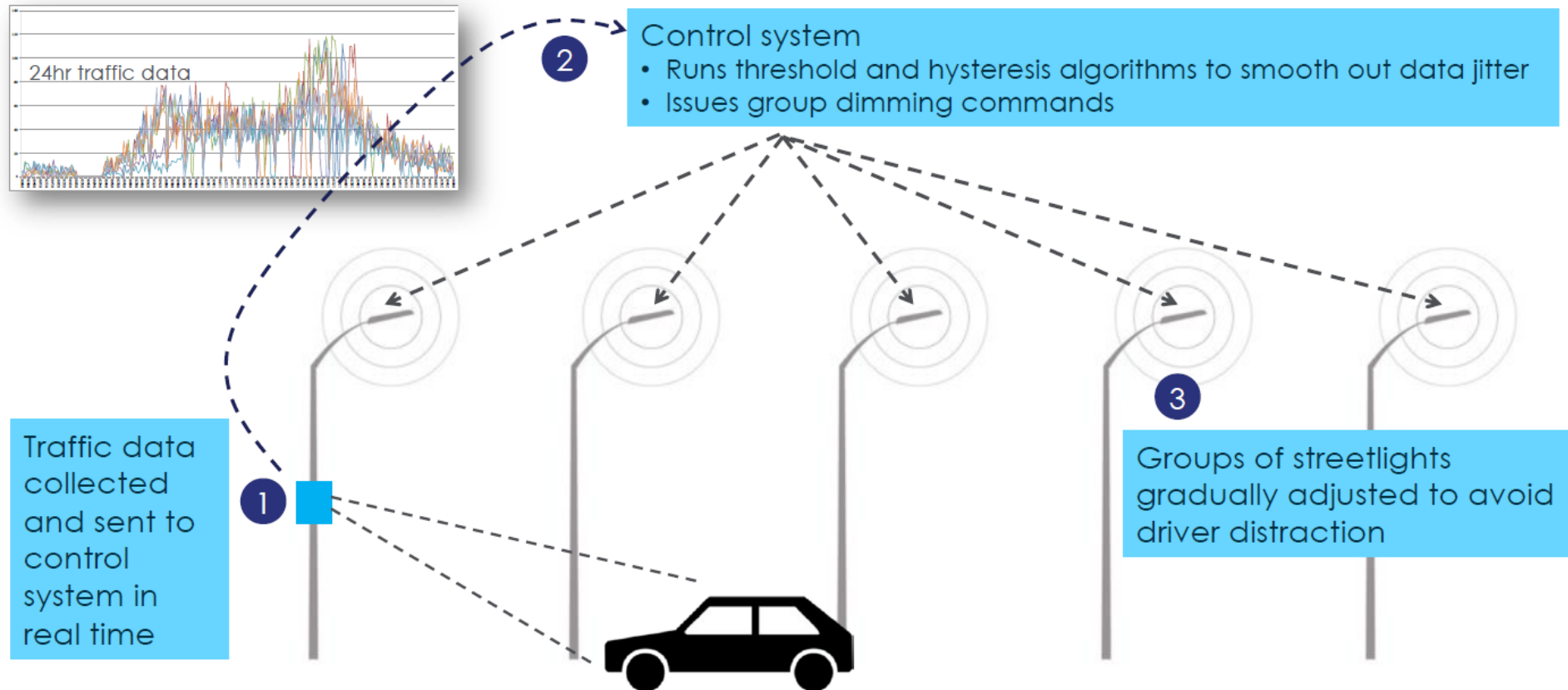
Class

Great Barton – a traffic adaptive pilot

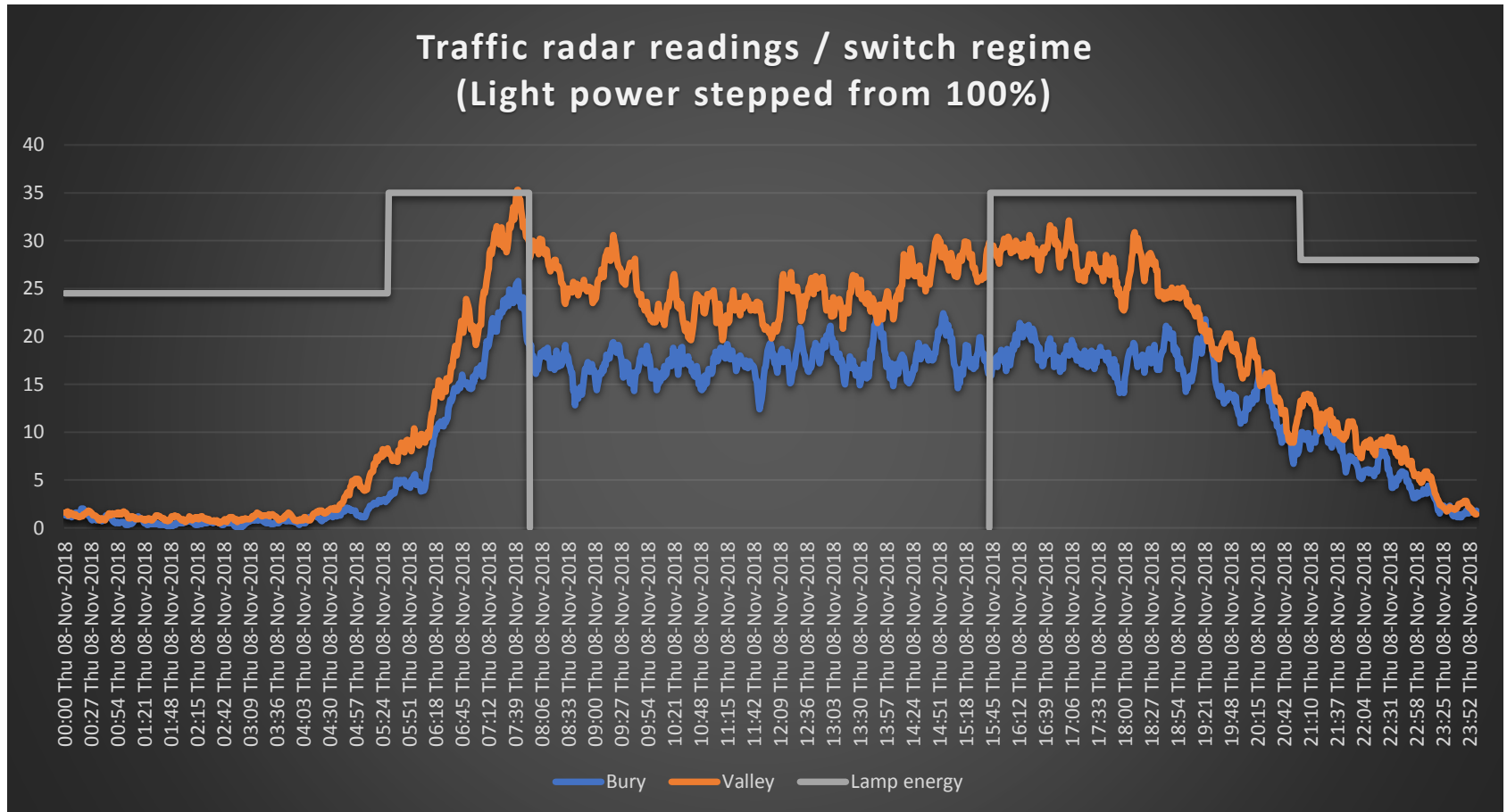
- A partnership between Suffolk CC, Telensa and BT
- Short stretch of A143 near Bury St. Edmunds
- Profile – busy rush hour, quiet early hours, irregular busy periods.
- 30mph limit.
- Operating between 2016 and 2018
- Camera + control device



