# Policy Brief: Improving the energy performance of commercial lighting products

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# A Policy Brief for improving the energy performance of commercial lighting products

## Evidence, analysis, targets and indicative standards

## Overview

1. This Policy Brief represents the outcome of the public consultation on commercial lighting products, which was carried out earlier this year. This is in accordance with the announcement in the Energy White Paper of 23 May 2007 where the Government said it would publish a series of consultation papers setting out its analysis of how the performance of energy using products will need to improve over the next 10–20 years, including proposals for product standards and targets to phase out the least efficient products[1]. This forms part of a wider annual review and policy development process, supporting delivery of the Government's objectives for energy and sustainable consumption and production.

2. To achieve the product standards and targets, a range of measures and approaches are required. These may include international agreements, European and domestic legislation, and voluntary action through the supply chain to enhance markets for the most cost-effective energy efficient goods and services. In the Energy White Paper, the Government announced a range of policies to support delivery.

3. We believe that the standards will provide retailers, manufacturers and service providers with a benchmark to improve the performance of products they provide. In addition, we are encouraging industry to deliver improvements in product standards.

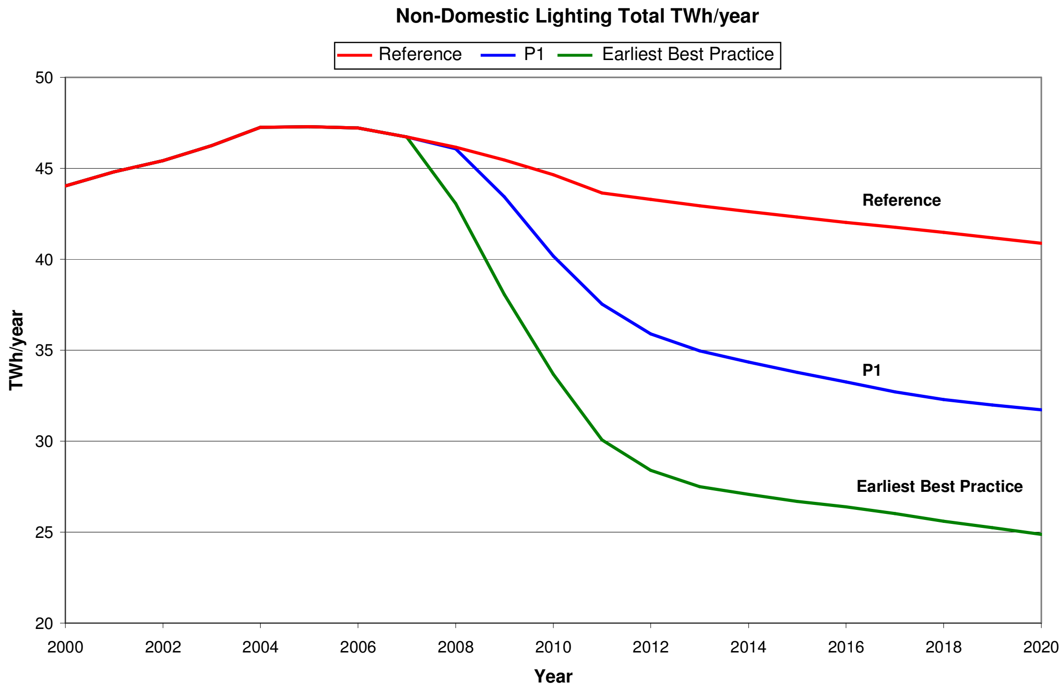
4. This Policy Brief addresses in-use energy consumption and carbon emissions associated with all internal and external, fixed to the building lighting for all commercial (ie non-domestic) premises including offices, retail, hotels, public service buildings, industrial and warehousing units. It excludes external lighting not fixed to the building, street lighting and traffic signals. Separate Policy Briefs cover domestic lighting products, and street lighting and traffic signals.

## How we expect commercial lighting products to contribute to future energy consumption

5. The following graph shows the Government's projections for energy use by commercial lighting products.

[1] See Energy White Paper (23 May 2007), para. 2.102.

## Total in-use energy consumption of installed UK commercial lighting (see scope in paragraph 4)




6. The Reference[2] projection takes into account underlying trends in markets and technologies, and the estimated or implicit impacts of historical and current policy measures. It does not, as yet, take account of the impact of all the policies announced in the Energy White Paper of 23 May 2007, which are still being developed and are not targeted at specific products. The intention is to revise these projections once it becomes clearer how these new policy measures will affect commercial lighting.

7. The Earliest Best Practice (EBP) projection shows what would happen if all new UK sales were based on the most resource efficient options, taking into account design and production cycles, but not taking account of price or other market barriers.

8. The P1 projection sets a target level of ambition that the Government is proposing could be delivered at a reasonable cost, taking into account such things as current UK and global performance benchmarks, economies of scale and the capacity of the supply chain to take coherent action to deliver more energy efficient products[3].

[2] The Reference line or 'REF' is included as a baseline against which progress towards absolute consumption targets can be monitored. It also permits us to measure the impact of market changes in response to published targets and delivered policy measures and to assess the need for additional action. REF is updated to estimate the aggregate impact of existing policy measures, superimposed on underlying market trends, on the supply, sales and use of commercial lighting products – and, therefore, on non-domestic energy consumption. The effectiveness of market transformation policy, taken as a whole, may be assessed as the extent to which it modifies REF.
[3] These market-based estimates for P1 are cross-compared with the performance improvements that could be envisaged through a set of ambitious but feasible policy options, over and above those included in the Reference line to check their feasibility. Section 3 of this Policy Brief (Policies, risks

9. In theory, delivery of EBP would result in energy use falling to 24.8 TWh by 2020. This would represent an energy saving of 16.0 TWh[4] (2.0 MtC, 7.2 Mt $CO_2$)[5] over the Reference projections for 2020.

10. The proposed P1 target would result in energy use from non-domestic lighting products falling to 31.7 TWh by 2020. This would represent an energy saving of 9.1 TWh (1.1 MtC, 4.1 Mt $CO_2$)[6] over the Reference projections for 2020.

11. We estimate that the P1 target would be achieved if, on average, products supplied and brought into use each year were to meet the indicative performance standards set out in the Appendix. These P1 targets and product standards take into account:

- Benchmark product designs and technologies.
- Underlying market and technology trends.
- The scope for delivering policy benefits at a reasonable cost.

12. We estimate this market shift could be delivered at a reasonable cost. For example, using tri-phosphor T5 fluorescent lamps with high-frequency ballasts for office lighting and compact ceramic metal halide lamps (or lamps of similar efficacy) for display lighting.

