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|---|---|
| **Title:** Raising minimum energy performance standards for lighting products Impact Assessment<br>**IA No:**<br>**RPC Reference No:**<br>**Lead department or agency:** BEIS<br>**Other departments or agencies:** | Impact Assessment (IA)<br>**Date: 12/09/2022**<br>**Stage: Consultation**<br>**Source of intervention: Domestic**<br>**Type of measure: Secondary legislation**<br>**Contact for enquiries:** |
| **Summary: Intervention and Options** | **RPC Opinion:** RPC Opinion Status |

| **Cost of Preferred (or more likely) Option** (in 2022 prices) | | | |
|---|---|---|---|
| **Total Net Present Social Value** | **Business Net Present Value** | **Net cost to business per year** | **Business Impact Target Status** Qualifying provision |
| £1454m | £687m | £36m | |

**What is the problem under consideration? Why is government action or intervention necessary?**

Light sources and luminaires ("lighting products") are currently regulated under ecodesign and energy labelling legislation in GB. The current minimum energy performance standards (MEPS) for lighting products are below what is reasonably achievable, resulting in untapped potential carbon, energy and energy-bill savings. We propose new Regulations to update the current MEPS to a more ambitious standard because market forces alone will not achieve this transition as quickly as is required due to several market failures. (1) The negative carbon externalities of a less efficient lighting products are not reflected in their price nor the price of power; (2) economies of scale for high efficiency lighting products are not currently realised due to higher prices acting as a barrier to market expansion; (3) behavioural changes leading to consumers choosing less efficient products due to inertia; and (4) misaligned incentives exist whereby landlords install low efficiency lighting products to save cost, causing tenants higher bills.

**What are the policy objectives of the action or intervention and the intended effects?**

The update to existing ecodesign requirements for lighting products is intended to set an optimal, new minimum standard for energy efficiency (also referred to as "efficacy") which reflects what is broadly achievable for products on the market. Market analysis and stakeholder consultation has taken place to ensure the intervention has a proportionate impact on consumers and businesses. The intended effects are to increase innovation, investment, and uptake of more energy efficient products by phasing out the least efficient products on the market; to reduce traded carbon emissions and energy bills for consumers and businesses; to minimise the adverse environmental impacts of lighting products; and to ensure effective regulation for consumers and businesses.

**What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)**

The preferred option (Option 2) has been assessed against a Do Nothing option (Option 1).

- Option 1 - Do Nothing. Under this option, the current ecodesign Regulations for lighting products would remain unchanged.
- Option 2 (preferred option) – Raise minimum energy performance standard for lighting products in GB to 120 lm/W in 2023 and 140 lm/W in 2027, with appropriate concessions. This standard reflects what is already technologically possible for most lighting products and will result in significant energy, emissions and bill savings.
- Option 3 – Self-regulation by the lighting industry.
- Option 4 – Increase the MEPS for lighting products in line with energy label classes E, F and G in 2023 and 2025.

**Will the policy be reviewed?** It will be reviewed. **If applicable, set review date: December 2029**

| | | | | |
|---|---|---|---|---|
| Is this measure likely to impact on international trade and investment? | | Yes | | |
| Are any of these organisations in scope? | **Micro** Yes | **Small** Yes | **Medium** Yes | **Large** Yes |
| What is the $CO_2$ equivalent change in greenhouse gas emissions? (Million tonnes $CO_2$ equivalent) | | **Traded: -1.72** | **Non-traded: 0.02** | |

***I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.***

Signed by the responsible SELECT SIGNATORY: ..... Date: .....

**Summary: Analysis & Evidence** Policy Option 2 (preferred option)

**Description: Implementation of MEPS for lighting products**

**FULL ECONOMIC ASSESSMENT**

| Price Base Year 2022 | PV Base Year 2022 | Time Period Years 28 | Net Benefit (Present Value (PV)) (£m) | | |
|---|---|---|---|---|---|
| | | | **Low : -** | **High: -** | **Best Estimate: 1454** |

| COSTS (£m) | Total Transition (Constant Price) | Years | Average Annual (excl. Transition) (Constant | Total Cost (Present Value) |
|---|---|---|---|---|
| **Low** | - | 28 | - | **-** |
| **High** | - | | - | **-** |
| **Best Estimate** | 0.7 | | 14 | **304** |

**1. Description and scale of key monetised costs by 'main affected groups'**

The Lighting market primarily consists of large overseas manufacturers, with smaller niche products produced in the domestic market. Manufacturing costs, along with the estimated additional costs for manufacturers to meet the increased energy performance requirements, make up 100% of all monetised costs which are based on GB sales figures for lighting products. These additional costs are assumed to be passed onto consumers through the supply chain but are offset by lower energy bills.

**Other key non-monetised costs by 'main affected groups'**

All non-monetised costs are judged to be negligible compared with the manufacturing costs outlined above. Considered in this assessment are the following: transitional/familiarisation costs for manufacturers of understanding the requirements; distributional impacts for consumers (although lower energy costs will offset the increased price of products); resource efficiency (considered disproportionate for lighting products - energy savings were modest); and enforcement and compliance costs (enforcement action would be undertaken by the Office for Product Safety and Standards (OPSS) which is already responsible for the implementation and enforcement of ecodesign and energy labelling regulations in the UK).

| BENEFITS (£m) | Total Transition (Constant Price) | Years | Average Annual (excl. Transition) (Constant | Total Benefit (Present Value) |
|---|---|---|---|---|
| **Low** | - | 28 | - | **-** |
| **High** | - | | - | **-** |
| **Best Estimate** | - | | 88 | **1,758** |

**Description and scale of key monetised benefits by 'main affected groups'**

Net energy savings are expected to account for the vast majority (~90%) of all monetised benefits leading to reduced energy bills for consumers (commercial and domestic). These energy savings lead to reduced emissions from the UK power sector, meaning a reduction in traded $CO_2e$ emissions. Improved air quality levels account for the remaining monetised benefits.

**Other key non-monetised benefits by 'main affected groups'**

The main non-monetised benefit is the improved lifetime and reduced variation in technology types from the move to LED lighting will have resource efficiency benefits through the reduction of waste as products are replaced less frequently and alternative, difficult to recycle technologies such as fluorescent tubes will be phased out of the market.

| Key assumptions/sensitivities/risks **rate (%)** | **Discount** | 3.5% |
|---|---|---|

Most quantified costs and benefits have been estimated using the Energy Using Products Policy model (described in Annexes 2 & 3). The modelling of this policy builds on the methodology and analysis from the previous Lighting regulations while updating key evidence sources for the assumptions used. Sensitivities in the key input variables include product costs, sales/stock, use (hours/year), energy use and lifespan. The model assumes all costs appear at the point of purchase and are independent of sales. Non-monetised costs and benefits as well as modelling assumptions are considered to, collectively, have a positive effect on Net Present Value (NPV).

**BUSINESS ASSESSMENT (Option 4)**

| Direct impact on business (Equivalent Annual) £m: | | | Score for Business Impact Target (qualifying provisions only) £m: |
|---|---|---|---|
| **Costs:** 16 | **Benefits: 61** | **Net: -11** | -46 |

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# 1 Problem under consideration and the rationale for intervention

1. The ecodesign legislative framework[1] enables the Government to set minimum energy performance standards (MEPS) and other environmental requirements for energy-related products (e.g. light bulbs, TVs or refrigerated display cabinets). This prevents products which have the worst environmental performance from entering the market and encourages product suppliers to improve the energy and resource efficiency of their products. Current estimates from the Department for Business, Energy & Industrial Strategy (BEIS)[2] show that the combined impact of existing energy-related products policies is expected to take £160-210 off the average household dual fuel energy bill in 2022 and an average of £170-180 over Carbon Budget 5, with uncertainty based on future energy prices. Products policy is also expected to save 17% on commercial bills and 2% on industrial bills in 2022, with an average of 22% on commercial bills and 3% on industrial bills over Carbon Budget 5.