How it works



24 hour results - representative



Return on investment

- Average energy savings around 30%
- 60% traffic-adaptive dimming between 10pm and 6am
- Threshold set to 2 vehicles per minute
- Zero impact on drivers or local residents – no-one noticed
- Collected speed and noise data
- ADEPT 2018 President's Award for Digital Innovation/
Technology & UK Innovations Best Internet of Things
Technology Award 2017
- £250k EU funding for further rollout (Ipswich)



Smart Lighting Concepts SLiC EU Funded Project



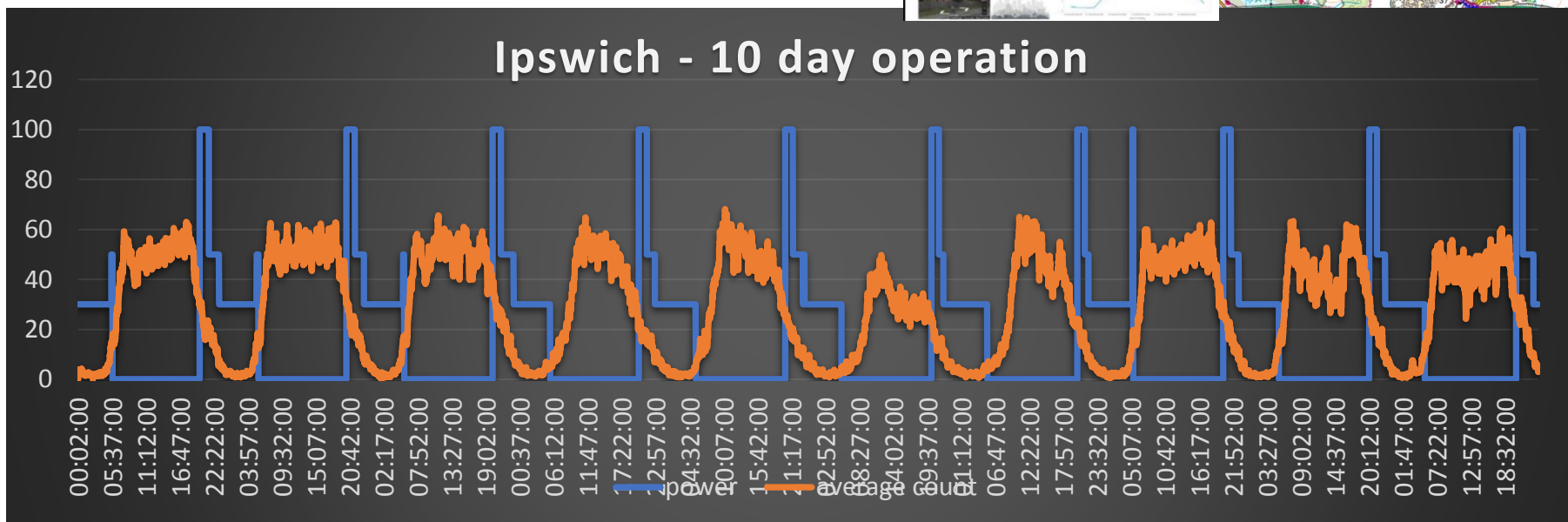
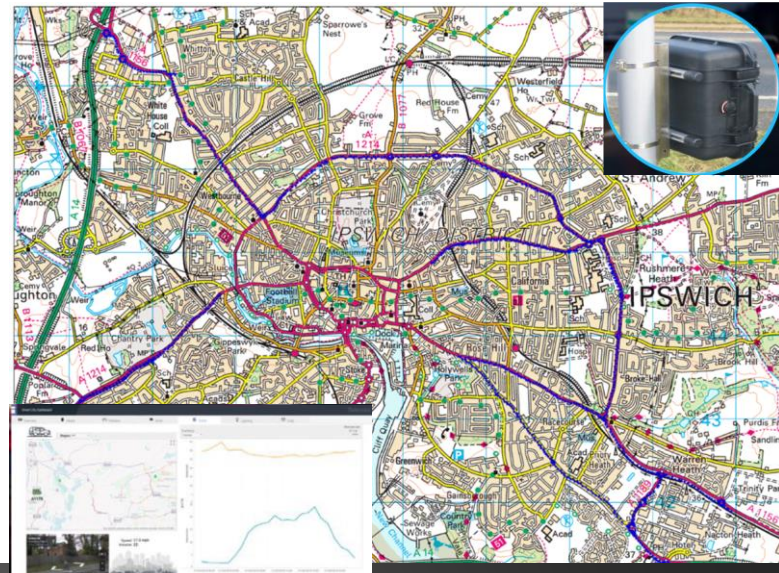
https://youtu.be/Yj_ICfyO_Ik



