Whole Airport
Energy Saving Lighting
Control System

IES Aviation Lighting Seminar
New Jersey – 2010

Gil DAVER - **AUGIER®** - FRANCE

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SUMMARY

1. *Introduction (Lamp flux control)*

2. *High Intensity Discharge (HID) lamps :*
   - *Technologies,*
   - *Operation*
   - *Solutions*

3. *Control of lighting systems*
   - *Local*
   - *Remote*

4. *Airport applications*

5. *Conclusions*

1. Introduction

Control of the luminous flux of lamps :

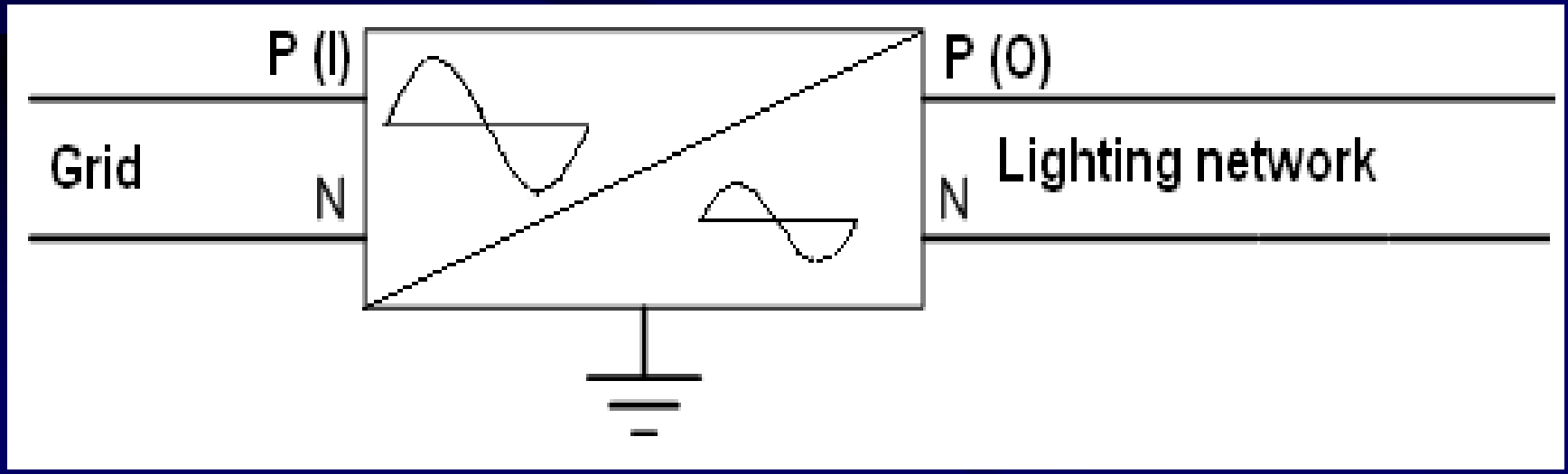
1) Airfield Ground Lighting by current

2) Street Lighting by voltage

1) AGL – Halogen lamps:

- *AGL – Constant Current Regulators from 2.8 to 6.6 A*
- *Use of 1.8 A as a warm up brightness*

2) Street lighting – High Intensity Discharge (HID) lamps:



2. HID lamps Technologies

MEASURES on HPS lamps :					
INPUT Voltage	-10% / Vr / 10%	-10% / Vr / 10%	-10% / Vr / 10%	-10% / Vr / 10%	-10% / Vr / 10%
OUTPUT Voltage	-30%	-20%	-10%	Vr	+10%
INDUCTIVE ENGINE					
Accurancy of the V control	+/- 3V	+/- 3V	+/- 3V	+/- 3V	+/- 3V
Efficiency of dimmer (%)	> 90%	> 92%	> 95%	> 95%	> 95%
I/O Power factor variation	> 30 %	> 20%	> 10%	> 3-5%	< 1%
Harmonics (%)	< 1%	< 1%	< 1%	< 1%	< 1%
THYRISTOR					
Accurancy of the V control	+/- 3V	+/- 2.5V	+/- 2V	+/- 2V	+/- 2V
Efficiency of dimmer (%)	> 95%	> 95%	> 96%	> 98%	> 98%
I/O Power factor variation	> 50 %	> 30%	> 10%	> 3-5%	< 1%
Harmonics (%)	< 30%	< 15%	< 5%	< 1%	< 5%
IGBT - PWM					
Accurancy of the V control	+/- 1V	+/- 1V	+/- 1V	+/- 1V	+/- 1V
Efficiency of dimmer (%)	> 99%	> 98.5%	> 98.5%	> 99%	> 98.5%
I/O Power factor variation	< 1%	< 1%	< 1%	< 1%	< 1%
Harmonics (%)	< 0.05%	< 0.05%	< 0.05%	< 0.05%	< 0.05%
Temp. at full load & at all V					
Operation temperature (°F)	-10/+130°F	-10/+130°F	-10/+130°F	-10/+130°F	-10/+130°F
Operation temperature (°C)	-25/+55°C	-25/+55°C	-25/+55°C	-25/+55°C	-25/+55°C

2. HID lamps Operation

Type of lamp	Min. of voltage %	Costs saving %
High Pressure Sodium	78	45-50
Low Pressure Sodium	83	35
Mercury Vapor	87	26-30
Metal Halide	78	40
Fluorescent with boot	83	35-45
Fluorescent eco version	83	30-35
Mixed Lamps	83	30

Guidelines on the Application of Dimming to High Intensity Discharge Lamps

A NEMA Lighting Systems Division Document (LSD 14-2002)

« … generally ***not lower than 50 percent*** of rated lamp wattage.”