2. UK lighting product annual sales are worth around £1.25bn[3,4], with lighting products responsible for 18% of all the electricity consumed in the UK.[5] The Lighting Industry Association (LIA) estimates that the lighting sector in the UK encompasses 1,700 companies across the supply chain and is worth £2.3bn to the economy.[6] Lighting industry manufacturing accounts for approximately half of this, £1.2bn. It is likely that the remaining £1.1bn covers services such as design, installation, maintenance and repair.

3. In terms of total import and export quantity (tons), the UK is reliant on importing lighting products from the EU accounting for 43% of all lighting imports compared to 44% from the rest of the world. Domestic market therefore accounting for 13%. For exports, 10% of all lighting products are exported to the EU from the UK in comparison to 3% to the rest of the world. The majority of the remaining non-EU UK imports and exports of lighting products (for both quantity and value) are largely comprised of UK-Asia and UK-US trade.[7]

4. Ecodesign is also a low risk intervention for GB businesses. As most lighting products are produced abroad, transition costs are largely borne by businesses outside of the UK. Given the value of UK imports of lighting products, we judge there would be a low risk that non-GB businesses would stop exporting lighting products to GB following the introduction of the

[1] The Ecodesign for Energy-related Products Regulations 2010, as amended.

[2] BEIS estimates – savings in relation to having no products policy measures

[3] UK Manufacturers' Sales by Product Survey (Prodcom) - Intermediate estimates (2016). Published on: 14/12/2017. Lighting product sales derived from the following divisions:
Division 26 - Manufacture of Computer, Electronic and Optical Products
Division 27 - Manufacture of Electrical Equipment

[4] ONS 2018

[5] https://www.statista.com/statistics/617777/electricity-consumption-of-lighting-sectors-uk/

[6] Lighting Industry Association (LIA), 2014. UK Lighting Sector Strategy. Available at:
https://www.thelia.org.uk/sites/default/files/resources/lighting-industry-strategy-pdf-1400832030.pdf

[7] HMRC UK trade info, using the following 6-digit level HS codes: 701190; 850410; 853921; 853922; 853929; 853931; 853932; 853939; 853950. For both quantity and value: 2016,2021. Available at:
https://www.uktradeinfo.com/trade-data/ots-custom-table/

proposed higher MEPS. Some non-GB businesses may raise their prices to GB consumers to off-set the transition costs, however we estimate that any increases are likely to be negligible given the production of lighting products at the required efficiency is already established. Our analysis has shown that the anticipated increase in up-front costs to the consumer are quickly recuperated through savings on energy bills. As such the benefits of the intervention remain in GB.

5. Whilst there are already ecodesign (and energy labelling) regulations in place for lighting products, the rationale for setting new, more ambitious energy-efficiency requirements for light sources and luminaires (excluding separate control gear) is that uptake of LED technology has greatly increased in recent years[8] and along with this increase in demand has come a rapid increase in LED efficacy (measured in lumens of light delivered per watt of energy, lm/W).[9.] The average efficacy of LEDs quadrupled between 2009 and 2015, with their average price dropping during the same period[10]. The current regulations enable a number of non-LED technologies to remain on the market, despite being considerably less efficient and more expensive to run that suitable LED replacements; in many cases LEDs have almost completely replaced these 'legacy' technologies yet they are allowed to remain on the market.

6. Therefore, the Government believes that in raising MEPS, the policy would result in increased energy bill savings for consumers and businesses and traded carbon savings (as well as a less significant level of non-traded carbon savings).

7. UK sales data from Growth from Knowledge (GfK) has shown that efficacy of light sources has continued to improve over the past few years, as shown in Table 1. Although efficacy has been improving year on year, it has been doing so at a decreasing rate. We expect the introduction of higher energy efficiency standards to increase the rate of technological innovation and hence efficacy as manufacturers compete for market share of lighting products over 120 lm/W and 140 lm/W.

**Table 1: Average efficacy of UK sales of light sources**

| *Year* | Sales-weighted average efficacy | Annual improvement |
|---|---|---|
| 2018 | 91.0 lm/W | |
| 2019 | 93.9 lm/W | 3.1 pp |

[8] European Commission, 2015. Preparatory Study on Light Sources for Ecodesign and/or Energy Labelling Requirements ('Lot 8/9/19'). Final report, Project Summary.

9 European Commission, 2015. Preparatory Study on Light Sources for Ecodesign and/or Energy Labelling Requirements ('Lot 8/9/19'). Final report, Task 2 Markets

10 IMPACT ASSESSMENT Accompanying the document Commission Regulation laying down ecodesign requirements for light sources and separate control gears pursuant to Directive 2009/125/EC of the European Parliament and of the Council, 2019. Available at: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/1551-Review-of-ecodesign-requirements-for-lighting-products

| | | |
|---|---|---|
| 2020 | 96.6 lm/W | 2.9 pp |
| 2021 | 97.4 lm/W | 0.8 pp |

8. Government intervention is required as the market is not moving quickly enough towards high levels of efficiency to enable the potential benefits to be realised. This is on account of several market failures:

   a) **Carbon externality**: the price of less energy efficient lighting products and the price of power used to run them does not reflect the negative externalities associated with energy use. The excess energy used creates an avoidable cost to society in the form of excess power consumption and greenhouse emissions. Government intervention allows market transformation, where consumers can only purchase more efficient lighting products, lowering the cost to society.

   b) **Economies of scale:** new lighting standards are likely to push the market to increase innovation among higher efficiency products, which can lead to economies of scale in the form of supply chain optimisation. In the absence of government intervention, higher efficiency lighting products will continue to cost more than their lower efficiency counterparts and to be seen as premium products, which acts as a barrier to wider deployment. Regulating the market by forcing it to develop more high efficiency products will lead to greater economies of scale, which will bring down the costs to consumers and lead to greater deployment.

   c) **Behavioural changes:** in the absence of higher MEPS, inertia may make consumers more likely to purchase lighting products with lower efficiency as they do not realise the opportunity cost of buying a less efficient product at lower upfront cost (i.e. forgone bill and energy savings which they would have benefitted from by buying a higher efficiency product at a slightly higher upfront cost). This can especially be seen in the non-domestic sector where the take up of more efficient lighting products is not as wide-spread. Therefore, the implementation of updated MEPS for lighting products would nudge consumers into purchasing more efficient lighting products, allowing for energy and bill savings to be made. Alongside this, it will encourage the non-domestic sector to catch up in its deployment of higher efficiency lighting products.

   d) **Misaligned incentives:** In rented properties where, commonly, lighting products are already installed by the landlord before tenants move in the costs of higher energy bills and/or less efficient lights accrue to tenants. The issue of misaligned incentives here can crop up, as it is less likely for landlords to include lighting products which have higher efficiency when making a decision to buy at the point of replacement. Therefore, without government intervention, landlords are likely to keep purchasing less efficient lighting products, which carry a higher cost to society.

9. The draft Regulations will apply in Great Britain only. In accordance with the Northern Ireland Protocol (“NI protocol”), EU Ecodesign and Energy Labelling Regulations will continue to apply in Northern Ireland. The costs and benefits

in this Impact Assessment are calculated on a GB basis. However, the Northern Ireland Protocol Bill was introduced by HMG in Parliament on 13 June 2022. The Bill proposes the creation of a dual regulatory regime in Northern Ireland, which will allow businesses selling products in Northern Ireland to choose between meeting UK or EU rules (or both). Once the NIP Bill has passed through the Parliamentary process and is in force, these proposals on lighting products could encompass the whole UK.