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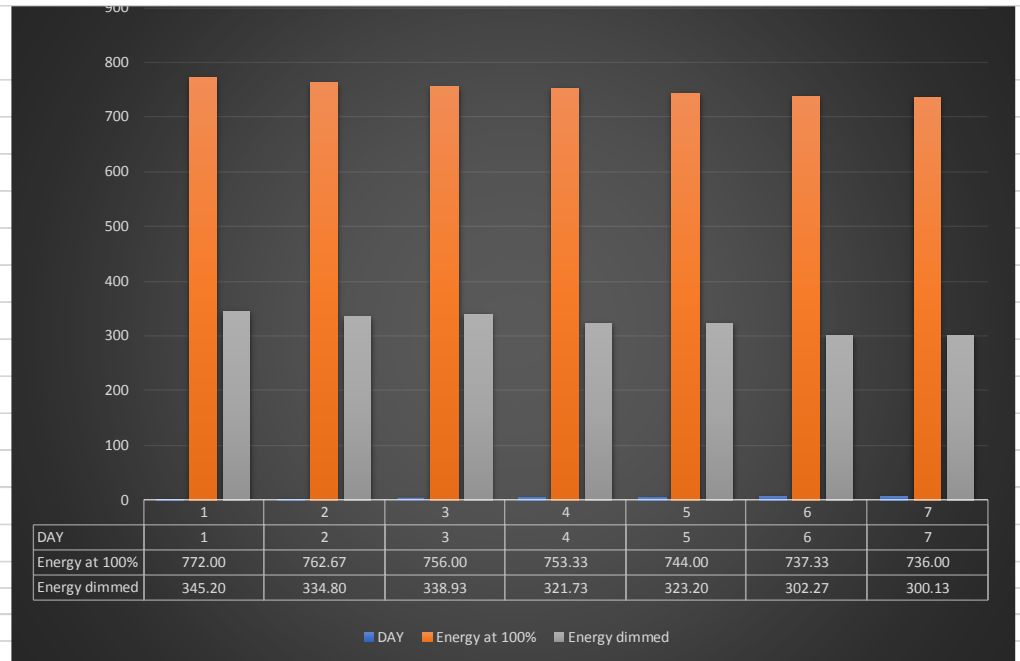
Next steps in Suffolk

- Further system development in Ipswich (25 cameras, 1000 lights, temperature sensing) as part of EU initiative (SLiC)
- More expansive research as part of an ADEPT/DfT 'Smart Places Live Labs' initiative.