2. HID lamps Operation

American recommendations for roadway lighting

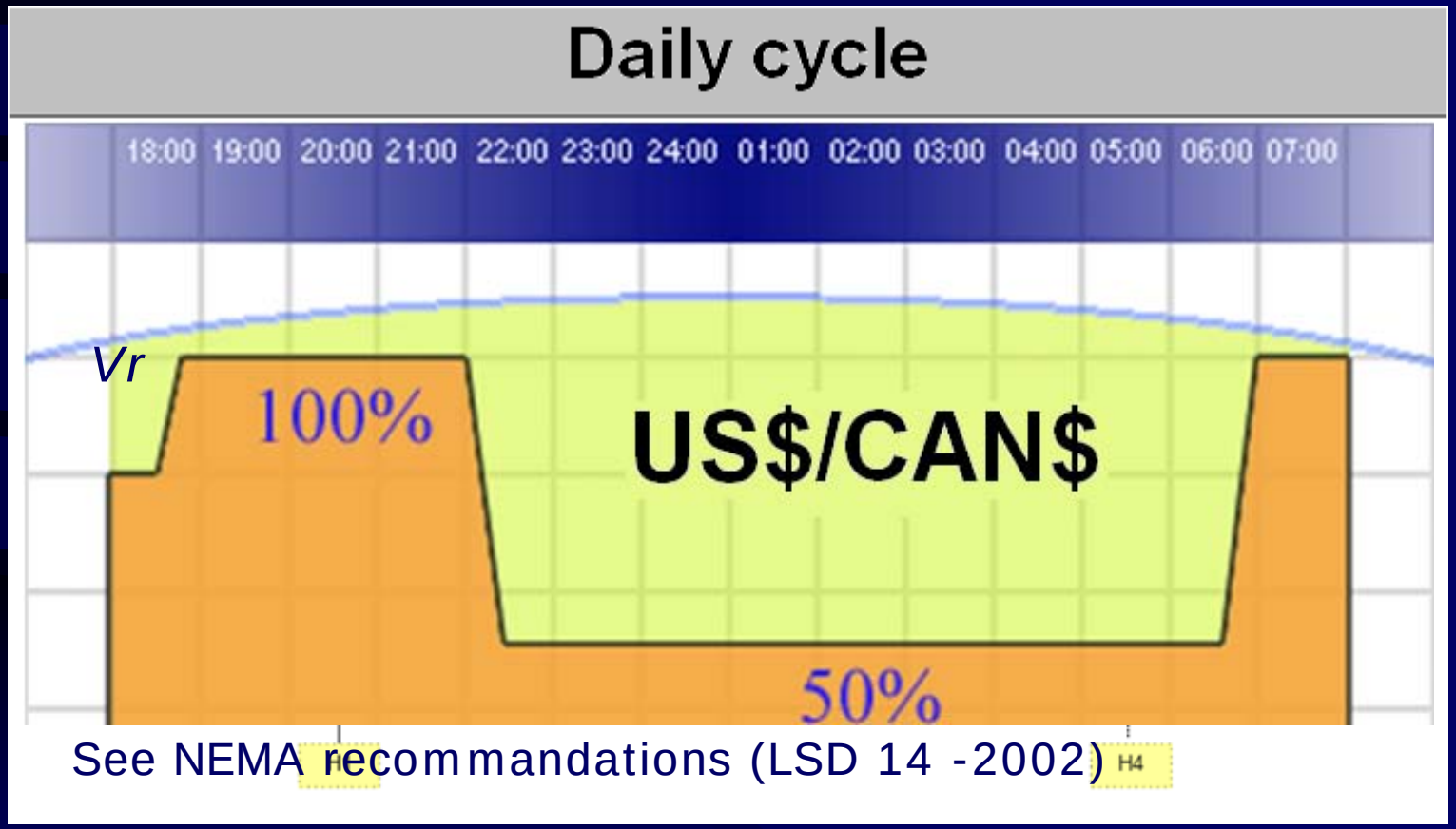
Illuminance for Intersections				
Functional Classification	**Average Maintained Illumination at Pavement by Pedestrian Area Classification** lux/fc			E_{avg}/E_{min}
	High	Medium	Low	
Major/Major	34.0/3.4	26.0/2.6	18.0/1.8	3.0
Major/Collector	29.0/2.9	22.0/2.2	15.0/1.5	3.0
Major/Local	26.0/2.6	20.0/2.0	13.0/1.3	3.0
Collector/Collector	24.0/2.4	18.0/1.8	12.0/1.2	4.0
Collector/Local	21.0/2.1	16.0/1.6	10.0/1.0	4.0
Local/Local	18.0/1.8	14.0/1.4	8.0/0.8	6.0

	Medium	6.0/0.6	9.0/0.9	8.0/0.8	4.0	0.4
	Low	4.0/0.4	6.0/0.6	5.0/0.5	4.0	0.4
Local	High	6.0/0.6	9.0/0.9	8.0/0.8	6.0	0.4
	Medium	5.0/0.5	7.0/0.7	6.0/0.6	6.0	0.4
	Low	3.0/0.3	4.0/0.4	4.0/0.4	6.0	0.4

From *'American National Standard Practice for Roadway Lighting, ANSI/IESNA RP-8* – table 9"
From *'American National Standard Practice for Roadway Lighting, ANSI/IESNA RP-8* – table 3"

2. HID lamps Operation

Standard operation for cost saving in street lighting



See NEMA recommandations (LSD 14 -2002)

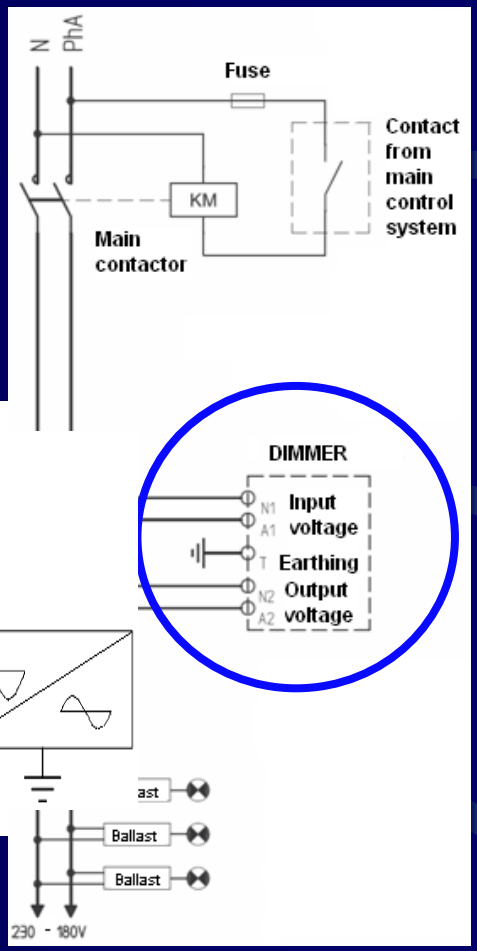
Lamp manufacturers do not agree this explanation … **Why ?**