# 2 Policy objective

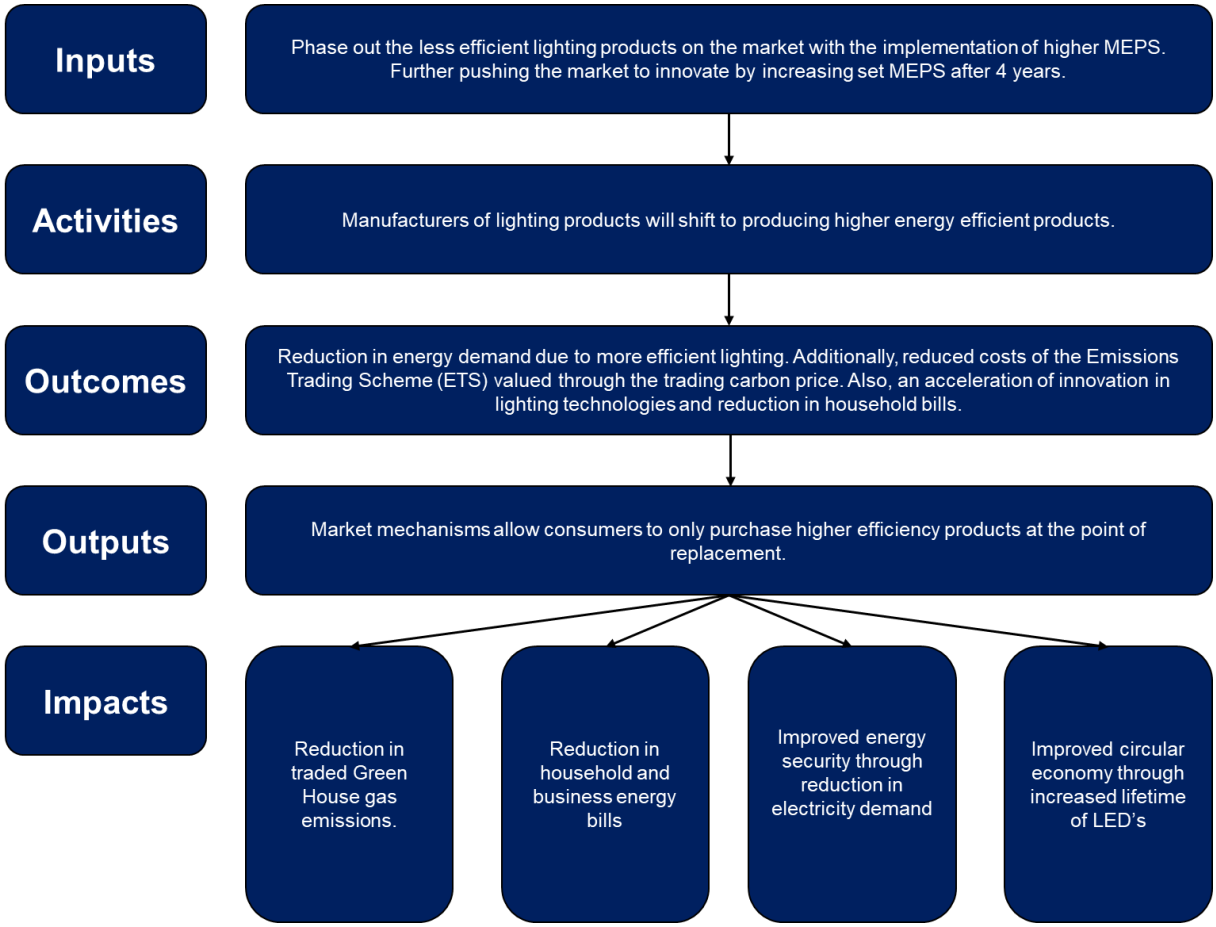
10. By increasing the minimum energy performance standard (MEPS) for lighting products, the worst performing products would be removed from the GB market. This is intended to reduce energy demand in the GB, leading to reduced power sector emissions[11], improved energy security and lower energy costs for consumers, businesses and the public sector. The policy also aims to drive innovation of more efficient lighting technologies. This aligns with the objectives set out in the Energy-Related Products Policy Framework[12] and the Secretary of State's priority outcomes for BEIS in 2022 (subject to change).[13] The logic map below shows the specific objectives and outcomes of the policy.

**Figure 1 - Logic map for implementation for raising minimum energy efficiency standards for Lighting products**

[11] Emissions from electricity are covered by the UK Emissions Trading Scheme (UK ETS), and these traded emissions do not count towards the UK's carbon Budgets

[12] The Energy-related Products Policy Framework, BEIS, 2021. Available here: https://www.gov.uk/government/publications/energy-related-products-policy-framework

[13] BEIS Outcome Delivery Plan: 2021 to 2022, BEIS, 2021. Available here: https://www.gov.uk/government/publications/department-for-business-energy-and-industrial-strategy-outcome-delivery-plan/beis-outcome-delivery-plan-2021-to-2022




11. The Government does not propose to update the energy labelling regulations for lighting products at this time. This is because the update made to these regulations in October 2021 was sufficiently ambitious to ensure that, even following the proposed updates to MEPS, very few products will achieve the top energy label classes in the medium term, hence the energy label will still provide useful information to consumers and will continue to incentivise manufacturers to improve their products.

# 4 Options considered

12. For the purpose of this Impact Assessment, three main policy options have been considered for lighting products: (1) Do Nothing, (2) increase the MEPS in 2023 and 2027 (the preferred option), (3) Self-regulation and (4) increase the MEPS in 2023 and 2025. The preferred policy option has been assessed against the Do Nothing option.

## 4.1 Option 1 – Do Nothing

13. Under Option 1 no changes would be made to the existing ecodesign requirements for lighting products. This option would therefore have no impact on manufacturers.

14. The main reason why this option has not been pursued further is that, without updated regulation, the market will not achieve the full potential of efficiency savings possible. Several market failures show this to be the case and the associated negative impacts are described in paragraph 8.

15. In a Do Nothing scenario, it is reasonable to assume that GB manufacturers of lighting products who do not export, have less incentive to innovate and produce products that comply with global requirements, as their focus is likely to be price competition over increasing energy efficiency. They will have the opportunity to undercut higher priced, more efficient products with cheaper, less efficient products.

16. Without adopting ecodesign requirements, the market failures listed above would be unmitigated. Currently, the prices of products do not reflect the real environmental cost to society in terms of the negative impacts that carbon emissions have on our atmosphere and the over-use of materials in manufacturing new products, with these materials largely going to landfill or incineration at end-of-product-life rather than being recovered and reused or recycled.

### 4.2 Option 2 (preferred option) – increase the MEPS to 120 lm/W in 2023 and 140 lm/W in 2027

17. Under the preferred option, existing ecodesign requirements for light sources would be updated to require lighting products placed on the GB market to meet MEPS of: 120 lm/W from 1st September 2023; and140 lm/W from 1st September 2027.

18. Under this policy option, the GB market for lighting products would be pushed towards the best performing LEDs on a technology-neutral basis. This would remove the Ponmax equation which is used in the current ecodesign regulations to lower the MEPS which must be met by a range of non-LED technologies, which are inherently less efficient; this enables them to remain on the market despite the availability of LED replacements. This mechanism was initially intended to soften the market transition to LED technologies. We judge that the market has now moved sufficiently towards LED replacements to justify removing this support for non-LED technologies. We will use the consultation to identify any negative impacts which our analysis has not found so far.

19. We will seek to avoid disproportionate negative impacts on certain lighting technologies within the market (e.g. directional LEDs) and on specific sectors of the wider economy or groups of individuals who have a specific need for continued access to certain lighting technologies (e.g. people with photosensitivity). Specifically, we have sought to avoid this by building in a series of concessions which would allow lighting products to meet slightly lower MEPS if they meet certain criteria. This recognises the fact that some lighting technologies face technological barriers to increasing efficacy at as fast a rate as other technologies and still play an important role in specific situations. We will use the consultation to identify any negative impacts which our analysis to date may have over-looked.

20. The concessions used are set out in Table 2, more detail on these can be found in Annex 7. These concessions are cumulative, meaning that if a light source meets more than one of the criteria in Table 2, the light source would benefit from all applicable concessions. The application of these concessions will be limited to light sources only, with luminaires and certain non-domestic lighting technologies being excluded on the basis that they are more efficient, therefore a smaller proportion of their market would be removed by the new MEPS.