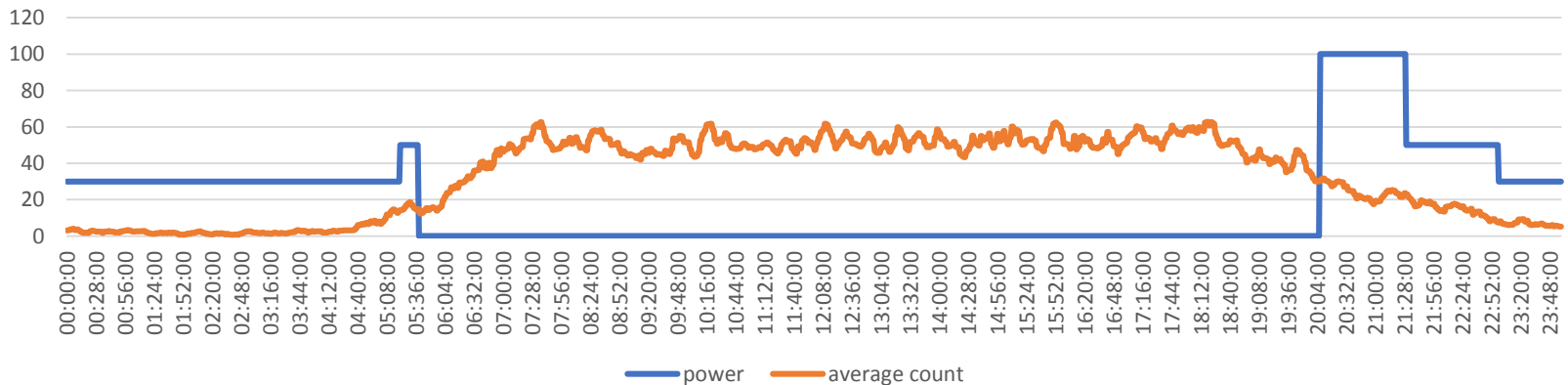


Initial results - Ipswich

DAY	Energy at 100%	Energy dimmed	Saving
1	772.00	345.20	426.80
2	762.67	334.80	427.87
3	756.00	338.93	417.07
4	753.33	321.73	431.60
5	744.00	323.20	420.80
6	737.33	302.27	435.07
7	736.00	300.13	435.87
7 day totals	5261.33	2266.27	2995.07
Kwh per yr/unit	273.5893	117.84587	155.74
£ per year/unit	£43.09	£18.56	£24.53
% Energy Saved			57%
Carbon Saving / Kg			1.62
Reduction in Co2 / Kg			5.941