2. HID lamps Solution

INSERTION *of a* ***DIMMER***

Easy installation on existing cabinet

Connected directly on the control contactor output



Advantage of V control:

1) Regulation of the rated V

→cuts up to 10% ***overvoltage***

→ some lighting cost ***savings***

2) Regulation of reduced V

→ main lighting cost ***savings***

IMPORTANT :

- *Global network dimmers operate ONLY with ferromagnetic ballasts*
- *BECAUSE Electronic ballasts balance the voltage drop !*

2. HID lamps Solution

*Dimmers with **PWM technology***

An AC/AC converter (PWM several kHz) injects a signal

inside an auto-transformer with a ratio at 40% of the rated V

Standard dimmer with ONLY a reduced voltage control

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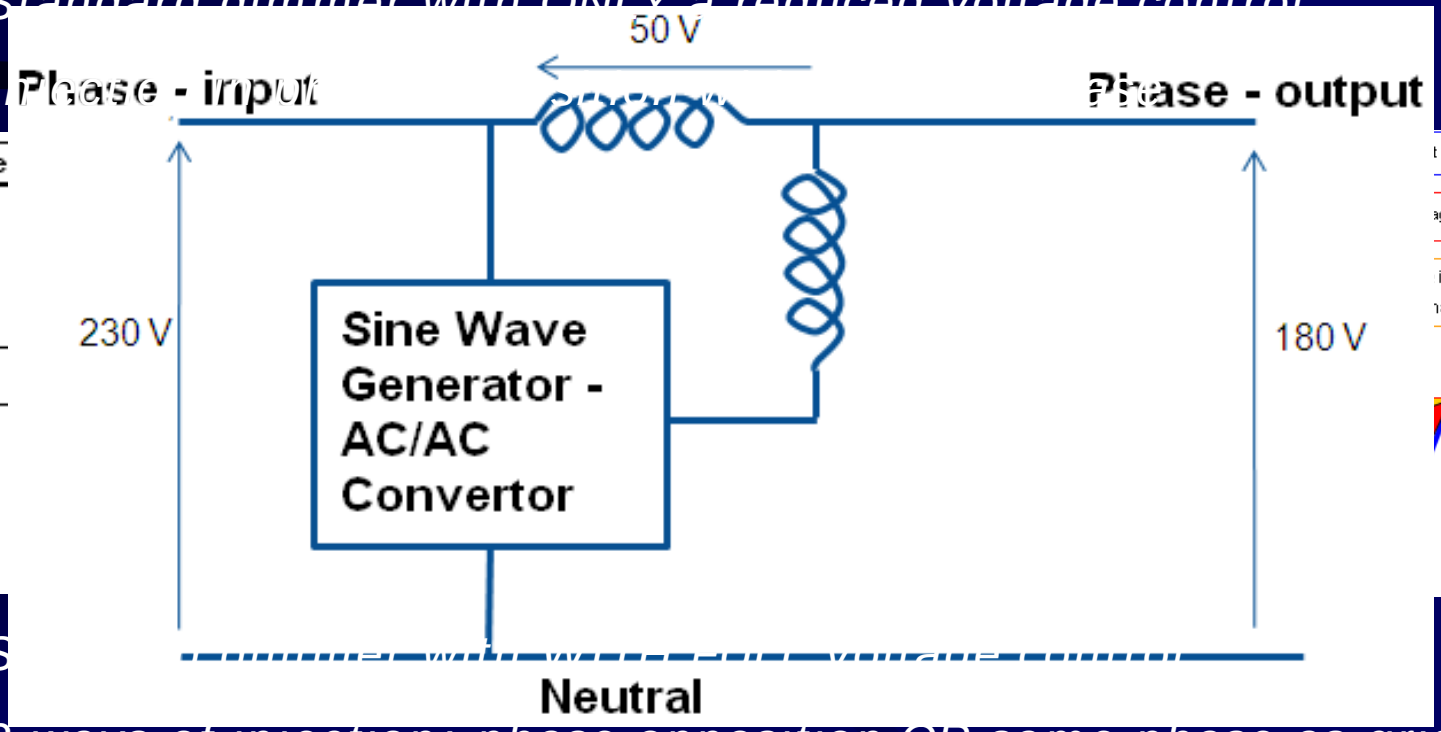