**Table 2: Concessions being implemented**

| Criteria | Concession |
|---|---|
| Mains voltage light source | 20 lm/W |
| Directional light source | 10 lm/W |
| Connected light source | 5 lm/W |
| CRI ≥ 93 | 10 lm/W |
| CCT ≤ 2000K | 5 lm/W |
| Lumen output ≤ 400 lm | 10 lm/W |

21. Further, the existing Regulations contain a range of exemptions, covering a small number of specific technologies and specific applications in order to ensure a continued supply (e.g. light sources used in medical devices are exempt; and individuals with a photo-sensitivity medical condition can continue to access alternatives to LEDs). Under the proposed policy option, these exemptions will remain in place, with only two changes. Firstly, we propose to improve the clarity and operability of the exemption to enable people with a photosensitivity condition to continue to access appropriate light sources. Secondly, we will remove exemptions for a small number of mercury-containing lighting technologies to reflect that these are being phased out of the EU and UK markets via new restrictions on the use of certain hazardous substances in electrical and electronic equipment, which will effectively prevent these products from being placed on the EU and UK markets [TBC subject to Defra Ministerial decisions in October]. Whilst the UK changes to the Restriction on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Regulations 2015 are not due to come into force until [year], we propose to remove them from the GB market through our ecodesign Regulations from 1 September 2023. As both the GB, NI and EU markets are supplied by broadly the same global manufacturers, we would

expect suppliers to have largely removed these light sources from their supply chains to the GB market by 1 September 2023. We will use the consultation to test the impacts of bringing this change forward to 2023 in GB.

22. We have undertaken an assessment to check if additional traded carbon savings could be achieved by removing or tightening any of these exemptions which concluded that additional policy benefits would be minimal and would be vastly outweighed by the additional costs and disruption to business or negative impact to consumer groups which would occur if they were to lose access to the specific lighting technologies.

23. When considering this option, we assessed a number of different variations of updated MEPS (such as option 4) as well as different profiles for when to implement these. We assessed these on the basis of their energy savings, traded and non-traded carbon savings, bill savings and wider policy benefits; how attainable the MEPS would be across the whole market for lighting products (i.e. balancing what is realistic for domestic products versus non-domestic products); and when the market would be ready. This consideration led us to the preferred policy option as the optimum way to balance all of these factors. As can be seen in Table 3, option 2 (preferred policy option) and option 4 result in the same energy savings and therefore the same traded carbon emissions, however option 2 is preferable as it offers a more achievable implementation profile and has a greater positive impact on innovation by encouraging suppliers to further increase efficacy levels of lighting products .

24. Firstly, the implementation date for the first tier of requirements (120 lm/W from 2023) was compared with later dates. We found there to be a significant reduction in the policy's energy savings if implementation was delayed by one year to 2024; this was because implementing sooner leads to a larger proportion of inefficient, non-LED lighting technologies being phased out of the market as a direct result of the policy through acceleration of investment decisions to place higher efficiency products on the market, and the long lifetime of use of inefficient products if the implementation is later, and therefore a greater reduction in emissions from the power sector. We acknowledge that a later implementation date would give suppliers more time to re-develop products to meet the higher MEPS, thereby reducing the proportion of models removed from the market.

25. Secondly, in relation to the interval between the first and second tiers of requirements, we had initially proposed a two-year interval (tier 1 in 2023 and tier 2 in 2025 as in option 4). The rationale for this was to provide a strong incentive to suppliers to improve the efficacy of products; it was also informed by an assumption of a high rate of year-on-year efficacy improvement. However, such a small interval risked creating product shortages between MEPS tiers because of suppliers focusing on preparing for tier 2 in 2025. Therefore, for the preferred policy option, we have revised this interval to be four years (tier 1 in 2023 and tier 2 in 2027). This assumes a slightly lower rate of year-on-year efficacy improvement of 3.5%, which we revised based on additional evidence gathered from industry representatives. A four-year interval leads to the tier 2 MEPS having a similar market impact at the point of introduction in 2027 as tier 1 has in 2023 (i.e. around 50% of products being removed from the market). On this basis, we believe a four-year interval will

still provide a strong incentive to suppliers to accelerate the rate of improvement in lighting product efficacy between the MEPS tiers.

26. We considered setting lower MEPS on both 2023-2025 and 2023-2027 implementation profiles, which would remove a smaller proportion of the current market for lighting products. However, this would have allowed a large number of relatively inefficient models to remain on the market, despite there already being highly efficacious substitutes available. This would have reduced the energy savings from the policy, leading to lower savings in traded and non-traded carbon emissions and energy bills. Even in a scenario with lower MEPS, we would have needed to implement similar concessions to reduce MEPS for certain lighting technologies which face inherent technical barriers. Therefore, on balance, implementing higher MEPS (120 lm/W and 140 lm/W) with a greater interval between tiers and with a set of concessions leads to a better balance between the policy benefits achieved through significant market transformation and avoiding the most severe and disproportionate impacts on the GB market.

27. This policy option represents regulatory divergence from the EU (and Northern Ireland) and is the first example of an ecodesign regulation which sets different and more ambitious minimum energy performance standard for an energy-related product in GB than in the EU single market.

28. As with existing ecodesign Regulations, products placed on the market before the new requirements come into force can continue to be sold and circulate to end users. The new requirements would bite for all products being placed on or after the GB market after the implementation date.

### 4.3 Option 3 - Self-regulation

29. We have considered self-regulation as an option, whereby suppliers of lighting products would voluntarily ensure that their products met a higher minimum energy performance standard. This could either replace the existing ecodesign regulations entirely or be a means by which manufacturers go beyond the existing mandatory requirements to meet the higher MEPS proposed by this policy. Under the ecodesign legislative framework, the Secretary of State must not regulate an energy-related product that is already the subject of self-regulation; the legislative framework also sets out principles which voluntary initiatives should follow.

30. To date industry representatives have not proposed self-regulation or a voluntary scheme as an alternative to new regulation; this was the same when the most recent update to ecodesign and energy labelling regulations was discussed and agreed by the European Commission and subsequently by the UK Government. Where self-regulatory initiatives have been considered at an EU level for products other than lighting, concerns were raised about the lack of guidance around the criteria used to evaluate self-regulatory initiatives, particularly with respect to monitoring and evaluation. This may have influenced the lighting industry's appetite for self-regulation.

**31.** A self-regulation scenario could create a coordination failure**.** In the absence of government intervention, there is a real risk of free riders introducing inefficient products into the market if a voluntary agreement were to be used.

Particularly in a scenario in which a voluntary agreement replaced the existing mandatory requirements, there would be a risk that free-riders could re-introduce highly inefficient products, which were previously banned, back into the market. Free riders would be those who do not sign up to the voluntary agreement but benefit from: (1) the positive effects of lower societal costs without paying for them; and (2) higher costs voluntarily incurred by their competitors which allows them to undercut the market cost. Therefore, government intervention is necessary to avoid a coordination failure and allow for an equilibrium to be reached in the market where firms can supply higher efficiency lighting products avoiding free riders.

32. Further, research suggests that voluntary agreements around energy efficiency are best considered for products which are not regulated in other economies, or where regulation is not practical[14]. Since mandatory requirements are practical and indeed already exist in many nations for lighting products, we have ruled out self-regulation in GB as a possible option. Continuing with a mandatory regulation approach provides clarity and a level of continuity for GB businesses.

### 4.4 Option 4 – increase the MEPS for lighting products in line with energy label classes E, F and G in 2023 and 2025

33. Implementing MEPS in line with the energy efficiency classes on the current energy label for lighting products was considered as a potential option. This would mean increasing MEPS to 110 lm/W in 2023 and 135 lm/W in 2025. As a result, products in energy label classes G and F would be removed from the market from 2023 and products in class E would be removed from the market from 2025.