13. If we are on track to deliver this target we would expect to see substantial shifts in the market, for example:

<u>2008</u>: Retailers cease replacing stocks of ordinary (GLS) A-shaped incandescent lamps of low efficacy and of energy rating higher than 100 W (predominantly 150 W lamps).
<u>2009</u>: Retailers cease selling GLS A-shaped lamps of low efficacy and of energy rating higher than 60 W (predominantly 150 W lamps, 100 W lamps, plus some 75 W lamps).
<u>2009</u>: Cease supply of linear fluorescent lamps longer than 600 mm with efficacy less than 75 lumens/watt[7].
<u>2010</u>: Retailers cease selling GLS A-shaped lamps of low efficacy and of energy rating higher than 40 W (predominantly 60 W lamps).

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and measures) describes these along with the associated risks and proposed strengthening initiatives.

[4] 1 terawatt-hour (TWh) = 1,000,000,000 kilowatt-hours (kWh).

[5] Carbon emissions for electricity are calculated from Government predictions of the electricity generation mix. Oil and gas are converted using standard Government factors. See MTP Briefing Note BNXS01 at www.mtprog.com/ApprovedBriefingNotes/pdf.aspx?intBriefingNoteID=150

[6] However, some of the energy an appliance uses provides useful heat and when this is reduced, the heating system will have to provide more heat, known as the heat replacement effect (HRE), so the net carbon reduction taking the HRE into account is 0.7 MtC, 2.5 $MtCO_2$. See MTP Briefing Note BNXS05 for further explanation at: www.mtprog.com/ApprovedBriefingNotes/pdf.aspx?intBriefingNoteID=151

[7] This is a simple statement of a minimum target for fluorescent lamps; it should be possible to define more complex minimum energy performance standards for various light output levels.

2011: Retailers cease selling GLS A-shaped lamps and 60 W ‘candle’ and ‘golfball’ lamps of low efficacy (predominantly 40 W and 25 W A-shaped GLS bulbs, and 60 W candles and golfballs).
2014: 50% of amenity lighting in leisure premises has an efficacy greater than 50 lumens/watt.
2014: 25% of display lighting has an efficacy greater than 75 lumens/watt.

14. Our analysis indicates, in principle, that the P1 target is achievable through normal market mechanisms, supported by policies to be implemented as announced in the Energy White Paper.

15. This is in line with the approach taken in the EU’s Eco-design of Energy-using Products Framework Directive (EuP), which encourages voluntary actions where appropriate.

16. The Government is committed to working with retailers, manufacturers and suppliers, to overcome barriers that might impede progress, and to promote delivery of these indicative standards more widely in the market. We will, therefore, work with the full range of policies outlined in the Energy White Paper. Where international or domestic measures rely on performance standards, we propose that we should seek to align them with the indicative standards outlined in this Policy Brief, subject to responses from the consultation. In particular we will:

- Press for EuP measures to adopt performance requirements for commercial lighting products in line with our indicative standards, while acknowledging the Single Market legal base for EuP and recognising that final performance requirements will need to be fully harmonised across the whole of the European Union.
- Encourage, for example through the International Task Force for Sustainable Products (ITFSP), harmonisation of international measurement standards for compact fluorescent lamps (CFLs) and light emitting diodes (LEDs).
- Review the Building Regulations[8] Part L2 requirements for lamps in light of our indicative standards.
- Use the indicative standards to identify the most appropriate minimum and/or forward looking standards for use in Government procurement.

17. In this Policy Brief, we set our P1 target and indicative standards based on our current understanding of what is necessary and deliverable. That analysis may change over time, for example, if new efficient technologies enter the market faster than expected; or if consumer trends change; or through international or EU action; or through policies on carbon emissions reduction more generally. We intend to maintain a continued active dialogue with businesses in the supply chain. The aim will be to review progress and to annually update this analysis, the P1 target and the indicative standards for commercial lighting products, among others, following consultation and review.

[8] The Building Regulations are devolved to the 3 Administrations: England and Wales, Northern Ireland and Scotland. See Section 3.4.3 for more detail.

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# 1 Status of Policy Brief

18. This Policy Brief is issued as part of an annual process, as announced in the Energy White Paper, to review and update the Government's published analysis, projections, P1 target and indicative standards for more sustainable products. This updated version takes into account the views received following the first consultation and, so far as possible, addresses substantial issues raised.

# 2 Market overview

19. As set out above, this Policy Brief addresses in-use energy consumption and carbon emissions associated with all internal and external, fixed to the building lighting for all commercial (ie non-domestic) premises including offices, retail, hotels, public service buildings, industrial and warehousing units. It excludes external lighting not fixed to the building, street lighting and traffic signals.

20. The commercial market is diverse, both in the type of lighting most commonly used for particular sectors, and in the size of enterprise using the lighting, and hence the procurement chain used. Large enterprises are more likely to use a lighting designer in the procurement chain and may, depending on the project budget, use state-of-the-art fittings. Small enterprises may use an electrical contractor to specify the lighting or treat the premises like a domestic building.

## 2.1 Trends

21. Market trends are indicated below by product type. These are general trends and there may be a range of different products used in each market sector.

### 2.1.1 Fluorescent lamps

22. Halophosphate (standard) T8 (26 mm) fluorescent tubes still form the largest single sales percentage of fluorescent lamps used for commercial purposes. Sales of the larger and less efficient T12 (38 mm) tubes have declined steadily since 1996. Sales of triphosphor T8, T5 (16 mm) and compact fluorescent L shape CFL-L tubes have grown. Compact fluorescent lamps, with integral ballasts (CFLi) and without ballasts (CFL), are replacing tungsten-filament, general lighting service (GLS) lamps in many cases.

23. Fluorescent lamps are mostly used in offices and public buildings, large retail premises and for general lighting in healthcare and schools. CFLi lamps are used in small offices and in hotels.

### 2.1.2 Tungsten filament lamps

24. GLS lamps are still quite widely used in some sectors, notably restaurants and pubs where a 'homely' feel is sought. Although it is always cost-effective to replace these lamps with CFLs and a large range of different sized lamps is now available, aesthetic reasons often override the economic argument. MTP estimates that the

stock of GLS lamps is slowly decreasing and, it is increasingly likely that new and refurbished premises will be unable to use GLS lamps as a result of the requirements of the 2006 revision of the Building Regulations.

### 2.1.3 Tungsten halogen lamps

25. These lamps are still used extensively in retail premises and as accent lights in other commercial premises. More energy efficient infrared versions are available but have not yet made a significant market penetration. Many of these lamps could be replaced by compact metal halide high intensity discharge lamps or light emitting diode lamps and the market for them is growing.

26. New ‘electronic’ halogen lamps are just reaching full commercialisation, while not as efficient as CFLs, they are up to two times as efficient as most tungsten-filament GLS lamps and overcome many of the drawbacks of CFLs in the restaurant and pub sector.

### 2.1.4 High-intensity discharge lamps

27. These lamps are used in industrial areas and warehousing as well as in retail sheds. The proportion of different lamp types has not changed much in recent years, with the exception of the growth of compact metal-halide lamp sales, as mentioned above.

