



NORTHERN
ALLIANCE FOR
GREENHOUSE
ACTION

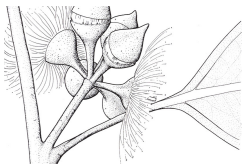
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NAGA

Regional Sustainable Public Lighting Action Plan



September 2007



Ironbark
Sustainability

Sustainability
Fund



1. Executive summary

This regional Sustainable Public Lighting Action Plan (SPLAP) outlines the current status of sustainable public lighting in the NAGA region from a Council perspective. It is designed to be considered in conjunction with the individual SPLAP's from each Council in the region. In addition it sets goals and lays out an action plan for increasing the sustainability of public lighting in the region.

Public lighting is a significant cost and energy consumer for the region. In the 2005/6 financial year it cost \$6.8 million to operate and maintain (not including installations in new developments), used over 52 million kWh of power and consisted of just under 100,000 lights installed. If NAGA Councils did not purchase Green Power or offset emissions in other ways then the emissions from Public Lighting would represent 43% of total Council corporate greenhouse gas emissions or over 84,000 tonnes each year. There is great opportunity to reduce these costs and emissions. This Action Plan outlines a process to reduce greenhouse emissions in streetlighting in the region.

This plan needs to be read in conjunction with the current NAGA Strategic Plan. Currently NAGA is researching advocating for it's members and region to aim to become carbon neutral. This action plan is designed to support this aim.

NAGA have identified several priority areas for regional action. These are:-

1. Policy development and financial support

To ensure sustainability is translated into appropriate policy for NAGA Councils. Including aiming for carbon neutral streetlighting using the NAGA Greenhouse Action Hierarchy.

2. Technology and Design

This priority action area is to ensure and implement a clear process in determining the range of efficient lighting types and designs for consideration now and into the future.

3. Advocacy

External organisation to NAGA have a large influence on sustainability outcomes in streetlighting. This area of action is designed to ensure NAGA works regionally to ensure sustainability and advocate for change.

NAGA have established a working group to progress the actions in this plan. However, the actions are the same as many of the actions in each individual Council SPLAP's and the process to develop this Plan has built upon the work of these local plans. The actions in this Plan are currently spread across a 2-3 year program and responsibilities have been allocated for each action. Additionally in 2010 a review of the action plan is scheduled.

It should be noted that this plan is only as good as the people working together to make the actions happen, within the NAGA, regionally and throughout Victoria. It is a good start, but a lot of work and commitment remains to achieve the outcomes outlined in this, the Northern Alliance for Greenhouse Action Regional Sustainable Public Lighting Action Plan.

Funding for this plan and the broader program has been provided by the Victorian Government Sustainability Fund. The NAGA has engaged Ironbark Sustainability to develop and manage the program. This action plan was written by Ironbark Sustainability and developed from information provided by the member Councils of NAGA through a series of regional meetings during 2006/7 and with input from the individual Sustainable Public Lighting Action Plans for the NAGA member Councils.

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3. Glossary

Term	Definition
CCP™	Cities for Climate Protection Program
CFL	Compact Fluorescent lamp
DB	Distribution Business
ESC	Essential Services Commission
HPS	High Pressure Sodium lamp
ICLEI	International Council for Local Environmental Initiatives
IS	Ironbark Sustainability
Luminaire	The lamp, fitting and control gear of the light
MAV	Municipal Authority of Victoria
MH	Metal Halide lamp
MV	Mercury Vapour lamp
NAGA	Northern Alliance for Greenhouse Action
OMR	Operation, maintenance and repair charge of the fitting
SLG	Street lighting Group of Councils
SPLAP	Sustainable Public Lighting Action Plan
SV(SEAV)	Sustainability Victoria (previously Sustainable Energy Authority of Victoria)
T5	Efficient lineal fluorescent lamp
VSPLAG	Victorian Sustainable Public Lighting Action Group

4. Introduction

4.1. **What is the Northern Alliance for Greenhouse Action (NAGA)**

NAGA has been operating since 2002 as an informal network that shares information, co-ordinates Councils' community based emission reduction activities and cooperates on the research and development of innovative corporate emissions projects.

NAGA's founding members are the Cities of Banyule, Darebin, Hume, Moreland, Whittlesea, Nillumbik Shire Council and the Moreland Energy Foundation Limited (MEFL); in early 2006, the Cities of Manningham, Melbourne and Yarra joined NAGA.

In April 2005 the Victorian Government released the Victorian Greenhouse Strategy Action Plan Update, which provided funding under the Greenhouse Regional Partnership Program for NAGA to expand the Alliance's work on local greenhouse issues, by providing funding for the employment of a coordinator. NAGA is the program's newest Regional Partnership, and also its only fully metropolitan partnership.

As part of involvement in the Regional Partnership program, NAGA is implementing emission reduction projects, (as well as transport demand management projects). NAGA members are also encouraged to establish their own cutting edge projects, which can act as pilots for future NAGA projects.

Projects (as of March 2007)

- Energy Smart Electricians
- Northern Metropolitan Sustainability Street Project
- Vic 1000 Sustainable Business Project
- Home Energy Action and Business Energy Action Projects
- Sustainable Public Lighting

For further information on NAGA contact the NAGA Co-ordinator on (03)9381 1722 or judy@mefl.com.au.

4.2. **What does 'Sustainable Public Lighting' mean to the NAGA?**

In the broadest sense, sustainability is about meeting the needs of this generation, without compromising the needs of future generations socially, economically or environmentally.

This action plan is designed to ensure that the current economic (e.g. cost) and social (e.g. safety) needs of the region are met without compromising the environment (e.g. climate change). Most current lighting stock on all roads/minor roads in the NAGA region is composed of lamps that use comparatively large amounts of energy and/or contain toxic chemicals such as mercury.

In this action plan the term "sustainable public lighting" refers to public lighting technology changes that will reduce the use of toxins and increase energy efficiency, thereby reducing greenhouse emissions, without compromising on social concerns such as lighting levels and public safety.

4.3. Why sustainable public lighting is important for Victorian councils

4.3.1. Greenhouse

Over 75% of Victorian Councils have joined the Cities for Climate Protection (CCP) Program. This requires a commitment by the council to meet voluntary greenhouse emission targets. For many councils the targets are to be met as soon as 2010.

Streetlighting in Victoria represents around 25-65% of any given Councils corporate greenhouse gas emissions.

4.3.2. Cost

Streetlighting costs Victorian Councils around \$40 million annually. This cost is split fairly evenly into maintenance and energy charges.

4.3.3. Technology

Streetlights remain in the environment for around 20 years. Any investment made now is expected to be around for some time, so any consideration of lighting type, need and location is an important decision for cost and sustainability.

4.4. Victorian context – The who's who of streetlighting

4.4.1. Councils & representative bodies

Councils are the key organisation responsible for paying for the service of public lighting service. There are several key council representative bodies with varying interest in sustainability in public lighting.