34. Under this option, we would apply the MEPS on a largely technology-neutral basis, meaning we would remove the mechanisms in the current regulations which allow certain non-LED technologies to remain on the market (despite being significantly less efficient than available LED substitutes). Nevertheless, we would provide for certain lighting technologies to benefit from limited concessions (reductions in the MEPS) to reflect inherent technological barriers and to avoid disproportionate impacts on those market segments.

35. Table 3 outlines the estimated traded carbon savings from this option were identical to the lead policy option, although the benefit to cost ratio is lower in option 4 compared to the lead option. This option is not favoured due to the lower level of ambition, which falls short of what is achievable in the non-domestic segments of the market for lighting products. Whilst this option would be more achievable for the market for typical domestic light sources, setting this lower level of ambition across the whole market would mean that the full potential for energy savings from the non-domestic lighting market would not be realised and the uptake of less efficient lighting products would continue to be enables and encouraged. Opting for lower MEPS would also, in turn, lead

[14] "Effectiveness of Energy Efficiency Voluntary Agreements", The Policy Partners and SQ Consult, 2017. Available at: https://www.iea-4e.org/document/408/effectiveness-of-energy-efficiency-voluntary-agreements

to lower innovation as suppliers would not have the same encouragement to make further efficacy improvement across their products.

36. Further, this policy option could create a risk of supply shortages between 2023 and 2025 as the market mechanisms struggle to adjust. Introducing the second tier of MEPS in quick succession may cause suppliers to prioritise development of products which can meet the second increase in MEPS in 2025 and distributors to under-order products between 2023 and 2025 in order to avoid holding excess stock of light sources between 110 and 135 lm/W when the tier 2 requirements come into force in 2025. Anecdotal evidence provided by industry-based stakeholders highlighted that a short interval of two years between the first and second tiers of increased MEPS could cause this.

37. We also considered lowering MEPS further but our assessment found the same problems, in particular the foregone traded and non-traded carbon savings and impact on innovation within the non-domestic market. Further, even in policy scenarios with lower MEPS, a series of concessions for specific lighting technology types would still be required, therefore there was no real reduction in the complexity of the policy.

**Table 3: Table of total traded CB5 and CB6 Carbon Savings from each option[15]**

| | Traded Carbon Savings CB5 (2028-2032) | Traded Carbon Savings CB6 (2033-2037) | BCR |
|---|---|---|---|
| **Option 2 (preferred policy option)** | **1** MtCO2e | **0.28** MtCO2e | **7.24** |
| **Option 4** | **1** MtCO2e | **0.28** MtCO2e | **7.10** |

# 5 Overview of costs and benefits

38. This section outlines the costs and benefits examined in this Impact Assessment, including the costs to businesses. High-level figures are provided, along with general arguments as to the costs and benefits considered (and not considered).

39. The draft Regulations will apply in Great Britain only. In accordance with the NI Protocol, EU Ecodesign Regulations will continue to apply in Northern Ireland (subject to any changes arising from the Northern Ireland Protocol Bill).

40. A 30-year appraisal period (2022/23 to 2050/51) was chosen considering the average lifespans for lighting products. Data suggest that a typical lifetime for the concerned lighting products varies between 2-40 years (for further detail,

[15] Table 3 outlines the potential traded carbon savings between the preferred policy option and option 4. The numbers above do not have concessions deducted from them. Therefore, it is important to note this when interpreting the values.

see Table A.1 in Annex 1). Based on the above, 30 years broadly represents a timeframe over which most of the existing stock of products will be replaced with product models that are compliant under the new requirements, and the full energy savings of these product models will be realised over their lifetime (see Table A.1).

41. At present, we have assumed additionality of 100% for this Impact Assessment. These regulations are going further than EU/International standards and as such there are no competing standards that would reduce additionality. Gains the market would make in the absence of intervention are factored into the baseline. Therefore, we estimate that all of the total costs and benefits to business and consumers would be realised as a direct result of the regulations.

42. The Energy Using Products Policy model produces outputs for costs and benefits to businesses and consumers at the UK level. These are then adjusted to a GB level as Northern Ireland will not be subject to the regulations. A scaling factor using the difference between populations has been used for the domestic sector and the difference between business counts for all non-domestic sectors. In both cases, GB values are scaled down to roughly 97% of the UK values. Population and business count estimates were sourced from the ONS.[16]

## 5.1 Summary of costs and benefits of lead policy option

43. Table 4 outlines the key costs and benefits that have been noted for the preferred policy option. The final column indicates how these have been considered in this Impact Assessment.

44. The benefit of the preferred policy option can be seen for an average consumer, where replacing an old technology with an LED, the expected increase in initial cost is estimated to be paid back in around a year. While longer for replacing existing lower efficiency LED's the estimated upfront cost is estimated to be lower but with the consequence of a longer payback period.

45. The draft regulations will impose a real cost on manufacturers of lighting products, though we expect the majority of business to reside outside of GB. For the purposes of this Impact Assessment, we assume that manufacturers operate in competitive markets and increased costs are passed on to the end consumers. This may be achieved through a marginal increase in the price of all products that are impacted, or through a more substantial increase to a sub-set of products that the manufacturer produces. If markets are not competitive, manufacturers may choose to absorb the increase in cost through reduced profits. However, we have no evidence that this will occur and therefore do not assume this is the case when undertaking our analysis. Ultimately this is an issue of where the costs are felt (by consumers or firms), not whether they are incurred.

[16] ONS population and business count estimates accessed here:
https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/mid2020
https://www.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/bulletins/ukbusinessactivitysizeandlocation/2021

46. Table 4 provides the high-level cost and benefit estimates of the lead policy option according to the costs and benefits outlined above for lighting products.

**Table 4: Estimated Costs and Benefits of Lead Policy Option, 2022/23 to 2050/51**

| ***2022 prices (£m), 2022 present value year*** **Costs/benefits, £m** | **Lead Policy Option (£m)** |
|---|---|
| Costs to manufacturers (assumed to be passed onto consumers) | 300 |
| Costs of increase in non-traded $CO_2e$ emissions (extra heating)[17] | 4 |
| **Total Costs (A)** | **304** |
| Value of energy savings (net) | 1,320 |
| Value of reduction in traded CO2e emissions | 405 |
| Net benefits of air quality improvements | 32 |
| **Total Benefits (B)** | **1,758** |
| Net Present Value (B–A) | 1,454 |
| Benefit Cost Ratio (B/A) | 5.8 |

47. Total figures may appear to not add up due to rounding.

48. The Energy Using Products Policy (EUPP) CBA model was based on one model, split into six sub-models covering domestic, commercial, industrial and street lighting (see Table A.3), examining the impact of the regulatory changes on lighting products. In each sub-model different lamp types have been segmented into their typical end-uses, so that usage and lifespan inputs could be consistently applied to each lamp type. The lamp types included in each sub-model are presented in Table A.3.