### 2.1.5 Light emitting diodes

28. LEDs have taken over the small niche market of coloured decorative lighting on the outside of buildings and in bars, clubs, etc. They are also extensively used for emergency signage. LEDs are mostly used in areas of low ambient light, as the lumen output from each LED is still quite low. LEDs are expected to improve in efficiency rapidly over the next decade, resulting in higher light outputs and the potential to make inroads into new markets.

## 2.2 Price

### 2.2.1 Fluorescent lamps

29. Price may be having an impact on the rate of halophosphate to triphosphor fluorescent lamp transformation as buyers may not be aware of the savings potential of triphosphor lamps. The price of fluorescent tubes are insignificant at first purchase compared with the price of the luminaire, but manufacturers will often fit halophosphate lamps in their ‘economy’ luminaires and triphosphor lamps in their ‘quality’ products.

### 2.2.2 Halogen versus ceramic metal halide

30. The price of ceramic metal halide lamps (CMH) is significantly higher than that of tungsten halogen lamps. It is unlikely that buyers are very aware of the benefits of CMH lamps (ie lower in-use energy costs and less heat produced). CMH lamps are only likely to be fitted during full fit-out of a new retail premise, as they are not a direct ‘plug-in’ for halogen lamps.

### 2.2.3 Light emitting diodes

31. LEDs are expected to rapidly increase in efficacy and, as they do so, they will be able to impact on more lighting markets. Although they are very expensive at present, they do offer the advantages of long life and low maintenance costs. A projection from a report commissioned by the US Department of the Environment[9] suggests that LED prices will halve over each five-year span for the next ten years.

## 2.3 Innovation

32. Other light sources such as organic light emitting diodes (OLEDs), electroluminescent panels, and induction and plasma lighting may make an impact in commercial lighting in the longer term. These technologies require significant development before they are cost-effective for general lighting applications.

33. Innovation is an important factor in market development and is covered in Section 4.1.

# 3 Policies, risks and measures

34. In the Energy White Paper, the Government said it would:

- Take steps within the UK to improve the take up of energy efficient products and work internationally, and through the EU to stimulate global innovation and competition to raise standards and to bring a greater choice and efficient products to UK consumers.
- Deliver on our Gleneagles G8 commitments to promote international co-operation on product labelling and standards and help develop practical standards to reduce standby power.
- Work with the UK supply chain to encourage delivery of more efficient goods and services.
- Publish a series of consultation papers setting out our analysis of how the performance of energy using products will need to improve between now and 2020, including proposals for indicative product standards and initiatives to phase out the least efficient products.

35. As set out above, our analysis indicates, in principle, that the P1 target is achievable through normal market mechanisms, supported by policies to be implemented as announced in the Energy White Paper.

36. In this Section we consider the potential for policy to assist in delivering P1. We identify:

- Policies we believe are already helping to deliver higher environmental performance standards.

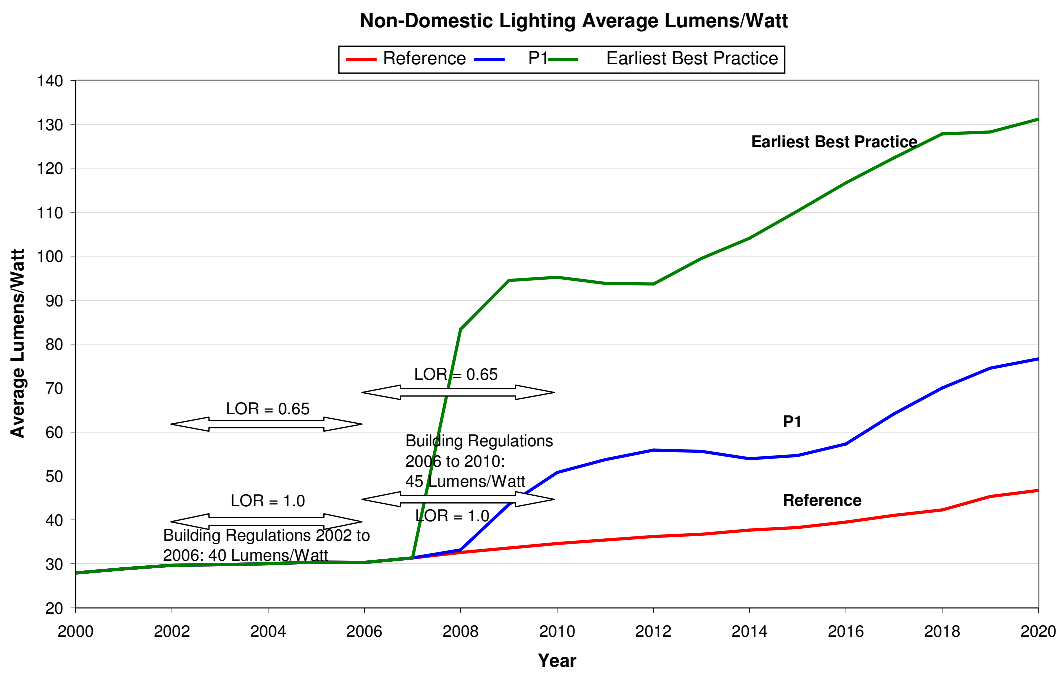
[9] Navigant Consulting Inc. 'Energy Savings Potential of Solid State Lighting in General Illumination Applications', U.S. Department of Energy, 2003.
http://www.netl.doe.gov/ssl/PDFs/SSL%20Energy%20Savi_ntial%20Final.pdf

- Supporting policies that could assist in delivering P1 in the event that the market fails to deliver it.
- The risks that these policies may not deliver efficiency improvements.
- Further actions that may be necessary to achieve the Government's targets.

37. Figure 3.1 illustrates how existing policy instruments and initiatives could support delivery of more efficient new commercial lighting products.

38. The graph plots the data in the Appendix (ie the indicative performance standards for the basket of new products), which correspond to the P1 projection. Also shown on the graph are equivalent performance values for the Reference and EBP projections. This illustrates the sales-weighted average performance of new products under the different projections. The sales-weighted average efficacy is plotted in units of lumen per watt. It should be noted that a higher figure represents a higher efficiency product.

**Figure 3.1 Performance standards for all new commercial lighting products**




39. The rapid increase in efficiency in the P1 curve between 2008 and 2009 comes from an assumption that the EU Framework Directive for the Eco design of Energy-using Products (EuP) can rapidly remove halophosphate fluorescent tubes from the market[10] and that these are replaced with triphosphor tubes.

40. The revision of Building Regulations Part P2 in 2002 recommended a minimum efficacy for general lighting (not including display lighting) of 40 luminaire-lumens per circuit watt. This figure would correspond to a lamp efficacy figure of about 53 lumen per watt for a lamp in a luminaire of light output ratio (LOR) 0.75. The range of lamp

[10] The rate of improve due to phasing out halophosphate lamps may be over-estimated in this model; this assumption will be re-visited when the implementing measures for office lighting under the EuP Directive (see Section 3.3.2) are finalised.

lumens required to satisfy this condition for light output ratios 0.65 to 1.0 is shown in Figure 3.1.