1. *The NAGA and other Victorian Greenhouse Alliances*

The NAGA is one of 5 greenhouse alliances representing around 50% of Victoria councils. The other Victorian regional partnerships are Central Victoria Greenhouse Alliance (based in Maryborough), North East Greenhouse Alliance (based in Wodonga), South West Sustainability Partnership (based in Warrnambool) and the Westernport Greenhouse Alliance (based in Narre Warren).

Sustainable public lighting has been identified as a key issue for each of these Alliances and most are actively involved in the Victorian Sustainable Public Lighting Action Group (see below for more details).

2. *Streetlighting Group of Councils (SLG)*

Formed in 2002 the SLG has a membership of around 30 Councils. The group aims to provide a unified voice for Councils around street lighting issues, to share knowledge and costs and to proactively address issues in the sector. The SLG to date has focussed mostly on regulatory issues such as fair and reasonable charging, contestability and clarification of ownership.

3. *Municipal Authority of Victoria (MAV)*

The MAV is the peak representative body for councils in Victoria. The MAV were unsuccessful in gaining funding in the 2007/8 State Budget for a program to replace significant proportions of Victoria's streetlights to energy efficient technologies and is keen to continue advocacy on behalf of councils in this regard.

4. *Distributors*

In Victoria the majority of public streetlights are owned and maintained by “distributors”. They are SP-Ausnet, Powercor, Citipower and Alinta. These companies are required to provide this service for councils and the community. They are required to abide by the Public Lighting Code in the provision of these services.

For councils to choose to initiate any large scale change over of lighting technology the local distributor would need to be consulted for approval and implementation.

5. *Essential Services Commission (ESC)*

The ESC is a state government authority and is responsible for ensuring that public lighting in Victoria is fair and reasonable. It has responsibility for ensuring the Public Lighting Code is followed and that pricing of the maintenance and energy side of public lighting is reasonable and fair.

6. *Sustainability Victoria (SV)*

SV is a state government authority that has been involved in assisting stakeholders for some years to identify the sustainable options around public lighting. Most notably SV provided funding for trials of efficient streetlights in 2004-5, resulting in the installation of several hundredlights throughout Victoria.

7. *Vicroads*

Vicroads is responsible for major roads in Victoria. The streetlighting on many roads throughout Victoria are jointly funded by Councils and Vicroads.

8. *Victorian Sustainable Public Lighting Action Group (VSPLAG)*

The VSPLAG was established in 2006 to assess the technical feasibility and commercial parameters of newer, more efficient public lighting technologies and to establish an orderly, transparent and timely process to deliver a fair and reasonable transition for these technologies.

The group involves all the main players including NAGA and other greenhouse alliances, the MAV, all Victorian distributors, SV, Vicroads and the ESC. Currently the group is focussing on assessing the technical issues of, and developing OMR charges for, the twin 14W T5 luminaire.

Annual cost to the region

Public lighting is a significant cost and energy consumer for the region. In the 2005/6 financial year it cost almost \$6.8 million to operate and maintain (not including installations in new developments).

CCP greenhouse reduction goals

	Corporate greenhouse target	Community greenhouse target	% of Corporate emissions from Public Lighting¹
Banyule	30% reduction from 1996 levels in 2010	20% reduction from 1996 levels in 2010	52% (in 2005/6)
Darebin	Carbon Neutral by 2020	20% reduction from 1995 levels in 2010	35% (in 2001/2)
Hume	10% reduction from 1996 levels in 2010	10% reduction from 1996 levels in 2010	44% (in 2003/4)
Manningham	20% reduction from 1996 levels in 2010	20% reduction from 1996 levels in 2010	60% (in 1996/7)
Melbourne	50% reduction from 1996 levels by 2010. Zero Net Emissions by 2020.	20% reduction from 1996 levels by 2010. Zero Net Emissions by 2020.	53% (in 2004/5)
Moreland	40% reduction from 1995 levels in 2010. Zero Net Emissions in 2020.	30% reduction from 1996 levels in 2016.	42% (in 2004/5)
Nilumbik	20% reduction from 1996/7 levels in 2012	20% reduction from 1996 levels in 2012	27% (in 2005/6)
Whittlesea	25% reduction from 1999 levels in 2010	Stabilisation in 2010 at 1998 levels.	26% (in 2005)
Yarra	25% reduction from 2000 levels in 2010	20% reduction from 1996 levels in 2010	47% (in 2004)

¹ Excluding purchase of Green Power or offset programs

5. Public lighting in the Northern Alliance for Greenhouse Action

There are almost 100,000 unmetered streetlights in the NAGA region. These light numbers are increasing every year as a result of increased residential development particularly in Whittlesea and Hume. The information in this section is based on maintenance billing data sent by the distribution businesses to each NAGA Council in the 2006 calendar year.

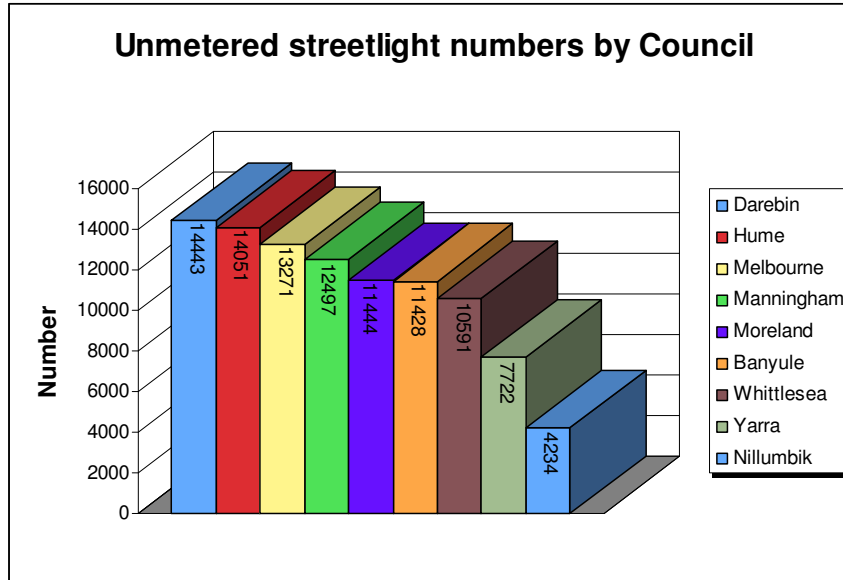


Figure 1: Public lighting in the NAGA

5.1. Total public lighting summary in the region

The following section provides information on lighting stock in the region, including types, numbers, estimated costs and greenhouse emissions.