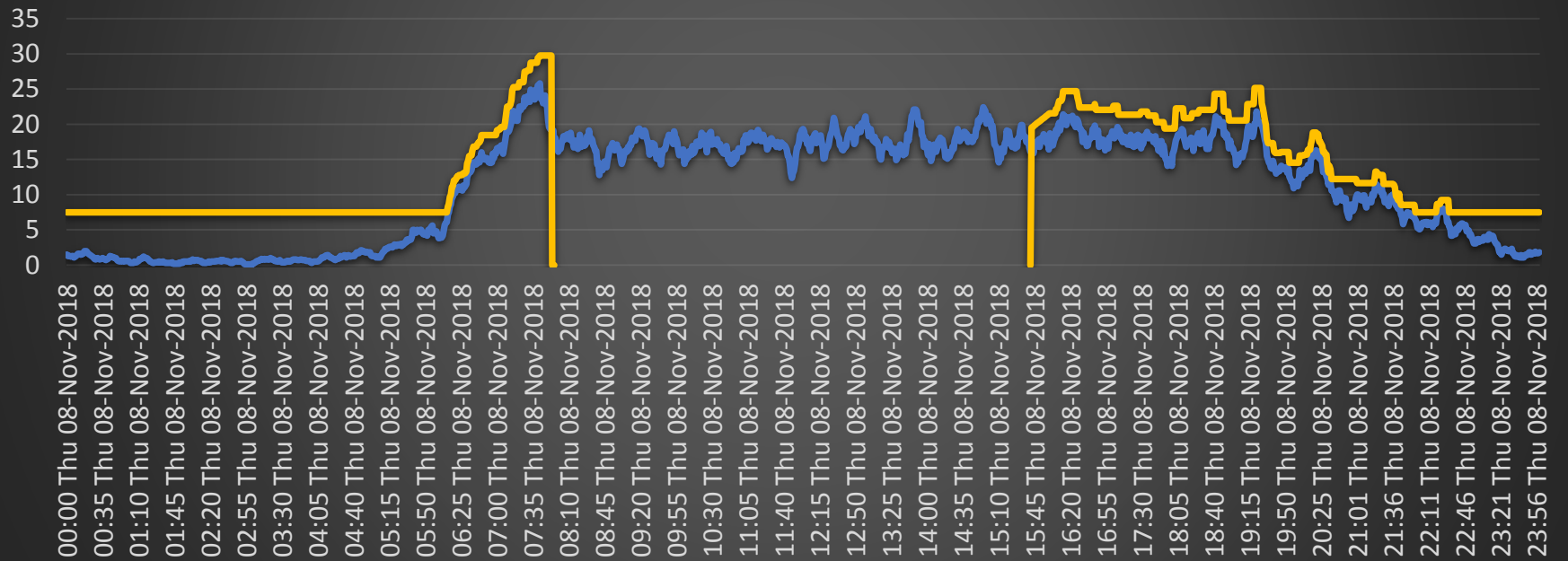


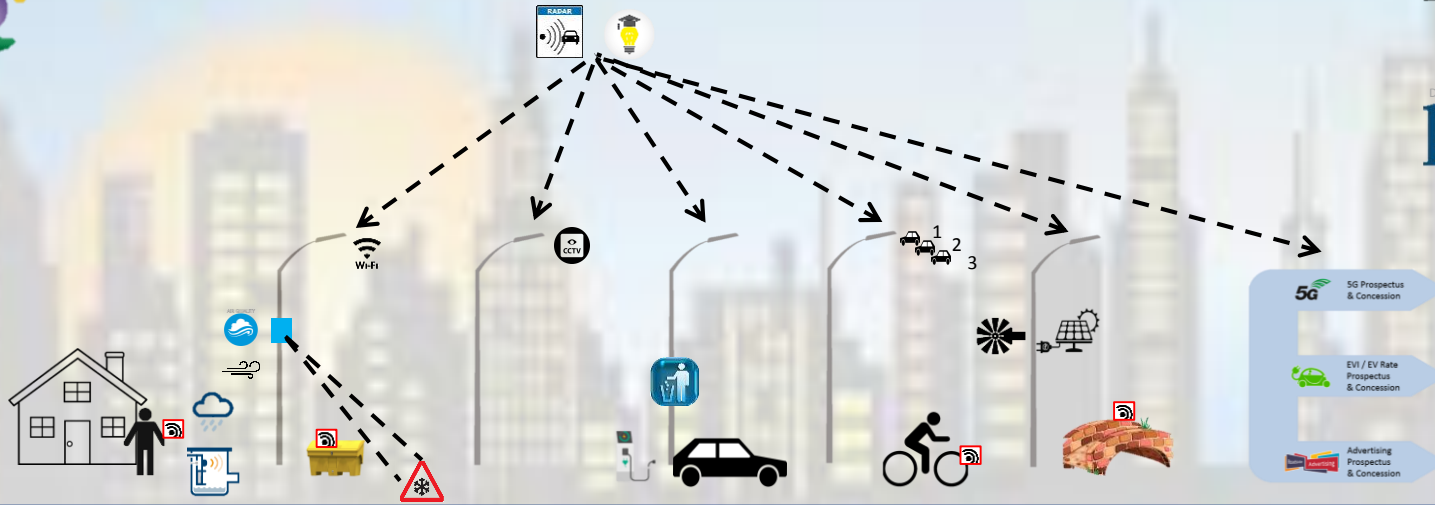
Ipswich model



Theoretical dimming (the dream?)