41. The 2006 revision, while setting no recommended minimum efficacy for new buildings, suggested an increased level of 45 luminaire-lumen per watt (~60 lamp-lumens per watt) for existing building refurbishments. Again, the range of lamp lumens required to satisfy this condition for light output ratios 0.65 to 1.0 is shown in Figure 3.1.

42. These recommended levels make it very difficult to use any amount of tungsten-filament or tungsten halogen lighting in general lighting schemes. However, the minimum efficacy for display lighting is only 15 lamp-lumens per watt at present, so this brings the whole sales-average efficacy of the sold products down.

## 3.1 Market analysis, projections and targets

Current status

43. This is our first Policy Brief resulting from the consultation process which addresses how the performance of commercial lighting products will need to improve between now and 2020, including proposals for product standards and initiatives to phase out the least efficient products. The intention is to update this analysis on a yearly basis.

44. Tables showing the target average performance levels each product group needs to achieve to realise the P1 target projection are provided in the Appendix. These tables also provide a metric against which developments in the market can be measured.

45. The intention is to monitor progress against the current projection for technology and market development, to consult on the evidence and, annually, to review and update the published analysis and policy response, including indicative product performance standards for new products supplied to the UK market.

**Policy:** Publish and update UK market and technology plans annually.
**Start date:** 2006.
**Reference:** Announcement in Energy White Paper 2007.
**Next deliverables:**
- 2008: Publish an updated P1 target and indicative product standards.
- 2008/09: Monitor market developments, refine models and consult on possible amendments to this paper.

Acknowledged risks

46. There is a risk that products will develop in a direction that differs from that which was initially expected in the projections (ie P1 target will not be met). To offset this risk, the Government may consider:

- Whether or not a more ambitious P1 target could be set as part of the review process.

- Pursuing measures designed to further accelerate the use of innovative technologies.

47. Weaknesses in knowledge about market and technology trends, the relationship between the performance of products measured under test conditions and what is achieved in real life could all lead to reduced effectiveness of the policy programme.

48. There is a risk that the single figure indicative target for commercial lamps is not a useful metric for the commercial lighting industry.

Strengthening initiatives

- 2008: Consider whether the indicative standards would be more effective if defined in terms of product families.
- Ongoing: Government will continue to monitor areas to identify where it may be beneficial to strengthen the evidence base on commercial lighting products.
- Ongoing: Government will continue to monitor the uptake of LED products and will decide whether there would be value in introducing measures to speed uptake.

## 3.2 Engaging the supply chain

### 3.2.1 Supply chain initiatives

Current status

49. In line with announcements in the Energy White Paper, the Government will ask major UK manufacturers and retailers to compete to supply commercial lighting products in line with the indicative standards set out in the Appendix.

50. Supply chains in commercial lighting are many and varied (eg directly from manufacturers (maybe via lighting designers), through wholesalers (Electrical Distributors Association members) or directly from retail outlets (mostly covered by domestic supply chain)). Non-domestic purchases made in retail outlets will have an impact on, and be impacted by, the recent supply chain initiative in the domestic sector.

51. Retailers representing a sizeable proportion of the UK domestic market, along with UK energy suppliers, are leading this initiative, which was announced in September 2007. The initiative aims to:

- Increase the sales-weighted average efficiency of lamps for the domestic market.
- Phase out the least efficient products.

52. However, the inefficient tungsten-filament products being phased out as a result of the agreement on domestic lighting are already much less frequently used in non-domestic lighting.

53. More significant for the non-domestic product standards would be to phase out the still extensive supply of halophosphate fluorescent tubes in the UK and to

improve the efficiency of display lighting by the more widespread supply of compact metal halide reflector lamps.

Acknowledged risks

54. Retailers, wholesalers, and/or manufacturers might not be prepared to compete to supply commercial lighting products in line with the indicative standards set out in the Appendix.

Strengthening initiatives

- 2008: Government will continue to consider where further actions could be employed to encourage manufacturers, wholesalers and retailers to work to meet a more ambitious P1 target and product standards. This could help to sustain successful supply chain initiatives.
- 2008: Government will continue to review opportunities to encourage procurement best practice, for example, through use of the Carbon Trust's guides and design advice.

### 3.2.2 Metrics: market development

Current status

55. For manufacturers, retailers, wholesalers and service providers to respond to the Government's request for initiatives on product standards, it is important that they can easily assess if individual products, or a basket of goods, will meet the Government's indicative performance standards.

56. Where a number of design parameters are involved (increasingly the case), this can become a complicated task. A pragmatic and flexible approach to setting performance standards that can adapt to new information and understanding is needed, especially given the move towards policy that requires attention to the whole-life impacts of goods and services, and where the science of lifecycle impacts is less well established.

Strengthening initiatives

- 2008: A 'Red-Green Calculator' has been developed for consumer electronic products using a simple points-based currency for ranking the impact of products over their life[11]. The tool returns a red or green verdict on each parameter, product or basket of goods, taking into account sales-weighted averages. This tool could be adapted for commercial lighting, and used by retailers, wholesalers, manufacturers and service providers to assess and, possibly, to report progress against their public commitments[12].

[11] General information on the Red-Green Calculator is available at www.mtprog.com/retailer.aspx
[12] The Government recognises that a single figure indicative performance metric and a full market red/green calculator would have limited usefulness in a market where most suppliers do not sell a 'balanced' portfolio across all lamp types. MTP is considering splitting the market into product families and these families could be addressed individually within the red/green calculator.

57. At present, the tool includes information for consumer electronics. A pilot version for lighting was issued to four major lamp manufacturers in February 2007. The final domestic lighting version was completed at the end of 2007.

**Policy**: Development of Red-Green calculator
**Start date**: 2006.
**Reference**: Energy White Paper 2007
**Next deliverables**:

- 2008: Domestic lighting tool agreed with manufacturers and retailers.
- 2008: Links to manufacturers' data.
- 2008: Develop versions of tool for commercial lighting sectors.

Acknowledged risks

58. The technical complexity of this area may deter the adoption of these standards by the supply chain.

Strengthening initiatives

- Ongoing: The Government will continue to work closely with retailers, wholesalers and manufacturers to develop suitable tools (eg the Red-Green Calculator) to enable them to adopt the indicative standards at low cost.

## 3.3 EU and international policy actions, programmes and initiatives

59. Commercial lighting products are internationally traded goods where unilateral UK policy actions may have only a limited impact on the design of products placed on the UK market. Therefore, the Government has committed to work at the international level to promote action to bring forward more sustainable products.

### 3.3.1 International collaboration

Current status

60. The UK is committed to promoting international co-operation on product labelling and standards and, generally, on policy towards more sustainable products.