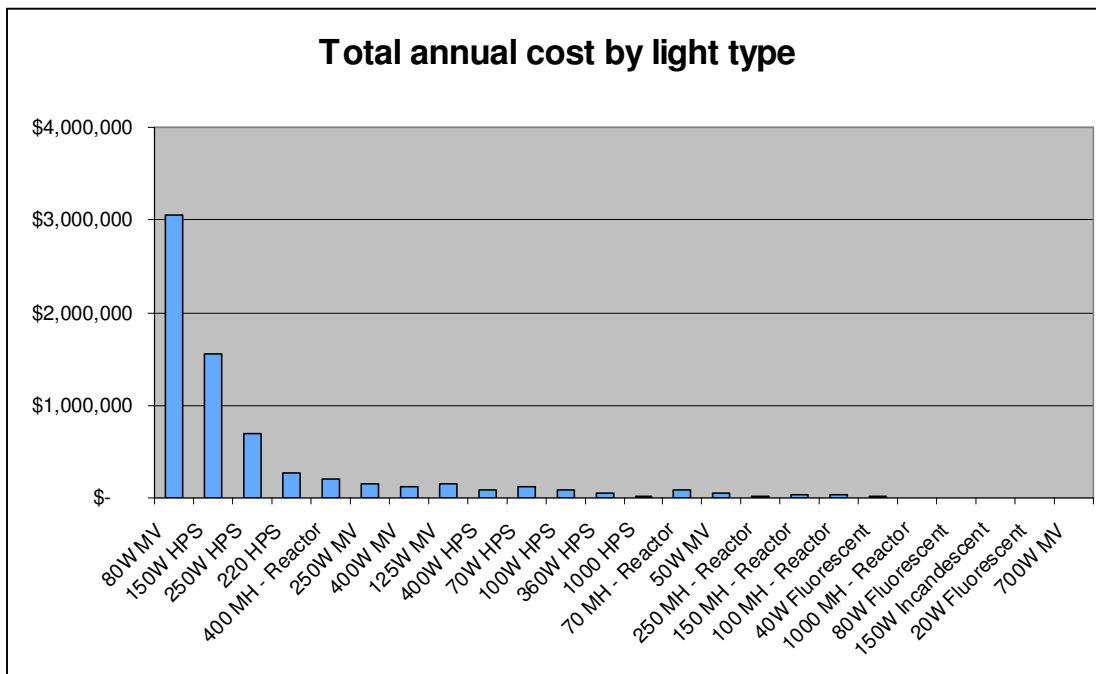


Figure 2: Annual cost of public lighting to the region by light type

Table 2: Breakdown of public lighting stock in the NAGA region (as of December 2006)

Type	Total regional light numbers	Total annual cost (GST exc.) ²	Total annual energy (kWh)
80W MV	61649	\$ 3,062,172	24,436,035
150W HPS	17605	\$ 1,559,504	10,262,266
250W HPS	6562	\$ 684,451	5,430,779
220 HPS	2273	\$ 277,845	2,319,824
400 MH - Reactor	1154	\$ 210,966	2,130,744
250W MV	1321	\$ 148,862	1,381,756
400W MV	753	\$ 116,313	1,292,214
125W MV	2160	\$ 156,522	1,287,824
400W HPS	530	\$ 76,786	688,546
70W HPS	1726	\$ 123,354	618,064
100W HPS	917	\$ 77,626	462,168
360W HPS	310	\$ 45,810	446,487
1000 HPS	7	\$ 20,317	323,400
70 MH - Reactor	804	\$ 80,881	287,028
50W MV	852	\$ 42,611	232,596
250 MH - Reactor	130	\$ 18,282	149,058
150 MH - Reactor	194	\$ 26,678	140,960
100 MH - Reactor	212	\$ 26,258	106,848
40W Fluorescent	278	\$ 11,156	58,380
1000 MH - Reactor	12	\$ 4,623	55,440
80W Fluorescent	191	\$ 8,262	40,110
150W Incandescent	7	\$ 1,666	4,410
20W Fluorescent	31	\$ 1,358	3,776
700W MV	3	\$ 343	3,077
Totals	99681	\$ 6,782,647	52,161,791³

5.1.1. The main lighting types

Unmetered lighting for public streets are by far the largest in terms of both numbers, energy consumption and cost of any type of lighting for the councils in the NAGA. The main streetlighting types are the 80W MV and the 150W and 250W HPS. There are many other types of lights including other streetlights, lights for public parks, pathways, sporting reserves, car parks and for security. All the figures below are based on data provided by the distribution businesses who own and maintain the majority of the assets.

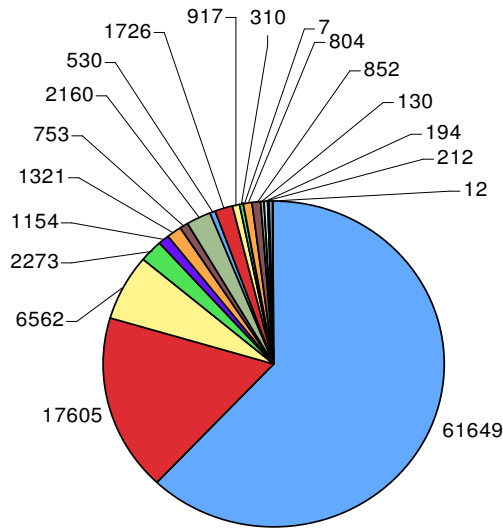
Sp-Ausnet maintains 22% of the lights in the region including all of Nillumbik, Whittlesea and large areas of Banyule and smaller areas of Darebin and Manningham. Alinta AE (formerly Agility) maintains 39% of the regions lighting, throughout Hume, in large areas of Darebin, Moreland and Banyule and in smaller numbers in Yarra and Melbourne. Alinta UE maintains the majority of lights in Manningham, representing 10% of the overall lights in the region. Citipower is responsible for maintaining 29% of the lights in NAGA and the majority of the lights in Yarra and Melbourne and large areas of Moreland and Darebin.

² Includes maintenance (OMR) and energy charges.

³ Many NAGA Councils purchase Green Power for energy in Streetlighting. This figure for energy consumption represents emissions of almost 70,000 tonnes of greenhouse gas emissions in September 2007 if the purchase of Green Power is not considered.

Consideration in Section 5 has been included to further investigate options around identifying types, numbers and solutions to sustainability for lighting other than streetlighting.

Total regional light numbers



Percentage of total energy usage by type

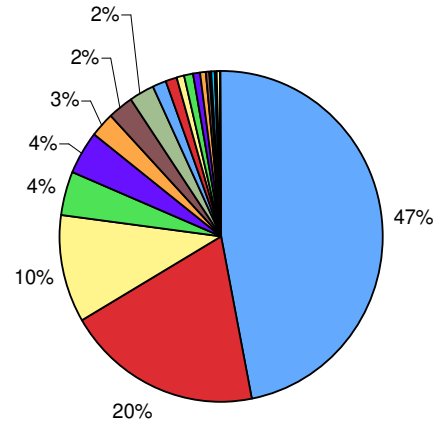


Figure 3: Light numbers and annual energy usage by light type

80W Mercury Vapour (MV)

The Councils in the NAGA (like most Australian councils) have a large population of 80W MV lights. These make up 62% of total numbers, using over 24 GWh of energy and costing over \$3 million to maintain and illuminate each year. These lights were installed from 1988 till 1995 in most residential streets throughout Victoria. They are a very energy inefficient type of light that provides a white light appropriate for Category P (Pedestrian) lighting.