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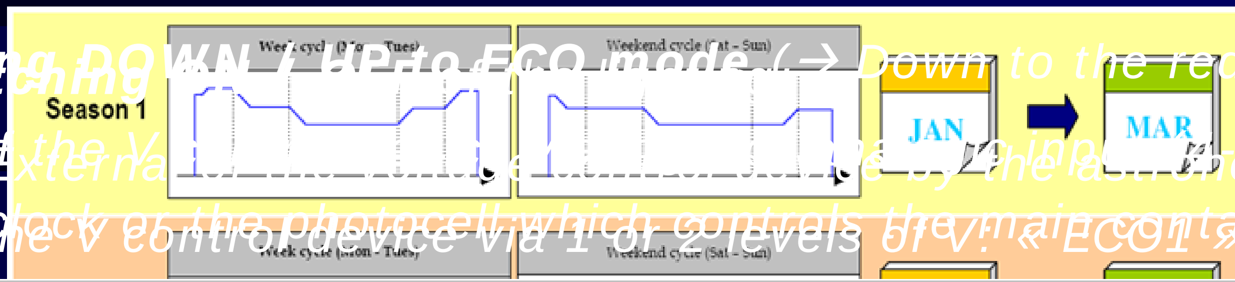
2 ways of injection: phase opposition OR same phase as grid one

3. Control:
- Local

2 main solutions:

Inside or External of the voltage control device

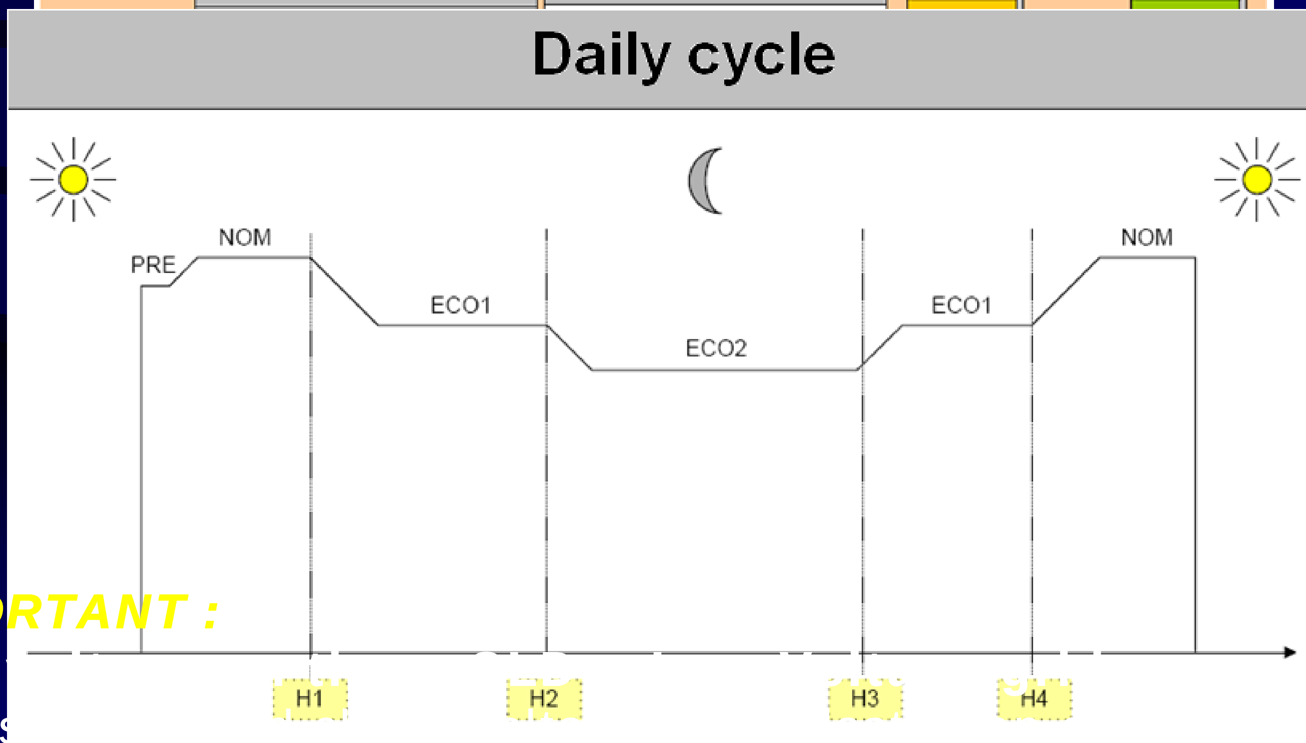


1) Switching …

- *External of the … by the astronomical clock or the photocell which controls the main contactor,*
- *… clock,*

2) Switching DOWN / UP to ECO mode (→ Down to the reduced voltage)

- *External of the V … input … 20mA / 0-10V)*
- *Inside of the V control device via 1 or 2 levels of V: « ECO1 » & « ECO2 »*



IMPORTANT :

Drop …

Always … work

3. Control:
- Remote

4 main technologies for remote control:
*Copper wiring, Optic fiber, Wifi & **GSM***

1) Copper wiring:

- *Serie communication RS232 with the dimmer –> Difficult to install*

2) Optic fiber wiring:

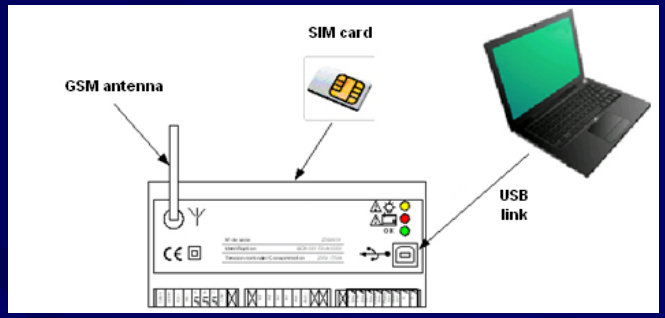
- *Serie communication through modem RS232 –> Difficult to install*

3) Wifi / Wimax:

- *Serie communication through modem –> robustness of the comm.?*

4) GSM modem:

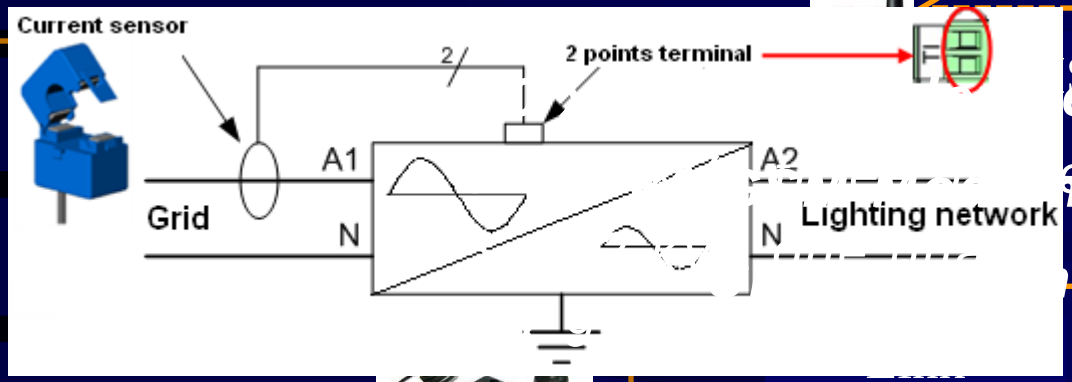
- *SMS to/from cellular phones*
- *AND / OR PC Supervision software*