49. The modelling takes into consideration different sub-technologies, using:

- forecast sales/stock figures;
- estimates for additional costs arising from producing products compliant with the draft regulations under lead policy option compared with rejected option 1 (Do Nothing) scenario;
- forecast level of usage (in hours/year);
- estimates for the energy usage (in kWh/year/unit), again for products compliant with the draft regulations under lead policy option compared with rejected option 1 (Do Nothing) scenario; and

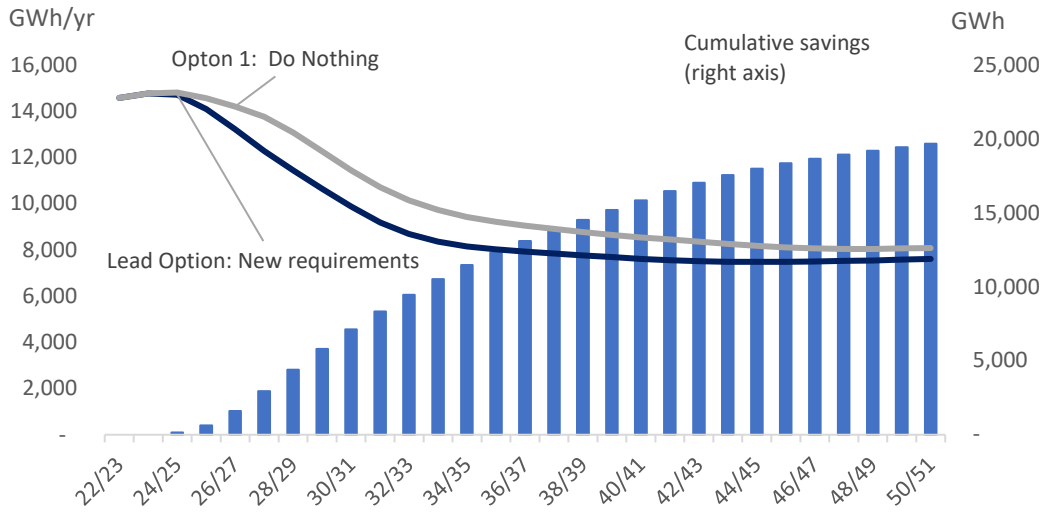
[17] For household users, it is assumed that extra heating is required to replace the reduced heat-loss of more efficient products. For non-domestic users it is, instead, assumed that any extra heating is offset by reduced cooling costs. See Annex 1 for more details.

- the expected lifespan of products (before a replacement is required, further information can be found in Table A.1)

50. Further information on the modelling approach can be found in Annexes 1 and 2.

51. The assumptions outlined above were formed following feedback given from consultation with industry, which was further tested with commissioned evidence which helped inform the decisions around cost and lifetimes in the modelling.

**Figure 2: Estimated energy use under Options 1 (Do Nothing)[18] and the Lead Option (updating ecodesign requirements) for lighting products and the cumulative gross energy savings of implementing the Lead Option.**

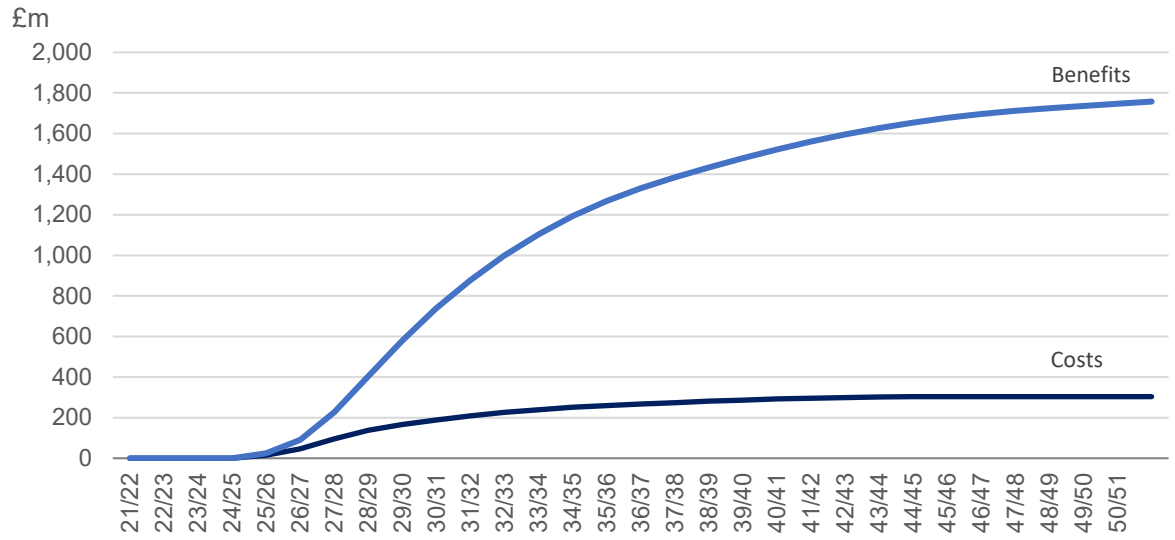



52. The draft Regulations for lighting products deliver an estimated NPV of £1,454m and are expected to save around 19,660 GWh of electrical energy and 1.7 million tonnes of traded $CO_2e$ over the appraisal period (2022/23 to 2050/51).

53. High-level descriptions of the modelling approach are outlined in the following sections alonghous with the outputs. More detailed descriptions are provided in Annex 1 and Annex 2, which includes the key modelling assumptions.

[18] Note that for Option 1 (Do Nothing), energy savings (GWh) also occur as we assume that some consumers of lighting products will take into account energy efficiency when purchasing, given that they will be utilised for long periods of a day. The savings, however, are less than the energy savings that we forecast to occur under the preferred option, Option 2.

**Figure 3: Cumulative costs and benefits of Lead Option for lighting products (2022 prices).**




Note that the modelling includes cost-scaling whereby, towards the end of the appraisal period, costs reduce year-on-year. This considers products whose costs would be incurred but benefits only partially realised during the appraisal period.

## 5.2 Transition costs

54. Generally, transitional (one-off) costs of implementing the policy, include familiarisation costs of understanding the requirements, and are inclusive of training staff and setting up IT.

55. Transitional costs are estimated to be minimal as a result of updating the ecodesign requirements for lighting products. Manufacturers are required to read and understand regulatory changes regarding the update in MEPS for all lighting products. The vast majority of the current regulations will remain unchanged, so suppliers will not need to familiarise with new definitions or procedures for compliance verification, for example.

56. However, following feedback in the consultation on the October 2021 updates to ecodesign regulations for lighting products, we have included a one-off cost to monetise the impact of reading and understanding the new GB legislation. This cost, valued at £700,000 in total for all GB businesses affected, will be realised in 2023 only. This transitional cost is calculated by multiplying the cost of one and a half days of labour by the estimated number of businesses that manufacture lighting products. We estimate this cost to be higher than previously due to increase in MEPS, divergence from EU standards and the time needed to adjust for the new MEPS.

57. The number of GB businesses affected is estimated from the GB Business Count database for the relevant industries.[19]The count stands at around 1,495 businesses.

[19] SIC codes: 2790 and 2620. Data accessed here: https://www.nomisweb.co.uk/query/construct/submit.asp?menuopt=201&subcomp=

58. For hours taken, the requirements may be presented differently in the legislation than in the past and so it may take businesses a bit more time to confirm that they are compliant with the new MEPS, given the divergence from previous legislation which uniformly followed EU proposals. This has been estimated as a day and a half of labour based on feedback from a previous consultation.

59. To estimate the price of labour it has been assumed reading and comprehending legislative text is unlikely to be low paid work. For small and micro businesses, it is likely that the business owner will take responsibility. In large companies it is likely to be members of a legal department or an expert in advising on changes in government regulation. This is reinforced by job titles included in responses to the consultation.[20] The Annual Survey of hours and Earnings finds the median hourly earnings for full-time legal professionals and quality and regulatory professionals to be £27 and £22 per hour respectively.[21] These hourly wages are the equivalent of £47,500 and £39,000 per-annum based on working 220 eight-hour days. As a result of this a £24 per hour wage has been assumed. An additional 30% is added to this wage to account for overhead costs businesses face when employing workers. This provides a final cost for the comprehension of the regulations. An opportunity cost equal to the transitional cost has been included to account for this member of staff being diverted from other duties.

60. This cost estimate does not account for the impact and influence of Trade Associations. Comments in the consultation suggested that a certain amount of knowledge sharing would take place. Trade associations will be able to help businesses to understand the new regulations. Businesses will also aid other businesses. If not every business needs to devote labour to reading the legislation then our cost estimate is likely to be on the high side.

## 5.3 Resource Efficiency

61. Circular economy principles ultimately mean closing the loop between the production and the end-of-life disposal. It intends to increase resource efficiency by minimising raw material extraction and optimising recycling and reuse. The existing ecodesign regulations set resource efficiency requirements for lighting products, which will remain unchanged under the preferred policy option. These existing requirements ensure that lighting products are designed to facilitate reuse, repair and recycling of the product; and require suppliers to provide certain information in instruction manuals and on free-to-access websites. Altogether, these measures aim to increase a product's lifespan and reduce its end-of-life environmental impact.