Every four years the lamps are replaced as part of a “batch” cycle replacement and every 8 years the photo-electric cells are replaced at the same time as the lamp replacement.

150W & 250W High Pressure Sodium (HPS)

On major roads such as in shopping strips and arterial roads the most common type of light is either the 150W or 250W HPS. These make up 25% of total numbers in the region, using over 15 GWh of energy and costing over \$2.2 million to maintain and illuminate each year. These lights were installed during the mid to late 1990’s to replace inefficient high wattage Mercury Vapour lights. They are a very energy efficient type of light that provides an orange light appropriate for major roads where the lighting is designed to reduce vehicle to vehicle accidents.

5.2. Regional and workplace roles and responsibilities

Management of public lighting is complex within each council in NAGA because council public lighting responsibilities can involve a number of departments and individuals. Across the region, the units within council that tend to have responsibilities for public lighting include:

- Environment (esp. greenhouse reduction targets)
- Recreation and Open Space (lighting of sports grounds and parks)
- Infrastructure, Assets and Traffic (design & installation of new lighting, payment of existing)
- Community Safety
- Corporate Services (Managing contracts, inc. Energy)

The key council contacts responsible for public lighting and sustainable public lighting at each member council are:

- Banyule City Council: Greenhouse Officer – Phone (03)9457 9825
- Darebin City Council: Senior Environmental Planner – Phone (03) 8470 8535
- Hume City Council: Sustainable Resource Technical Officer – Phone (03) 9205-2488
- Manningham City Council: Customer Service Engineer – Phone (03) 9846 0527
- Melbourne City Council: Co-ordinator Environmental Engineering – Phone (03) 9658 8665
- Moreland City Council: Greenhouse Co-ordinator – Phone (03) 9240 1264
- Nillumbik Shire Council: Greenhouse Project Officer – Phone (03) 9433 3219
- City of Whittlesea: Greenhouse Programs – Phone (03) 9217 2476
- Yarra City Council: Environment Officer – Phone (03) 9205 5753

At the regional level, the NAGA established a public lighting steering committee in 2005. This group is responsible for progressing the regional action plan.

5.3. ***Community and regional expectations***

Expectations of council and the community have been used to direct the development of goals for the SPLAP. These expectations have been taken into account whilst developing this Action Plan, and the implementation process must recognise the complexity of public perceptions and the subsequent need for consultation/education on all projects.

Community

- ***Safety***
Lighting of public areas to provide a perception of safety. This includes addressing issues public drug use and crime.
- ***Efficient use of rates***
Aim for an approach that effectively invests the communities money in efficient and inexpensive lighting technology.
- ***Environmental***
Public lighting that reduces greenhouse gas emissions. Including appropriate levels of lighting, increased energy efficiency, use of local renewable generation and Green Power purchasing.
- ***Neighbourhood Character***
Public lighting that reflects the local neighbourhood character, including consistent design corresponding to neighbourhood character statements.

Safety

Under the NAGA Council's responsibilities to Safer Design this action plan is an opportunity to improve the level and quality of public lighting in the NAGA. It is the intention of any replacement lighting to improve the perceived safety concerns around adequate lighting.

Specifically the lighting technology will aim to:

- Comply with the Australian Standards.
- Provide an even spread of light with minimal pooling of shadows.
- Replace the majority of Council's older, poor performing and damaged stock.
- Improve colour rendition to provide better facial feature identification for pedestrians.
- Improve the light output of the current lighting stock to assist with tackling crime.
- Reduce glare whilst adequately illuminating directional signage.

The NAGA Councils (in addition to the above)

- ***Lighting Standards***
Current assessment of Public lighting in the NAGA is guided by AS1158.
- ***Energy Cost Reduction***
Public lighting provided at a fair, transparent and reasonable cost.
- ***Lighting for Transport***
Lighting to increase the use of active and public transport.
- ***Appropriate Maintenance of Public Lighting Stock***
Replacement of lamps, photoelectric cells etc. in a timely and efficient manner.
- ***Educated Community***
A community that is aware of sustainable public lighting issues and the work of the council in this field.

- *Flexible public lighting system*
To allow deliverance of best practice technology and systems. Including a flexible non monopoly market place for maintenance.

5.4. Existing sustainable public lighting initiatives by The NAGA

5.4.1. Trials and installations

In 2004 NAGA was successful in gaining funding for a sustainable public lighting program. The program installed 120 trial lights across the (then 6) NAGA Councils with Agility (now owned by Alinta). The following lights were installed during 2004:-

Municipality	Street and location	Light Type	No. of units
Banyule	Macleod Parade, Macleod	Twin 14W T5	10
	Somerset Dv, Viewbank	Twin 14W T5	10
Moreland	Richmond St, Hadfield	Twin 14W T5	2
	Richard St, Hadfield	Twin 14W T5	3
	Gowrie St, Glenroy	42W CFL	5
	Guilfoyle St, Coburg North	50W HPS	5
Darebin	Shorts Rd, Coburg North	Twin 14W T5	5
	Roseberry St, Preston	Twin 14W T5	10
	Townhall Av, Preston	Twin 14W T5	10
Hume	Jackson St, Sunbury	Twin 14W T5	4
	Brook St, Sunbury	Twin 14W T5	6
	Barkly St, Sunbury	50W HPS	7
	Timins St, Sunbury	50W HPS	2
	Cnr Brooks St & Barkly St	Twin 24W T5	1
Whittlesea	Industrial Ave, Thomastown	50W HPS	3
	Trawalla Ave, Thomastown	42W CFL	10
	Trawalla Ave, Thomastown	50W HPS	3
Maribyrnong	Indwe St, West Footscray	Twin 14W T5	10
	Indwe St, West Footscray	50W HPS	5
	Roberts St, West Footscray	50W HPS	5

Additional trials have occurred prior to April 2007 in the NAGA region including:

In the City of Whittlesea:

- Aurora Estate, 60 Twin 14W T5, 63 HPS 50 and 6 CFL 42
- Promenade Estate, 75 CFL 42
- Laurimar Township, 35 CFL 42

In 2005, NAGA won the UNAA Environment Day Awards for the Best Local Government Initiative for its pilot Sustainable Public Lighting project.

5.5. Further sustainable public lighting options

There are many options available to ensure public lighting in the NAGA region becomes more sustainable. This section is not an exhaustive list, it is simply designed to provide general information on some of the options currently available. As the action plan is implemented other specific information will be developed. The main areas of interest are in energy efficiency and design.

5.5.1. Energy Efficiency

One of the more straightforward ways to increase sustainability is to ensure the lights installed are more efficient than the current stock. The table below provides some generic options for how some of the current light in the NAGA can be replaced to achieve better efficiencies ⁴.