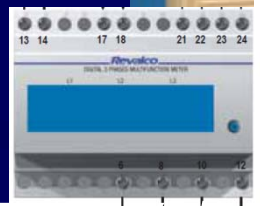
3. Control:
- Remote

Meet cellular operators → **special prices**

Solution with GSM network



Cabinet + GSM modem



29 x 6 kVA one phase

60 Power meters

14 x 3 kVA one phase

PC
software

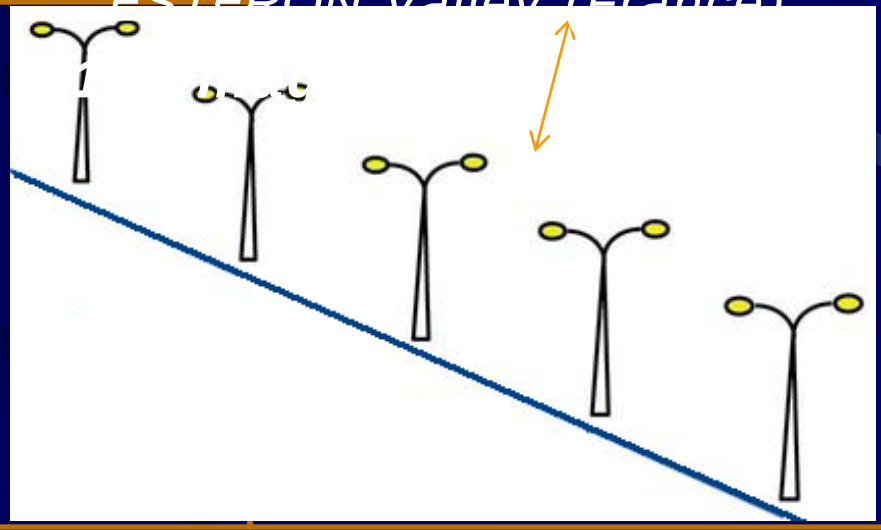
60 cabinets

2 400 x HPS lamp 100W

200 x HPS lamp 150W

1 Monitoring PC

ESTERON Valley (France)



3. Control Remote

***Individual monitoring** of HID lamps*

The previous system could include:

- *Up stream side:*
  - ***A Global monitoring system** with GPS position of lamps*
- *Down stream side:*
  - ***An Individual monitoring** of the real state of each HID lamp (by Power Line Carrier)*

tages:

e maintenance hours

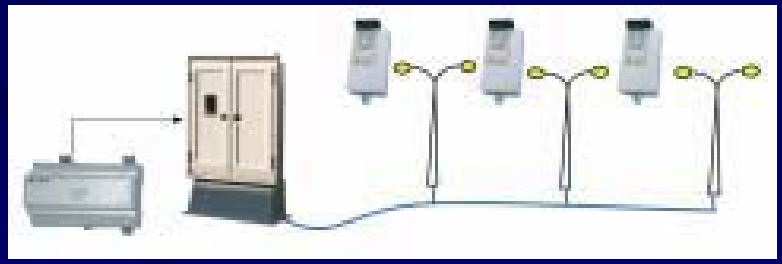
2 600 modules

planning of repairing actions

(HPS-150W)

vantage:

Return On Investment (ROI) quite long



4. Airport applications

Main HID lamps uses

→ *Where cost savings are !*

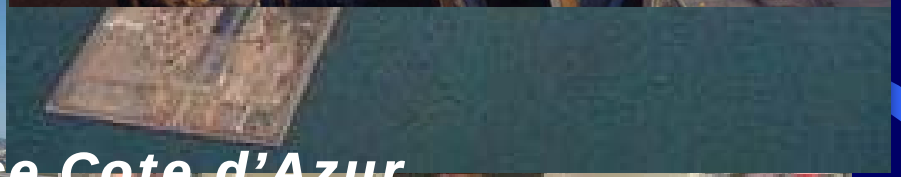
1) Apron

(Manual part IV §13: 20 -> 10 lux)

2) Parks

3) Roads

4) Terminals



Marseille Provence

5 x 27 kVA (Apron)

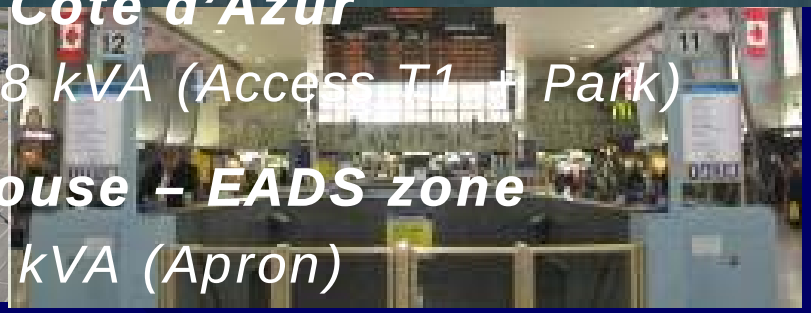
1 x 36 kVA (Park)

Lyon St Exupery

1 x 27 kVA (Park)

Bâle - Mulhouse

2 x 9 kVA (Park)



Nice Cote d'Azur

1 x 18 kVA (Access T1 + Park)

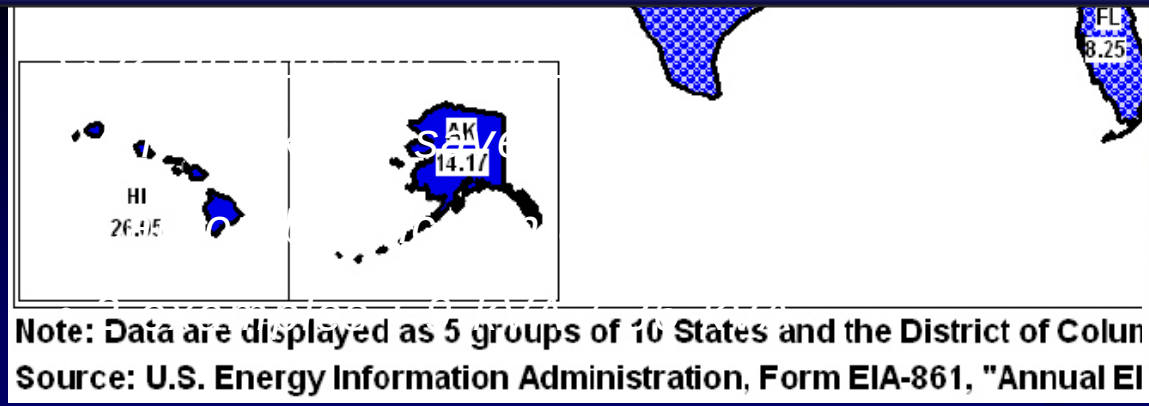
Toulouse – EADS zone

1 x 6 kVA (Apron)

5. Conclusions

State / Province	Cost	Dimmer 9 kVA 1 phase	Dimmer 36 kVA 3 phase	R.O.I.

GREEN INFO		Lighting ON	Reduced Power	kVAh saved per year	Carbon balance CO2 Tons (10 years)
Dimmer 1 phase	9 kVA	4 200 h	3 000 h	13 500	**12**
Dimmer 3 phase	36 kVA	4 200 h	3 000 h	54 000	**49**



... Thank you for your attention

& Think about them !

and at your children future !!!

Gil DAVER, Export manager

AUGIER, your energy

gil.daver@augier.com

Phone +33 4 9208 6227