61. Defra has been instrumental in establishing (ITFSP)[13] which seeks to ensure the harmonisation of policy options with those of other countries to maximise impact in a global market led by the supply chain. Defra operates the secretariat for the ITFSP.

62. Within the ITFSP, product working groups called Global Sustainable Product Networks (GSPNs) have been established and one of these addresses lighting.

63. The ITFSP work on lighting builds on the International Harmonisation of CFL Initiative (CFLI) begun in May 2005[14]. Its main aims are to:

[13] See www.itfsp.org for details.
[14] See www.apec-esis.org/www/cfl/ for details.

- Develop a single test procedure for all CFLs regardless of their potential point of sale[15].
- Test the robustness of the procedure by round robin testing worldwide.
- Develop an internationally accepted tiered system of performance standards[16].

64. This project was reinforced by working through the ITFSP to encourage co-operative action to set and raise global lighting efficiency standards. Co-operation is growing particularly in partnership with China.

65. Key outputs to date are:

- October 2006: Proposed amendment of IEC 60969 sent to International Electrotechnical Commission (IEC).
- 2006: Draft testing procedure produced and round robin testing conducted.
- October 2006: Draft tiered system of performance standards published.
- May 2007: Progress reviewed in China – tiered performance standards agreed.

**Policy**: Develop international harmonised measurement standard for CFLs.
**Start date**: May 2005.
**Reference**: See www.itfsp.org , www.apec-esis.org/www/cfl/
**Next deliverables:** ITFSP Secretariat and GSPN on lighting will:
- 2008: Review progress in China – tiered performance standards to be agreed.
- 2008: Facilitate consideration of whether the CFL Initiative could be extended to cover a wider range of lighting products and services.
- 2008: IEC to consider amendments to IEC 60969.

Acknowledged risks

66. The IEC might not accept the amendments to IEC 60969.

67. Some countries will still want to have CFLs tested to their own standards and not adopt the new procedure.

68. There is a risk that commitment to the ITFSP, the GSPN and International Harmonisation Initiative for CFLs will not be sustained by all international partners or that insufficient implementation support will be provided.

Strengthening initiatives

- 2008: Harmonisation initiative partners will lobby strongly in favour of amendments to IEC 60969.
- Ongoing: The ITFSP will urge countries to avoid independent testing standards so that CFL prices are reduced globally.

[15] In order to reduce the cost of testing to many different standards and hence the unit price of the product to the manufacturer.
[16] A tiered system is required so that developing countries can step up towards the best practice levels in achievable stages while keeping prices low; more developed countries (eg EU Member States) can adopt higher performance standards at the outset.

- Ongoing: Government will continue to review the effectiveness of these initiatives.
- It may be possible that the GSPN could be run on a more informal basis to continue influencing major international partners.

### 3.3.2 Mandatory standards

Current status

69. The Framework Directive on the Eco-design of Energy-using Products (2005/32/EC) (EuP)[17], adopted in 2005, allows the European Commission to set performance requirements for products placed on the EU market.

70. Work tasks are underway for office, domestic and street lighting (the latter two are covered in the separate Policy Briefs on domestic lighting and street lighting). The UK is contributing evidence into the preparatory studies and the Government will be pushing for ambitious, but realistic and achievable, standards to be adopted. In particular, the Government supports the removal of halophosphate fluorescent tubes from the market. Future preparatory studies are expected to include industrial lighting, in which the Government would support the removal of high-pressure mercury lamps from the market. The EuP Directive will cover, where appropriate, any energy efficiency requirements for ballasts for fluorescent lighting and hence would form implementing measures for phase three of the EC Directive 2000/55/EC[18]. The UK is developing a consensus opinion on which policy options to support.

**Policy**: EU Framework Directive for Eco-Design of Energy-Using Products (EuP)
**Start date**: 2005 (Framework Directive adopted)
**Reference:** http://ec.europa.eu/energy/demand/legislation/eco_design_en.htm
**Next deliverables**:
- 2008: EC decides on policy options and brings in implementing measures.
- 2009: First inefficient products removed from market.

Acknowledged risks

71. Timing for delivery of standards via EuP is uncertain. Delivery of the UK's preferred standards via EuP is also uncertain since the EuP has a Single Market legal base so any final performance requirements will need to be fully harmonised across the whole of the European Union.

72. There is also a significant risk that current regulatory processes will not be able to respond sufficiently nimbly to a rapidly changing market, leading to ineffective regulation and market drivers.

[17] See MTP Briefing Note BNXS03.www.mtprog.com/ApprovedBriefingNotes/pdf.aspx?intBriefingNoteID=389
[18] EC Directive 2000/55/EC 'Energy Efficiency requirements for ballasts for fluorescent lighting'.

Strengthening initiatives

- 2008: The UK Government will consider the value of including a mechanism for regular review and updating of product criteria in the product implementing measure.
- Ongoing: The Government continues to monitor the effectiveness of the regulatory processes in question and consider whether to press the European Commission for regulatory action under this Directive to:
  - Remove high-pressure mercury lamps from the market.
  - Remove halophosphate fluorescent lamps from the market.
  - Remove low efficacy GLS lamps from the market.
  - Introduce minimum standards for luminaire efficiency.

  However, the current timetable indicates that an implementing measure will not come into force before 2009 with the phase-out schedule beginning in subsequent years. The Government will work with the supply chain in an effort to phase in new standards in advance of this measure (see Section 3.2.1 above).

### 3.3.3 Metrics: test and measurement

73. Initiatives on tests and measurements are covered in other Sections:

- International harmonisation of test standards for CFLs – see Section 3.3.1.
- Standards for LEDS – see Section 4.

## 3.4 UK policy actions, programmes and initiatives

### 3.4.1 Public procurement

Current status

74. The Government published its Sustainable Procurement Action Plan (SPAP) in March 2007, re-affirming its commitment to use Government procurement to drive the market for energy efficient products. Alongside the Action Plan, it published updated and extended standards for an increased range of products that are mandatory for Central Government departments. Defra consulted on energy efficient products, which has informed the minimum mandatory standards for this product group in the revised **Buy Sustainable Quick Wins** (published in July 2008). We are reviewing the approach to setting mandatory standards with the newly formed Centre of Expertise for Sustainable Procurement.

75. Guidance on energy efficiency and energy savings as possible assessment criteria in public sector tendering was published in July 2008 as part of the Energy Services Directive. The Directive also sets out a number of options relating to public sector procurement of energy using products, buildings and energy services, which the Government consulted on during the winter of 2007. The outcome of this consultation will be announced shortly.

76. The NHS (England) published its Sustainable Procurement Action Plan in August 2007. Similar action plans for local authorities are being produced.

77. The Government has made a commitment to procure products that meet a certain standard of sustainability, for example, through the use of the current mandated minimum specification, originally announced in 2003[19]. For lighting, these standards are best practice standards for lamp, ballast and luminaire efficiencies.