Table 2:- Energy efficient replacement options for current lighting stock

Type	Preferred replacement option	Annual energy savings if replaced (kWh)
1000W HPS	With Active Reactor	64,680
1000W MH - Reactor	With Active Reactor	11,088
125W MV	twin 24w T5	834,365
150W HPS	With Active Reactor	615,252
150W Incandescent	30W CFL	3,469
150W MH - Reactor	With Active Reactor	28,192
220W HPS	With Active Reactor	463,965
250W HPS	With Active Reactor	1,086,156
250W MH - Reactor	With Active Reactor	29,812
250W MV	150W HPS/MH with Active Reactor	681,261
360W HPS	With Active Reactor	89,297
400W HPS	With Active Reactor	41,280
400W MH - Reactor	With Active Reactor	127,744
400W MV	250W HPS/MH with Active Reactor	76,839
40W Fluorescent	twin 14w T5	3,482
50W MV	twin 14w T5 or 26W CFL	13,820
700W MV	400W HPS/MH with Active Reactor	1,603
80W Fluorescent	twin 24w T5	28,077
80W MV	twin 14w T5	16,681,803
TOTAL		20,926,553 or 40% of total energy usage⁵

For more information on light quality and energy consumption refer to **Appendix 1: Summary of Agility Sustainable Public Lighting report -2006.**

⁴ The actual type should be considered on a case by case basis and in conjunction with the relevant stakeholders (e.g. other considerations - such as white versus yellow lights and maintenance issues need to be reviewed in most situations).

⁵ Representing 27,730 tonnes of greenhouse gas emissions if the purchase of Green Power is not considered.

5.5.2. Changeover opportunities

For bulk changeovers of 80W MV the most opportune timing is to integrate this program with the existing distribution business maintenance regime. Every 4 years the globes are replaced and every 8 years the globe and pe cell is replaced. By changing the luminaires at this time it is possible to leverage contributing funding from the distribution businesses because of the savings from not having to replace the globes or pe cells. Below is a table that summarises the standard replacement cycles for each NAGA council.

	Alinta	% of lights	SP-Ausnet	% of lights	Citipower	% of lights
Banyule	2008/9	57%	2010/11	43%		
Moreland	2008/9	64%			TBC	36%
Hume	2007/8	100%				
Darebin	20010/11	68%	2007/8	4%	TBC	29%
Nillumbik			2007/8	100%		
Whittlesea	2007/8	<1%	2009/10	100%		
Manningham	2009	89%	TBC	11%		
Yarra	2008/9	4%			TBC	96%
Melbourne	TBC	4%			TBC	96%

Table 3: Scheduled batch replacement times and lighting numbers for minor road lighting in NAGA

5.5.3. Design

Several design solutions can reduce greenhouse gas emissions, including:

➤ Taller poles

Optimum pole spacing and mounting heights can reduce the capital costs, due to less poles and luminaires being required. Increasing the mounting height of luminaires in minor roads, from 5 metres to 7 metres can result in about a 15% increase in the pole spacings with commensurate reductions in capital costs, maintenance and energy costs.

➤ Non – standard lighting

Energy inefficiency may be caused by the use of non standard decorative lighting, due to reduced mounting height and luminaire design. Energy requirements, per linear metre of road, may typically be 15-30% more than standard lighting.

➤ Frosted lamps

Frosted lamps reduce light transmission, and, therefore efficiency by about 10%. However there are concerns with potential glare using the existing luminaires and non-frosted lamps.

➤ Street tree planting

When trees are present they may cause undesirable shadowing and may render street lighting ineffective. Any planting needs to consider the impact on lighting.

6. The NAGA sustainable public lighting action plan

6.1. Priority Action Areas and Goals

The NAGA have identified several priority areas for regional action. These are:-

- **Policy Development and Financial Support**
- **Technology and Design**
- **Advocacy**

The following sections state goals for each priority area and an action table to progress the stated goals.

6.1.1. Policy development and financial support

This priority action area is as a response to the high expected cost of any transition to sustainable public lighting and the need to ensure sustainability is translated into appropriate policy for NAGA Councils.

The goals of this area are to:

- Prepare councils to invest in more sustainable public lighting
- Develop options so the most economic options are used to reduce emissions to zero.
- Ensure decisions around sustainability utilise the NAGA Greenhouse Action Hierarchy. This hierarchy identifies the preferred method of reducing greenhouse emissions with the most effective long term strategies listed first. Note that a combination of actions is likely to have the most impact on reducing emissions. The hierarchy is:
 1. Avoidance through appropriate use
 2. Improve efficiency
 3. Generate local renewable energy
 4. Purchase accredited Green Power
 5. Purchase offsets and other green energy products

Action	Breakdown of Tasks	Responsibility	Timeline	Priority	Status (As of March 2007)
A. Scope technical options	I. Identify broad scale short – medium term technical solutions (inc. from progressive roll outs to bulk changes)	IS	2007	High	
	II. Identify implementation costs and timelines for each Council	Councils, IS to assist	2007	High	
B. Identify funding opportunities	I. Gauge opportunity for funding from Council	IS, Councils	2007	High	Nillumbik completed
	II. Identify contributions from Distributors	NAGA street lighting subcommittee	Ongoing	High	
	III. Investigate price reduction through bulk purchasing	VSPLAG	2007	Low	Ongoing
	IV. Approach State and Federal Government for joint funding	Councils, MAV, VLGA	2007	Med	Underway
	V. Consider third party finance options	Councils	2008-9	Med	
	VI. Determine opportunities from carbon trading	IS	2008-9	Low	Low level funding expected
C. Review funding models	I. Use existing NAGA model or develop new model	Councils, IS to assist	2007	Med	
D. Council Policy and support	I. Brief Councillors and senior management on issues	Councils, IS	2007 and ongoing	High	Nillumbik completed
	II. Capacity build regionally	IS	2007-8	Med.	Funded till 2008

6.1.2. Technology and Design

This priority action area is to ensure a clear process in determining the range of efficient lighting types for consideration now and into the future.

The goals of this area are to:

- Ensure new installations follow best practice
- Establish a range of energy efficient lighting and design options
- Create access to independent technical expertise
- Maintain lighting in line with relevant standards and community expectations
- Ensure appropriate design for lighting for sustainable transport and in parks

Action	Breakdown of Tasks	Responsibility	Timeline	Priority	Status (As of March 2007)
A. Establish technology options	I. Compile data on existing and past trials	NAGA, VSPLAG	2007, Ongoing	High	Ongoing
	II. Develop standard technical notes for distribution to developers	IS	2007	High	
	III. Review need for ongoing technical support to Councils.	IS, NAGA	2008	Med.	
B. Improve asset management (For metered and unmetered Public Lighting)	I. Audit lighting system and management requirements	Councils, NAGA	2007-9	Med-Low	Some audits done, requirement for further audits to be ID'ed
	II. Improve assets database to record changes as they occur. Consider regional utilities system	Council, NAGA if regional	2007/8, ongoing	Low for region. High in some councils	
C. Research	I. Consider waste management issues of bulk changes	NAGA	2007/8	High	
	II. Compile and extend existing work – funding required	IS, NAGA, VSPLAG	Ongoing	Med	Ongoing
	III. Investigate opportunities (eg. Renewables, improved switching etc.)	NAGA, Distributors, IS	Ongoing	Med	Ongoing

6.1.3. Advocacy

This priority action area relates to the high degree of influence external organisations have to determine the types of lights installed. NAGA needs to work regionally with a range of groups to ensure sustainability in public lighting occurs.