62. The overall savings from resource efficiency requirements were not quantified in the Impact Assessment when the current ecodesign regulations were made. Lighting products are already in the scope of Waste Electronic and Electrical

[20] Job titles include: Senior Product Specialist, Head of EU technical market access.

[21] Earnings and hours worked, occupation by four-digit SOC: ASHE Table 14 accessed here: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/occupation4digitsoc2010ashetable14. SOC codes 241 and 246

Equipment Regulations 2013 (WEEE), in which these savings were assessed qualitatively and predicted to be modest in comparison to the energy savings.

63. We expect the overall volume of lamp waste will naturally reduce as LEDs gain market share due to the significantly longer lifetime of LEDs in comparison with legacy lamps. However, the preferred policy option does not include any changes to the current resource efficiency requirements, hence we have not considered any further impacts on resource efficiency in this Impact Assessment.

## 5.4 Enforcement and Compliance Costs

64. Enforcement and compliance costs are not easily quantified. Enforcement action is undertaken where the market surveillance authority (MSA) believed there is sufficient risk-based justification to do so, in line with standard enforcement policy[22]. Additional costs resulting from the preferred policy option are considered to be minimal because the new MEPS will be applied in a way which simplifies the calculations involved in determining the efficacy required of any given lighting technology. This will ease the burden on MSAs when verifying compliance, when compared with the complexity of calculations under the current ecodesign regulations. All other aspects of the verification procedure to be followed by MSAs and the wider enforcement and sanctions regime (set out in the Ecodesign for Energy-related Products Regulations 2010) will remain unchanged under the preferred policy option.

65. Testing costs are not expected to increase under the lead policy option because the updated MEPS requirements only displace the existing MEPS requirements and no additional testing or reporting requirements are introduced. Also, we anticipate that product suppliers would be able to continue using the methods of measurement set out in established international standards which are used for testing under the existing ecodesign regulations and which would be used in a Do Nothing scenario. Any extra costs that are incurred are expected to be absorbed by the supplier. We will use the consultation process to assess whether testing costs have been adequately considered.

66. Any increase in frequency of testing or increase in the cost of testing, is expected to positively benefit UK Small and Medium-sized Businesses (SMEs, defined as having up to 49 Full Time Equivalent (FTE) and 10 FTE employees respectively[23]) involved in these sectors, who would have the opportunity to profit from the increased demand.

67. Finally, at present, BEIS desk-based research indicates that there are few GB manufacturers of lighting products, so any potential increase in testing costs would not have a large-scale effect. However, any such costs may fall disproportionately on to smaller businesses and are therefore considered in the Small and Micro Business Assessment (SaMBA) (see Section 5).

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[22] OPSS enforcement policy, May 2018. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/712141/safety-and-standards-enforcement-enforcement-policy.pdf.

[23] BEIS Better Regulation Framework Manual, February 2018. Available at: https://www.gov.uk/government/publications/better-regulation-framework.

68. As suggested in HM Government's OIOO (One-In, One-Out) Methodology[24], the cost and benefits calculated have assumed 100% compliance since we have no evidence to suggest it would be otherwise. Lack of compliance would, however, impact on both costs and savings. Given the uncertainty, and the scale of the impact, differing levels of compliance are implicitly investigated through the Sensitivity Analysis (see Section 9.8 and the corresponding section for lighting products).

## 5.5 Distributional Impacts

69. In setting the updated requirements, distributional impacts are taken into account. A key constraint in setting requirements is that those should have no significant negative impact on consumers as regards to the affordability and life cycle cost of the product. A medical exemption has been given to consumers that may suffer from photo-sensitivity (more details can be found in section 6).

## 5.6 Trade Impacts

70. In terms of impact on UK trade, the proposed MEPS requirements are expected to facilitate UK trade of lighting products. In terms of total import and export quantity (tonnes), the UK imports 43% of lighting products from the EU in comparison to the rest of the world and exports 10% of lighting products to the EU in comparison to the rest of the world. In monetary value (£), 34% of the UK's total import of lighting products are imported from the EU, and 20% of the UK's total export of lighting products are exported to the EU. The majority of the remaining non-EU UK imports and exports of lighting products (for both quantity and value) are largely comprised of UK-Asia and UK-US trade[25]. We expect UK-US trade to increase given for some LED technologies such as double-ended linear LED's the US market is more advanced in terms of efficacy than the EU market, so we expect increasing MEPS to have a positive effect on imports from the US.

71. Therefore, the UK imports and exports large quantities of lighting products from and to the EU, and the value of the trade with the EU is very high. In setting the MEPS above current EU requirements, a negative effect on competitiveness of UK lighting products can be expected. The negative effect on imports (for both quantity and value) is caused by the fact that the higher standards in place in GB would exclude around 40-50% of products currently on the EU market, therefore the pool of products which could be imported and be compliant with the new Regulations would be smaller than at present. Nevertheless, we judge there would be a low risk of non-GB businesses choosing to stop exporting lighting products to the GB market as a way of avoiding the need to comply with the proposed new ecodesign requirements.

72. The negative effect on exports (for both quantity and value), comes from marginally higher prices of domestic products due to the assumed

[24] HM Government's OIOU (One-In, One-Out) Methodology, July 2011. Available at: https://www.regulation.org.uk/library/2011_oioo_methodology.pdf

[25] HMRC UK trade info, using the following 6-digit level HS codes: 701190; 850410; 853921; 853922; 853929; 853931; 853932; 853939; 853950. For both quantity and value: 2016,2021. Available at: https://www.uktradeinfo.com/trade-data/ots-custom-table/

passthrough of innovation costs. However, the manufacturing of lighting products in GB is a small sector, so this effect on exports is expected to be small. The expected negative effect on both imports and exports is anticipated to be temporary, given we expect the EU market will eventually converge towards the proposed MEPS in GB. Further, as the market for higher efficiency lighting products evolves to meet the new standards, we would expect these additional costs to fall away and for costs to return to a new equilibrium. As a result, we do not believe the proposed MEPS are likely to have more than a negligible impact on trade. In addition, there may be potential benefits to GB manufacturers in being first movers on these higher minimum standards. We will seek to test this hypothesis further through consultation with stakeholders.

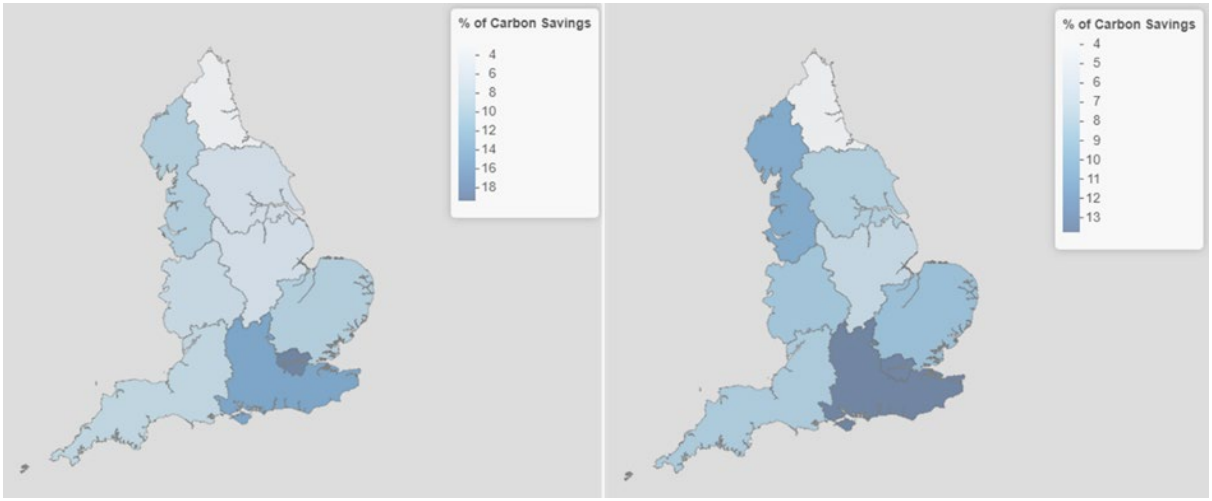
## 5.7 Regional Impacts

73. Figure 4 below show us the distribution of traded carbon savings from the lead policy option broken down into domestic and non-domestic settings. The non-domestic map on the left shows the highest percentage of traded carbon savings accumulate from London, this can be explained as the magnitude of businesses[26] are concentrated in London and south-east versus the north-east which has the lowest percentage of traded carbon savings.