78. The Government is also committed to identifying stretching-forward looking standards to provide longer-term signals to business and to encourage innovation. The Government is working on the use of the 'Forward Commitment Procurement' Model[20] to encourage the early uptake of LEDs of high efficiency in office, hospital and street lighting applications.

**Policy:** UK Government Sustainable Procurement Action Plan.
**Start date:** 2007.
**Reference:**www.sustainable-development.gov.uk/publications/pdf/SustainableProcurementActionPlan.pdf
**Next deliverables:**
- 2008: Market consultation on ultra-efficient lighting in the context of a forward commitment procurement.
- 2008: Revised Government procurement standards announced.
- 2009 onwards: Forward commitment procurement ultra-efficient lighting tenders.

Acknowledged risks

79. Specifying fixed threshold values in procurement specifications may result in 'lock in' to incumbent technologies by excluding alternative products and lead to innovation being stifled. Outcome-based specifications (based on say a lighting level, rather than a specific technology), along with challenging and progressive threshold values can help to minimise this.

Strengthening initiatives

- 2008: The Government will consider including standards and overall targets specifically for the procurement of commercial lighting, where applicable, within its formal procurement guidelines that are at, or above, the performance targets in the Appendix.
- Strengthened leadership and scrutiny of performance on sustainable procurement throughout Government as set out in the SPAP.
- Transforming Government procurement agenda will build procurement capabilities and capacities within Departments and improve delivery of agreed policies.

[19] www.mtprog.com/Procurement.aspx
[20] See www.berr.gov.uk/files/file35312.pdf

### 3.4.2 Product information

Current status

80. There are currently no statutory requirements to supply specific product information for products intended for the non-domestic market. Major manufacturers have some standardisation in the way they present product information. For lamps, most catalogues have values for initial lamp output flux (in lumens at 100 hours) and lamp wattage. The exceptions are reflector lamps for which the beam angle and peak intensity (in candelas) are quoted along with the wattage. Colour temperature, rated lifetime (time to 50% failures) and colour rendering information are usually also quoted. Some literature designed for the non-domestic market will quote the domestic lamp label for a product, although the Energy Labelling of Household Lamps Directive[21] does not apply to the non-domestic market. The vast majority of lamps sold in the non-domestic market (other than reflector lamps) are classes A or B. There are some proposals in the draft implementing measures under the EuP Directive work on office lighting regarding additional labelling requirements for office lighting products but these proposals are not favoured by manufacturers.

81. There is much less standardisation in the way that product information for luminaires is given. An attempt by CEN[22] working group TC169 WG2 on 'Lighting Applications' to produce a standard proved unsuccessful. CELMA[23] is reconsidering how luminaires might be effectively categorised and has produced a draft table of minimum values for various luminaire types. This table has been submitted to the EuP Directive working group for consideration. The proposed table contains proposed minimum light-output ratios for every luminaire type currently used.

Acknowledged risks

82. There is a risk that if the luminaire classification scheme does not include an element associated with the quality of the light emitted but is simply based on total light-output ratio then bare batten lamps would appear to be among the most efficient lighting. Although technically they do emit the most light; they do not make the best use of the light and they have unwanted 'side-effects' like disabling glare. Any standard should to take account of these drawbacks.

Strengthening initiatives

- The Government will support luminaire minimum standards that remove the lowest 25% of luminaires in each class from the market.

[21] Directive 98/11/EC on domestic lamp labelling came into force on 1 January 2001.
[22] CEN is the European Committee for Standardization. See www.cen.eu/cenorm/homepage.htm
[23] CELMA is the Federation of National Manufacturers Associations for Luminaires and Electrotechnical Components for luminaires in the European Union.

### 3.4.3 Mandatory standards

Current status

83. The guidance supporting Part L of the Building Regulations[24] (Approved Document Part L2A in England and Wales, equivalent guidance elsewhere in UK) gives minimum standards for the carbon emissions from new buildings other than dwellings. From January 2006, the Regulations require new buildings to have 23.5% to 28% lower carbon emissions than a building built to 2002 standards. The targets can be met using a range of measures including more efficient lighting. For refurbishment of general lighting systems a minimum standard of 45 luminaire-lumens per circuit watt is recommended. Part L is reviewed at least every five years: the next review is scheduled for 2010.

**Policy:** Application of the Building Regulations.
**Reference:** Approved Document L2A: Conservation of Fuel and Power (New buildings other than dwellings) (2006 edition).
**Start date:** April 2006 for Building Regulations.
**Next deliverables**:
- 2010: Revision of Building Regulations Part L.

84. The Northern Ireland Building Regulations requirements (Part F) are the same as for England and Wales Part L. These requirements came into operation on 30 November 2006[25].

85. In Scotland, there is guidance on energy efficient lighting to mandatory standard 6.5 of the Building (Scotland) Amendment Regulations 2007, which entered into force on 1 May 2007. The energy standards are to be revised at least every five years.

Acknowledged risks

86. The energy related parts of the Building Regulations (Part L) are not updated frequently enough to keep abreast of new technology developments; the next revision is not scheduled until 2010.

87. Building Regulations do not currently contain any requirements for optimised use of daylight so new buildings may be using more lighting than necessary.

Strengthening initiatives

- The Government will continue to look at ways to ensure that:
  - Lighting and daylight provision are targeted effectively.
  - Performance levels are in line with the P1 targets.

[24] www.planningportal.gov.uk/england/professionals/en/
[25] See. www.buildingregulationsni.gov.uk.

### 3.4.4 Enhanced Capital Allowance

88. The Enhanced Capital Allowance (ECA) scheme is a key part of the Government's programme to manage climate change. The ECA scheme encourages businesses to invest in energy saving lighting. It provides businesses with 100% first year tax relief on their qualifying capital expenditure. To qualify, the equipment must be specified on the Energy Technology Criteria List (ETCL), which is managed by the Carbon Trust on behalf of Government. The scheme allows businesses to write off the whole cost of the equipment against taxable profits in the year of purchase.

89. As announced in the Budget speech of March 2008, lighting installations no longer have to be considered as 'plant and machinery' to qualify for ECAs. The removal of this restriction allows many more potential market segments (most noticeably offices) to claim ECAs on the installation of best practice lighting fittings.

90. Also in the Budget speech, the Government announced the inclusion of LEDs (for accent and display applications) in the next revision of the ETCL. Technical reviews of lighting controls and High Efficiency Lighting Units (HELU) have been conducted and the eligibility criteria updated.

**Policy:** Enhanced Capital Allowance scheme
**Start date:** 2001
**Reference**: www.eca.gov.uk/etl
**Next deliverables:**
- 2008: Update ETCL with new criteria for LEDs and other HELUs
- Ongoing: Review suitability of new products for the ETCL.

Acknowledged risks

The HELU criteria specify particular products so that new products are difficult to add to the list in a timely manner.

Strengthening initiatives

- The Carbon Trust and Government will continue to monitor the LED market.
- The Carbon Trust is examining lighting technologies (other than LEDs) that could be proposed for ECA scheme support in the near future and is considering more timely methods for updating the criteria list.