The goals of this area are to:

- Work collaboratively at a regional level with distribution business', government and other stakeholders
- Establish efficient management systems with these stakeholders
- Advocate for change where required
- Develop external funding support for asset replacement and maintenance programs

Action	Breakdown of Tasks	Responsibility	Timeline	Priority	Status (As of March 2007)
A. Create a collective regional voice	I. Maintain the sub committee of NAGA to manage the project	NAGA	2007	High	Completed 2005. Ongoing
B. Allow councils to choose more efficient lighting types	I. Develop OMR charges and list sustainable options on the load table - Support current VSPLAG process to achieve this	Council, NAGA	2007	High	NAGA is represented at VSPLAG
	II. Negotiate roll out opportunities with DB's	Council, NAGA, ESC	2007, Ongoing	High	
C. Community consultation	I. Collate information and inform on actions/issues	NAGA, Councils	2008/9	Med	Completed during trial (2004/5)
D. Work with Vicroads	I. ID options for main road lighting	NAGA, VSPLAG	2008/9	High	
	II. Pursue transition issues and options	NAGA, VSPLAG	2008/9	Med	

6.2. Summary action timeline

This section summarises the main points from the detailed action tables above in chronological order, and notes their priority with respect to achieving the region's sustainable public lighting goals.

Timeline	Priority action area	Action	Breakdown of Tasks	Responsibility	Priority	Budget	
Ongoing	6.1.3 Advocacy	B. Allow councils to choose more efficient lighting types	II. Negotiate roll out opportunities with DB's	Council, NAGA, ESC	High	Established till 2008- AS1 ⁶	
	6.1.1 Policy Development and Financial Support	B. Identify funding opportunities	II. Identify contributions from Distributors	NAGA	High	Not required	
		D. Council Policy and support	I. Brief Councillors and senior management on issues	Councils, IS	High	Established till 2008- AS1	
	6.1.2 Technology and Design	A. Establish technology options	I. Compile data on existing and past trials	NAGA, VSPLAG	High	Established till 2008- AS1	
			C. Research	II. Compile and extend existing work – funding required	NAGA, VSPLAG	Med	Required
			III. Investigate opportunities (eg. Renewables, improved switching etc.)	NAGA, Distributors	Med	Required	
2007/8	6.1.3 Advocacy	A. Create a collective regional voice	I. Maintain the sub committee of NAGA to manage the project	NAGA	High	Not required	
		B. Allow councils to choose more efficient lighting types	I. Develop OMR charges and list sustainable options on the load table - Support current VSPLAG process to achieve this	Council, NAGA	High	May be required	
	6.1.2 Technology and Design	A. Establish technology options	II. Develop standard technical notes for distribution to developers	IS	High	Established - AS1	
			III. Investigate opportunity for ongoing technical support to Councils	IS, NAGA	Med.	Established - AS1	
		C. Research	I. Consider waste management issues of bulk changes	NAGA	High	Required	

⁶ AS refers to funding through the Sustainability Accord (A) and Stage 1 of the NAGA Sustainable Public Lighting Program (S1).

Timeline	Priority action area	Action	Breakdown of Tasks	Responsibility	Priority	Budget
2007/8 (cont.)	6.1.1 Policy Development and Financial Support	A. Scope technical options	I. Identify broad scale short – medium term technical solutions (inc. from progressive roll outs to bulk changes)	IS	High	Established till 2008- AS1
			II. Identify implementation costs and timelines	IS, Councils	High	Established till 2008- AS1
		B. Identify funding opportunities	I. Gauge opportunity for funding from Council	IS, Councils	High	Not required
			IV. Approach State and Federal Government for joint funding	Councils, MAV, VLGA	Med	Not required
			III. Investigate price reduction through bulk purchasing	VSPLAG	Low	Not required
		C. Review funding models	I. Use existing NAGA model or develop new model	IS	Med	Established till 2008- AS1
D. Council Policy and support	II. Capacity build regionally	IS	Med.	Established till 2008- AS1		
2007-9	6.1.2 Technology and Design	B. Improve asset management	I. Audit lighting system and management requirements	Councils, NAGA	Med-Low	Required
			II. Improve assets database to record changes as they occur. Consider regional utilities system	Council, NAGA if regional	Low. High in some councils	Required
2008/9	6.1.3 Advocacy	D. Work with Vicroads	I. ID options for main road lighting	NAGA, VSPLAG	High	May be required
			II. Pursue transition issues and options	NAGA, VSPLAG	Med	May be required
		C. Community consultation	I. Collate information and inform on actions/issues	NAGA, Councils	Med	May be required
	6.1.1 Policy Development and Financial Support	B. Identify funding opportunities	V. Consider third party finance options	Councils	Med	Established till 2008- AS1
			VI. Determine opportunities from carbon trading	IS	Low	Established till 2008- AS1

6.3. Monitoring and review processes

The NAGA's SPLAP is a dynamic document, which is designed in such a way that it can respond to changes in attitudes, technology, awareness and means for achieving council's sustainable public lighting goals. The SPLAP will be a reflection of NAGA's growing knowledge and experience in greenhouse gas reduction in the public lighting sector.

Parts of this plan are to be monitored and reviewed by the NAGA Public Lighting Sub-Committee, which will ensure that the plan is incorporated into NAGA's processes and culture. Member Council's will inform and update the NAGA Public Lighting Sub-Committee and refer significant decisions (i.e. around application of funding) to the full NAGA Committee. The monitoring and review process is important so that:

- Responsible staff do not experience unnecessary extension of their workloads.
- Chosen actions continue to be the best for achieving NAGA's sustainable public lighting goals.
- New sustainable public lighting knowledge and technology can be incorporated into the SPLAP if NAGA decides this is appropriate.
- NAGA's progress toward the goals set in section 6 can be assessed, and success measured.

The regional SPLAP should be reviewed in an ongoing manner with an extensive review in 2010 or timed to co-incide with a general review of NAGA operations. It is the responsibility of the NAGA Street lighting sub committee to ensure this plan is implemented and the review is completed.

The review should consider the Key performance indicators below and the following:

- The progress of actions, their effectiveness and acceptance by staff, member Council's and the community.
- Identification of areas requiring additional action.
- Accommodation for changes in priorities for achieving greenhouse gas reduction.

6.4. Key performance indicators for sustainable public lighting

- Performance in completion of, or work on, actions listed in this plan;
- Greenhouse gas emissions for public lighting;
- Community perceptions of public lighting;
- Ongoing costs of public lighting;
- Funding support, recognition and rewards for NAGA's sustainable public lighting program.