Traffic radar readings with theoretical adaptive regime





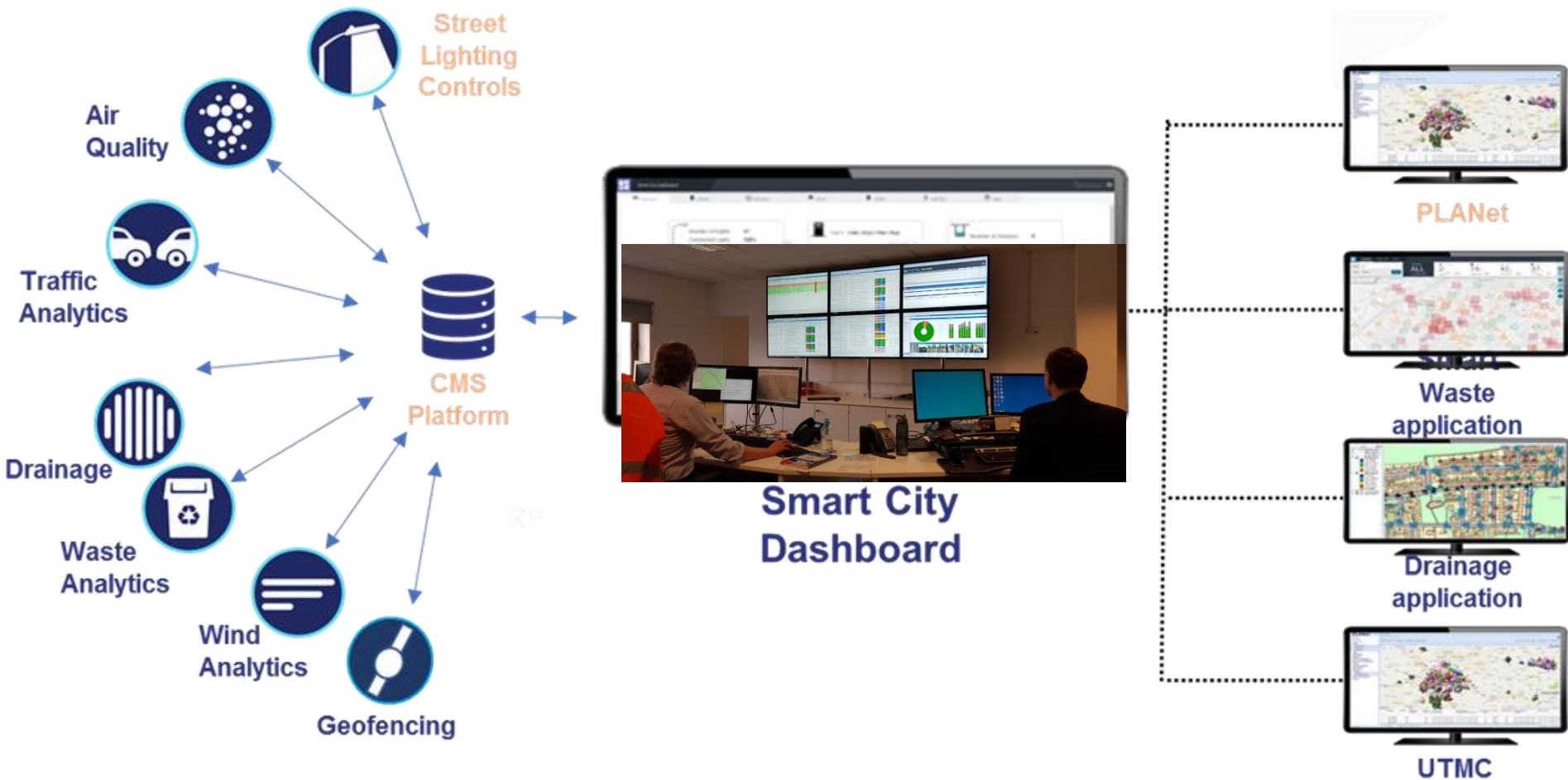
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Column innovation

- Future proof to accommodate sensors
 - Aesthetics
- New composite lantern material
 - Steel / aluminium
 - Radio frequency transparent
 - National Composites Centre
 - Wind tunnel testing



Assessing the impact



Thanks for listening!

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