## 3.5 Other policies with potential to impact on commercial lighting

### 3.5.1 Smart metering

91. The Energy White Paper set out a number of policies on energy billing and metering, designed to reduce energy consumption. The Department for Business, Enterprise and Regulatory Reform (BERR, formerly the DTI) recently consulted on the implementation of these polices (the consultation period closed on 31 October 2007). In summary, these are:

- To promote awareness of domestic energy use through a requirement on energy suppliers to present consumption data (preferably in graphical form) on consumers' bills to allow them to compare different periods of energy consumption.
- To provide real-time display units to certain customers so that they can see in real time, and in a way that is relevant to them, how much electricity they are consuming.
- To require the installation of smart meters for business customers above a certain energy usage threshold, where it has been proven to be cost-effective.

92. The Energy White Paper also set out the Government's expectation that smart metering would be introduced in the remainder of the business sector and the domestic sector over the next decade.

93. Smart metering could be used to obtain separate bills for lighting energy use.

### 3.5.2 Promoting energy/carbon savings in industry and commerce

94. Since 2001 for Climate Change Agreements, and 2005 for the EU Emissions Trading System, industry has been required to improve its energy performance and reduce emissions. This encourages, for example, savings due to the more efficient use of lighting and commercial refrigeration. There are various products covered by the Market Transformation Programme (MTP) that will contribute to the savings required.

95. The Carbon Reduction Commitment (CRC), a mandatory emissions trading scheme aimed at the large non-energy intensive sector, is expected to start in 2010. The CRC will incentivise energy saving measures across 5,000 of the larger commercial and public sector organisations – including retail premises, hotels and offices. As the CRC will cover indirect energy usage by these organisations, it should be expected to add to demand for energy efficient lighting products in the commercial sector.

### 3.5.3 Likely phase out of EU 'anti-dumping' charges on CFLs

96. The EU currently levies duties on Chinese light bulbs. These 'anti-dumping'[26] charges are designed to protect European manufacturers from cheap imports. They have been in place since 2002 and range up to 66 % of the price of the bulb. In July 2007, Trade Commissioner Peter Mandelson recommended an end to the system on environmental grounds and Member State trade experts showed strong support. Withdrawal of the levy would have likely reduced the costs of CFLs in the UK, making them more affordable and attractive to consumers. The duties were set to expire, but on 2 October the EU Council voted to extend them for another year[27].

[26] See EU anti-dumping pages at http://ec.europa.eu/trade/issues/respectrules/anti_dumping/index_en.htm
[27] See Council Regulation 13040/07 of 2 October 2007 at http://register.consilium.europa.eu/pdf/en/07/st13/st13040.en07.pdf.

### 3.5.4 EC Energy Services Directive

97. It is feasible that use could be made of the EC Energy Services Directive[28] to set minimum standards for lighting energy use or building energy use (using the Energy Certificates bands to describe minimum standards). Implementation of this policy could stress the importance of designing lighting schemes to provide the right light in the right place when it is needed.

# 4 Other potential measures

98. This Section looks towards other measures that may need to be developed to enable the desired average energy performance to be achieved.

99. The most promising innovation in non-domestic lighting is the development of light emitting diodes (LEDs). MTP has developed a Roadmap[29] describing a possible course of development of these products. The Engineering and Physical Sciences Research Council (EPSRC) has given significant funding to fundamental research and the Carbon Trust is starting to support applied research in this area. There is a risk of supply of LEDs not being able to meet demand. Therefore research into fundamental issues such as creating LEDs on silicon substrates (rather than sapphire) and reducing the colour variability of white LEDs to reduce waste are important to provide more useful and inexpensive LEDs.

100. In spring 2006, the Department of Trade and Industry (now Department for Business, Enterprise and Regulatory Reform (BERR)) called for research on LEDs. Two knowledge transfer networks (KTNs) have been set up. The Photonics Cluster Business Network was developed (www.photonicscluster-uk.org) to provide support and guidance for LED manufacturers, especially small and medium sized businesses and the UK Displays and Lighting Network plays a similar role primarily for OLED and Electroluminescent technologies being developed for display lighting. The Technology Strategy Board has invited tenders for projects under its March 2008 research call.

101. One of the major risks in a new and fast-developing technology is that poor understanding of the technical requirements for high-efficiency operation of LEDs may lead to some poor quality products reaching the market that may then be in the lighting stock for a considerable period (LEDs can have lifetimes of between 30,000 to 50,000 hours if operated at the correct temperature). Effective dissemination of best practice via the Knowledge Transfer Networks will assist in mitigating this risk.

102. The KTNs have an important role to play in training, increasing awareness and providing joined-up thinking within the industry. There is also a need to develop international standards for LEDs to ensure that high quality products enter the market.

[28] Directive 2006/32/EC on energy end-use efficiency and energy services; http://europa.eu.int/eur-lex/lex/LexUriServ/site/en/oj/2006/l_114/l_11420060427en00640085.pdf
[29] Revised 2008 version now available as BNCL12 at http://www.mtprog.com/SelectProductStrategy.aspx?intSelection=2&intSector=8

103. There is no evidence being collected in the UK at present on the potential size of the market for LED products. The Lighting Industry Federation has offered to collect data on a limited range of products, but its membership does not represent as significant a proportion of the LED market as it does for lamps (where it represents 80% of sales). Collection of good market data would improve the accuracy of future projections and the possibility of securing further ECA scheme support (see Section 3.4.4) for LED products.

104. Several other new technologies have the potential to make an impact in commercial lighting. Policies designed to further accelerate the use of innovative technologies such as OLEDs, induction lighting, electroluminescent lighting, plasma lighting are required. The Carbon Trust does provide funding for technology transfer and applied research projects that could be accessed by developers of these products.

# 5 Potential impacts

105. This Section provides a partial analysis of the more significant potential impacts of the proposals contained herein.

## 5.1 Consumer cost/benefit analysis

106. There is a strong economic benefit in switching from tungsten-filament lamps to CFLs over the lifetime of the CFL, particularly for high-use light fittings. The Energy Saving Trust has calculated a potential lifetime saving (10,000 hours) of up to £60[30] for a high-output, high-use lamp with a payback time for most lamps of less than 1 year. There is no significant economic benefit (in simple pay-back terms) in switching from tungsten-filament lamps to inefficient tungsten halogen lamps.

107. There is little economic benefit in changing linear fluorescent lamps from halophosphate to triphosphor unless a major refurbishment project with scheme redesign is undertaken.

108. The installation of new tri-phosphor lamps, high-frequency ballasts and luminaires of good optical design could lead to a reduced number of luminaires being required, which would have significant capital cost savings (~£90 per luminaire) as well as operating costs (at least £5 per luminaire per year). The lamps also have a 66% longer life thereby reducing maintenance costs.