Appendix 1: Public lighting in the NAGA in detail

Distributor	Banyule	Darebin	Hume	Manningham	Melbourne	Moreland	Nillumbik	Whittlesea	Yarra	Total regional light numbers	Type	% Council pays	Total annual energy (kWh)	Total annual cost (GST exc.) ⁷
Alinta - AE	74	39	10			2			14	139	50W MV	100%	37947	\$ 5,994
	4777	6425	10494		253	5447			195	27591	80W MV	100%	11101515	\$ 1,359,477
			1							1	80W MV	33%	133	\$ 33
	59	11	95		2	81			3	251	125W MV	100%	149696	\$ 15,717
	6	36	11		4	9			1	67	250W MV	100%	76822	\$ 7,947
	1	8	8							17	250W MV	33%	6432	\$ 1,229
	10	32	5		3	15				65	400W MV	100%	120120	\$ 10,660
	6	7				3				16	400W MV	33%	9757	\$ 1,430
										0	700W MV	33%	0	\$ -
										0	70W HPS	100%	0	\$ -
	47	36	163			8			1	255	100W HPS	100%	128520	\$ 19,885
	777	1399	1996		181				22	4375	150W HPS	100%	3178875	\$ 413,990
	377	695	228		11	1461			27	2799	150W HPS	33%	671139	\$ 182,726
		0								0	220W HPS	100%	0	\$ -
	107	105	439		48	170			16	885	250W HPS	100%	1014741	\$ 106,246
	281	365	455		13	83			38	1235	250W HPS	33%	467297	\$ 91,077
	5	11	36		6					58	400W HPS	100%	107184	\$ 10,330
	2	1	104			71				178	400W HPS	33%	108552	\$ 18,417
										0	70W MH	100%	0	\$ -
										0	150W MH	100%	0	\$ -
										0	250W MH	100%	0	\$ -
	1					1				2	20W Fluorescent	100%	244	\$ 70
	35	181	3			2			3	224	40W Fluorescent	100%	47040	\$ 8,989
	2	181	3			2			3	191	80W Fluorescent	100%	68187	\$ 9,955
		7								7	150W Incandescent	100%	4410	\$ 1,666

⁷ Includes maintenance (OMR) and energy charges.

Distributor	Banyule	Darebin	Hume	Manningham	Melbourne	Moreland	Nillumbik	Whittlesea	Yarra	Total regional light numbers	Type	% Council pays	Total annual energy (kWh)	Total annual cost (GST exc.)
Alinta - UE				85						85	50W MV	100%	23205	\$ 3,666
				4373						4373	80W MV - standard	100%	1759520	\$ 215,469
				2078						2078	80W MV - decorative	100%	836104	\$ 102,388
				53						53	125W MV	100%	31609	\$ 3,319
				3						3	700W MV	33%	3077	\$ 343
				1278						1278	70W HPS	100%	456246	\$ 88,333
				45						45	100W HPS	100%	22680	\$ 3,509
				680						680	150W HPS	100%	494088	\$ 64,346
				850						850	150W HPS	33%	203811	\$ 55,490
				229						229	250W HPS	100%	262571	\$ 27,492
				462						462	250W HPS	33%	174811	\$ 34,071
				21						21	400W HPS	100%	38808	\$ 3,740
				9						9	400W HPS	33%	5489	\$ 931
				54						54	40W Fluorescent	100%	11340	\$ 2,167
CitiPower		24			792	28			534	1378	125 MV	100%	821839	\$ 107,578
		18			722	7			124	871	250 MV	100%	998689	\$ 103,677
						4				4	250 MV	33%	1514	\$ 291
		33			504	16			25	578	400 MV	100%	1068144	\$ 93,514
					7					7	400 MV	50%	6468	\$ 743
		2			1	16			25	44	400 MV	33%	26833	\$ 3,835
		9			430	1			151	591	50 MV	100%	161343	\$ 31,356
		3135			754	3050			4051	10990	80 MV	100%	4421936	\$ 588,322
					29					29	20 Fluorescent	100%	3532	\$ 1,288
					7					7	1000 HPS	100%	323400	\$ 20,317
		10			223	33			23	289	100 HPS	100%	145656	\$ 26,154
		542			1797	560			1554	4453	150 HPS	100%	3235550	\$ 461,670
		292			11	313			247	863	150 HPS	33%	206928	\$ 64,149
		1			2272					2273	220 HPS	100%	2319824	\$ 277,845
		10			1699	29			430	2168	250 HPS	100%	2485829	\$ 281,216
					1					1	250 HPS	50%	573	\$ 95
		3			63	29			189	284	250 HPS	33%	107459	\$ 23,688
					228				3	231	360 HPS	100%	381289	\$ 37,064

Distributor	Banyule	Darebin	Hume	Manningham	Melbourne	Moreland	Nillumbik	Whittlesea	Yarra	Total regional light numbers	Type	% Council pays	Total annual energy (kWh)	Total annual cost (GST exc.)
Citipower					79					79	360 HPS	50%	65199	\$ 8,746
(continued)		3			189	1			8	201	400 HPS	100%	371448	\$ 35,486
					16					16	400 HPS	50%	14784	\$ 1,934
					8	1			1	10	400 HPS	33%	6098	\$ 1,019
					414	1			33	448	70 HPS	100%	161818	\$ 35,021
					12					12	1000 MH - Reactor	100%	55440	\$ 4,623
					212					212	100 MH - Reactor	100%	106848	\$ 26,258
					194					194	150 MH - Reactor	100%	140960	\$ 26,678
					130					130	250 MH - Reactor	100%	149058	\$ 18,282
		1			1150				1	1152	400 MH - Reactor	100%	2128896	\$ 210,711
					2					2	400 MH - Reactor	50%	1848	\$ 254
					804					804	70 MH - Reactor	100%	287028	\$ 80,881
Sp-Ausnet								37		37	50W MV	100%	10101	\$ 1,596
	3328	312		1053			3168	7387		15248	80W MV	100%	6135185	\$ 751,307
							1	2		3	80W MV	33%	398	\$ 99
	97			1			114	265		477	125W MV	100%	284483	\$ 29,869
							1			1	125W MV	33%	197	\$ 39
	77			9			54	70		210	250W MV	100%	240786	\$ 24,804
	43						60	49		152	250W MV	33%	57513	\$ 10,915
	3	2		1			20	2		28	400W MV	100%	51744	\$ 4,722
	10	2		1				2		15	400W MV	33%	9148	\$ 1,410
	41	53		15			13	206		328	100W HPS	100%	165312	\$ 28,078
	824	25		90			362	1600		2901	150W HPS	100%	2107867	\$ 272,867
	100	10					266	308		684	150W HPS	33%	164008	\$ 44,266
	107	9		38			88	313		555	250W HPS	100%	636363	\$ 66,263
	226	94		16			81	326		743	250W HPS	33%	281135	\$ 54,304
	2						3	6		11	400W HPS	100%	20328	\$ 2,042
	3	2					3	18		26	400W HPS	33%	15856	\$ 2,886
Total	11428	14131	14051	11444	13271	11444	4234	10591	7722	98316			52008625	\$ 6,739,263

Appendix 2: Summary of Agility Sustainable Public Lighting report - 2006

Agility (now Alinta AE) have recently released a report funded by Sustainability Victoria that summarises the results of the NAGA trials and several other trials completed by Agility over the past 12-18 months⁸.

This report is an excellent summary of the current lighting stock for minor road lighting compared with the more efficient luminaires.

The report identifies several issues with the current 80W MV luminaire. Of particular relevance is the testing that was carried out and the table that summarises the pros and cons of each luminaire type (see Table 1 overleaf).

Table 1:- Lamp Comparisons based on the work completed by Alinta in 2006.

Luminaire	Price per unit	Energy rating	Light output	Lumens per watt	Ballast life	Lamp life	Colour	Lantern Sturdiness	Low Voltage operation	Cold weather starting	CO ₂ reduction
2 X 14 W, T5	★ ★	★ ★ ★ ★	★ ★ ★	★ ★ ★ ★	★ ★	★ ★ ★	★ ★ ★ ★	★ ★ ★	★ ★ ★ ★	★ ★	★ ★ ★ ★
2 X 24 W, T5	★ ★	★ ★ ★ ☆	★ ★ ★ ★	★ ★ ★ ★	★ ★	★ ★ ★	★ ★ ★ ★	★ ★ ★	★ ★ ★ ★	★ ★ ★	★ ★ ★ ☆
42 W, CFL	★ ★ ★	★ ★ ★	★ ★ ★	★ ★ ★	★ ★	★ ★	★ ★ ★ ★	★ ★ ★ ★	★ ★ ★ ★	★ ★	★ ★ ★
50 W HPS	★ ★ ★	★ ★ ★	★ ★ ★	★ ★ ★	★ ★ ★ ★	★ ★ ★	★ ★	★ ★ ★ ★	★	★ ★ ★ ★	★ ★ ★
80W MV	★ ★ ★ ★	★ ★	★ ★ ★ ★	★ ★	★ ★ ★ ★	★ ★ ★	★ ★ ★ ★	★ ★ ★ ★	★	★ ★ ★ ★	★ ★

This table is a useful reference for council. Note that several of the items listed above will be considered by the distributors when determining pricing of maintenance (OMR) charges and so will have no technical bearing on councils. Council will be able to take these into account when considering costing of the luminaire types. These items are the items with heading coloured **orange** and include price per unit, ballast life, lamp life and lantern sturdiness.

⁸ Sustainable Public Lighting Initiative, K.Poulton & R. Simms, 2006. Funded by Sustainability Victoria.

The key areas for councils to consider are around light quality and energy consumption.

Light Quality

Quality lighting is possibly the most important issue for councils and is exactly why lighting is provided in the first place. Several of the sections in the table above reflect on this.

Light output

This item relates to the spacing of the lanterns and needs to be considered in combination with lantern design. For example although the table indicates the light output from the 2x14W T5 lamp is poorer than the 80W MV, the standard T5 lantern has a larger spacing than the 80W MV because of superior lantern design.

Colour

This indicates whether the lamp is a white light or yellow light (hps). The white light is preferred for minor roads and pedestrian activities.

Low voltage operation

During the testing it was discovered that the light output from the 80W MV and the 50W HPS was significantly effected by voltage. Voltage fluctuates significantly throughout the night and is dependent on the amount of demand for power in the neighbourhood. The testing showed that as voltage reduced (when demand is high, such as during peak periods at 5-9pm in the evening) the light output reduced.

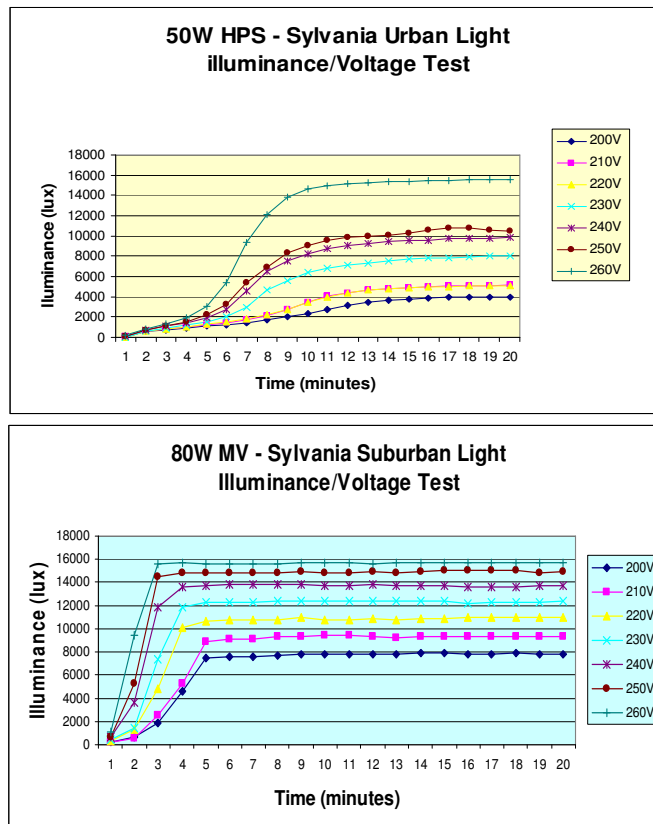


Figure 1:- Voltage variation test – demonstrating significant light reduction in the 80W MV and 50W HPS.

Typically it is expected in many areas that Voltage will vary from 220V to 250V each day. The standard lamp illumination figures are measured at 250V. For the 80W MV this means a depreciation from standard illumination figures during peak times of around 26% (at 220V). For the 50W HPS this means a depreciation from standard illumination figures during peak times of around 52% (at 220V).

Cold weather starting

The 2x14W T5, the 50W HPS and the 42W CFL were effected by temperature when starting. On average it took around 30 minutes for the lamps to warm enough to put out close to normal light outputs when temperatures were at -5°C, with the HPS taking the longest to stabilise. Above zero degrees within 3-10 minutes most of the lights were performing close to their rated levels.

In Melbourne these figures are of no concern. The lights are designed to start at around 5pm in the middle of winter. There are very few records of temperatures below 5°C at this time. A quick search found that in Viewbank in the Northern Suburbs over a 5 year period had four days where this happened. None of the records were less than 3°C.

Energy Consumption

Energy consumption is referred to in the above table through the Energy Rating and the CO₂ Reduction. There are significant expected energy savings from completing efficiency projects. Optimum greenhouse savings are outlined in Table 2 above.

For example, by replacing one 80W MV with a twin 14W fluorescent the energy cost savings are as follows:-

$$\text{Current energy cost (\$29) - New energy cost (\$9) = Savings (\$20)}$$

Note that maintenance charges are expected to increase which will offset these savings somewhat. Indications when this plan was developed suggest the maintenance cost will be increased by around \$8-10 per luminaire per year.