109. The use of compact metal halide lamps in a retail environment could save more than £17 per year in running costs over tungsten halogen lamps, which would pay back the extra capital cost in about three years. The lamps would also last three times longer than halogen lamps reducing maintenance costs.

[30] This is the result of a recalculation by EST July 2007.

## 5.2 Business impacts

110. Four main manufacturers represent 80% of the UK market for non-domestic lighting products. Some CFLs and linear fluorescent lamps are produced in the UK and Eastern Europe, with the majority produced in Asia.

111. One major issue for UK business as a result of policies outlined in this Policy Brief is the adequate supply of good quality CFLs to replace tungsten-filament lamps. A significant gearing up to worldwide CFL production will be required to service the additional demand. It is not expected that any significant increase (or decrease) in UK manufacturing will occur as a result of the policies.

112. Another issue would arise if the EuP Directive tried to remove from the market all CELMA B2 class ballasts. There are some luminaires for which, either on size or operating temperature grounds, no other ballast is suitable.

## 5.3 Waste impacts

113. Discarded tungsten-filament lamps make up the largest proportion of lamps entering the waste stream by weight (65%). About 90% of the aggregated waste from all lamps is glass, with metals being the second most common waste material. The composition of the metal waste component is not known to MTP at the moment. It should be noted that these fractions differ for different lamp types. For example, for a CFL with integrated ballast the glass fraction is typically 54%, plastics 21%, electronics 21% and metals 3%[31].

114. Fluorescent technologies rely on a small mercury dose for their operation. The Restriction of Hazardous Substances Directive (2002/95/EC) limits this to a maximum of 5 mg per lamp for CFLs and tri-phosphor lamps and 7.5 mg for halophosphate lamps. There is evidence to suggest significant amounts of mercury are released into the environment during the electricity generation stage to produce the extra power required by GLS and halogen lamps compared with that required by fluorescent and discharge lamps.

115. There is increasing evidence[32] to suggest that over the lifetime of both lamp types, CFLs produce less mercury than GLS bulbs. This is due to the fact that mercury is emitted from power stations during electricity generation and CFLs are more energy efficient.

116. The major manufacturers have set up a recycling scheme in which used discharge lamps are taken back by the manufacturer that supplies the new lamps. Fluorescent tubes are now routinely processed to recover their mercury for re-use. This is more controllable and environmentally benign than allowing mercury to be released directly into the atmosphere at a power station. Research is enabling the mercury content of lamps to be reduced further, and mercury-free lamps may become practicable in the future (zinc may be a substitute for mercury in discharge

[31] Source: European Lamp Companies Federation.
[32] D Parsons 'The Environmental Impact of compact fluorescent lamps and incandescent lamps for Australian conditions'. The Environmental Engineer, Vol. 7 (2), 2006.

lamp types and LEDs are mercury free and have the advantage of very long lifetimes).

117. Fluorescent lamps entering waste stream are controlled under the Waste Electrical and Electronic Equipment Regulations (WEEE) 2006, which require waste lamps to be collected and recycled, and for this to be financed by the producers of the equipment (see also paragraph above). The WEEE regulations sets targets for lighting equipment including fluorescent lamps whereby '*recovery shall be increased to a minimum of 70 % by an average weight per appliance*' and *'reuse and recycling shall be increased to a minimum of 50 % by an average weight per appliance'*. Glass accounts for typically more than 95% of a linear fluorescent lamp.[24] Such glass is phosphor coated meaning that recycling is a more complicated operation than that for container glass as used for bottles, etc. Further, CFLs with integrated ballasts have particular recycling issues in that a significant proportion of the waste is either electronics or engineering grade plastics making recycling a more complicated activity.

## 5.4 Health impacts

118. The Department of Health is aware that there are some people for whom the phasing out of inefficient tungsten-filament light bulbs in favour of compact fluorescent or halogen lamps may potentially cause a problem by aggravating certain light sensitive and neurological conditions. They are working closely with other government departments and stakeholders to assess the scale and extent of this and to resolve any potential problems.

119. Faulty CFLs and mains frequency linear fluorescent lamps can cause a flicker that, in extreme cases, could trigger an epileptic seizure – the use of electronic CFLs or linear fluorescent control gear[33] can eliminate this small risk to susceptible people.

# 6 Further information

120. The following MTP publications (available from www.mtprog.com/) are linked to this Policy Brief and present the underlying evidence base of information such as further explanations, definitions, assumptions and important background information:

BNCL05 – Test standards for commercial lighting
BNCL06 – Performance Standards in commercial lighting – an overview
BNCL09 – Retail display lighting – an overview
BNCL11 – A new stock and sales model for commercial lighting products
BNCL12 – Light-emitting diodes; Innovation briefing note
BNXS01 – Carbon Emission Factors for UK Energy Use
BNXS03 – Framework Directive for the Eco-design of Energy Using Products (EuP Directive)

[33] These are CFLs with electronic, rather than magnetic ballasts. They are normally marked on their packaging as 'electronic CFL'.

# Appendix
# Target average performance standards for commercial lighting products

121. Table A1 below show the target average performance specifications (in lumens/watt) for new products supplied to UK end users. They are categorised by function so that functions that currently have more efficient lamps available to them also have a higher average performance standard. These specifications correspond with the Government's underlying published stock models and projected energy consumption in each sector (the P1 target presented in this Policy Brief).

122. These specifications may be used directly in suitable policy instruments (eg the supply chain initiative) and provide a metric against which developments in the market can be measured.

123. The underlying stock modelling is subject to an ongoing consultation and review process. More detail on the modelling, current market analysis and data downloads are available via the MTP's What-If tool (http://whatif.mtprog.com).

**Table A1 Commercial lighting**

| Year | Average lumens/watt |
|---|---|
| 2000 | 27.9 |
| 2001 | 28.9 |
| 2002 | 29.7 |
| 2003 | 29.8 |
| 2004 | 30.1 |
| 2005 | 30.4 |
| 2006 | 30.3 |
| 2007 | 31.4 |
| 2008 | 33.1 |
| 2009 | 43.5 |
| 2010 | 50.8 |
| 2011 | 53.7 |
| 2012 | 55.9 |
| 2013 | 55.6 |
| 2014 | 53.9 |
| 2015 | 54.7 |
| 2016 | 57.3 |
| 2017 | 64.1 |
| 2018 | 70.1 |
| 2019 | 74.6 |
| 2020 | 76.7 |

124. The sales weighted average performance of the P1 scenario grows quickly from 2009-2013 on the assumption that the EuP directive will remove halophosphate lamps from the market and that the voluntary initiative will remove inefficient triphosphor lamps and CFLs respectively. The slight dip in the performance

standards between 2014 and 2015 is because after the majority of these long-lived lamps have been replaced, the average sales efficiency is influenced by relatively higher sales of short-lived, low efficiency products such as tungsten halogen lamps. This decrease is reversed as more of these products are transformed to metal halide or LED products as a result of suggested upgrading of Building Regulations display lighting requirements.