74. The trend continues in the domestic side of the market, where we see the magnitude of the traded carbon savings accumulating jointly from London and south-east due to the density of population[27] in these areas. Conversely the fewest traded carbon savings come from the north-east.

75. It is important to note, we do not expect any regions to be disproportionately affected by the introduction of the regulations. Rather, the distribution is a consequence of the location of consumers and businesses.

**Figure 4 – Traded Carbon Savings mapped for Lead Policy option, non-domestic (left), domestic (right)**




[26] ONS Business count data, broken down by subregion 2021 https://www.nomisweb.co.uk/datasets/idbrlu

[27] ONS population survey, broken down by subregion, 2020 https://www.nomisweb.co.uk/datasets/pestsyoala

## 5.8 Sensitivity analysis

76. Annex 3 provides an overview of the model used for the cost-benefit analysis and details the modelling assumptions that have been made with description of their levels of uncertainty. The model also accounts for optimism bias explicitly through the use of prudent inputs. These are explained in detail for lighting products in Table 5 below.

77. To interpret the table below, a variable with a 'high' risk rating has 1.5 times the percentage uncertainty of a 'medium' risk rating variable, and a 'low' risk rating variable has half of the uncertainty of a medium risk variable. A change of ±10% in the variables is used as the base uncertainty which is then multiplied by the risk factor (1.5 for high; 1 for medium; 0.5 for low risk) to obtain the percentage impact change.

**Table 5: Outline of the sensitivity of the model by variable**

| Variable | Risk rating | Impact | Change in NPV | Comment |
|---|---|---|---|---|
| Product Cost (£) | High | The cost value could change by up to ±15%, resulting in a ±15% change to overall costs. | A change in costs of ±15% results in a ±3% variation on NPV (±£45m). | The model assumes Costs and Stock/Sales figures are independent, therefore a change in the cost of products has no impact on the volume of products sold/in stock. Benefits remain unaffected. |
| Energy Cost (pence per kWh) | Medium | The energy cost value could change by up to ±10%, resulting in a ±10% change to overall costs and benefits. | A change in energy costs of ±10% results in a ±9% variation on NPV (±£132m). | The cost of energy affects the monetised benefits of energy savings and costs through the heating replacement effect (see Annex 1 for further details). |
| Energy Use (hours/year) or (kWh) | Medium | The use value could change by up to ±10%, resulting in a ±10% change to overall costs and benefits. | A change in energy use of ±10% results in a ±9% variation on NPV (±£132m). | The number of hours in a year per product is used or power the product uses is directly proportionate to the overall energy use, and hence benefits and costs through the heating replacement effect. |
| Sales/Stock | Medium | The sales/stock value could change by up to ±10%, resulting in a ±10% change to overall costs and benefits. | A change in sales of ±10% results in a ±10% variation on NPV (±£145m). | Overall costs and benefits are directly proportional to the size of the Sales/Stock. |

| | | | | |
|---|---|---|---|---|
| Lifespan | Medium | Impact is dependent on when lifespan variation changes as earlier changes have longer impacts. | Not Quantified | The products' lifespan in the model affects both the costs and benefits but not proportionately. The shorter the lifespan, the greater the costs and benefits (due to the older stock being replaced more quickly). |
| Additionality | Low | Additionality affects both costs and benefits proportionately. | Not Quantified. | A change in the additionality assumption has a proportional effect on the costs and benefits, and therefore NPV. As these regulations go further than current EU and international standards we consider the risk of the additionality being less than 100% to be low. |

78. Table 5 indicates the relative sensitivity of a variable and how this affects the overall costs/benefits. A range of costs and benefits were considered to model potential divergence in the actual input variables from those estimated by the model. These consider both divergence in future values from those estimated as well as un-monetised costs and benefits, including compliance.

79. Figures assume all costs will be incurred by GB consumers. Some costs may be absorbed by non-GB businesses (manufacturers and/or retailers in the supply chain) which will reduce the costs to GB. Some small costs could be absorbed by non-GB consumers, where lighting products manufactured in GB are exported, but we expect this to be negligible.

80. The model does not account for the link between costs and sales. However, if the manufacturing costs were higher than expected, the possible corresponding reduction in sales would constrain the scale of the impact on the overall costs.

81. The estimated costs and benefits are partially dependent on projected long run variable supply costs of fossil fuels.[28] This analysis is consistent with the central price forecast scenario[29]. Given the scale of uncertainty over future fossil fuel prices, a specific sensitivity analysis of the high and low fuel cost scenarios has also been included. As electricity makes up the bulk of consumption for this evaluation the risk has been assessed as medium rather than high.

82. Table 6, below, shows that both costs and benefits are larger when energy prices are assumed to be higher. However, the increase in benefits far exceeds the increase in costs. Total costs fall by £1 million in the low energy price scenario and increase by £1 million in the high energy price scenario. This is due to the increased cost of heating necessitated by more efficient lighting products producing less heat. Total benefits drop by £132 million in the low energy price scenario and rise by £132 million in the high energy price

[28] Table 5: Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal. Can be found - https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

[29] Table 9-13: Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal. Can be found - https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

scenario. Whilst the level of energy savings remains the same in the three scenarios, the value of the saved energy is highest in the high energy scenario.

**Table 6: Estimated Costs and Benefits of Lead Option, Energy Price Analysis**

| *2022 prices (£m), 2022 present value year* | Energy price scenario (£m) | | |
|---|---|---|---|
| | **Low** | **Central** | **High** |
| Costs to Manufacturers (passed on to consumers) | 300 | 300 | 300 |
| Costs of increase in non-traded CO2e emissions (extra heating) | 3 | 4 | 5 |
| **Total Costs (A)** | **303** | **304** | **305** |
| Value energy savings (net) | 1,188 | 1,320 | 1,452 |
| Value of reduction in CO2e emissions | 405 | 405 | 405 |
| Net benefits of air quality improvements | 33 | 33 | 33 |
| **Total Benefits (B)** | **1,626** | **1,758** | **1,890** |
| **Net Present Value (B–A)** | **1,322** | **1,454** | **1,585** |
| **Benefit Cost Ratio (B/A)** | **5.4** | **5.8** | **6.2** |

## 5.9 Impact on GB businesses

### 4.9.1 Direct Costs and Benefits to GB Businesses

83. This section considers the costs and benefits of the proposal to GB businesses. It is restricted to GB-based manufacturers and GB business purchases of lighting products. The proposed requirements have no impact on products manufactured in, and then exported from GB, since manufacturers are only obliged to meet the requirements of the country they are exporting to.

84. As per BEIS guidance[30], we consider only the direct costs to businesses here. These include manufacturing costs which, elsewhere, are assumed to be passed onto consumers.

85. The costs imposed by these regulations can be considered direct because they clearly fulfil two of the three criteria laid out in case studies. First, the impact falls on businesses subject to the regulation and accountable for compliance. Second, the impacts are generally immediate and unavoidable. Increased minimum energy performance standards will lead to an instant, and permanent shift in the supply curve for manufacturers of products which fall beneath the new standards.

86. Business consumers that are the end-users of these products will also see reduced energy costs. Since these energy savings would be automatic through use of their compliant purchases – and not from a change in behaviour – we also consider these to be direct.

[30] Business Impact Target: statutory guidance, 2019. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/776507/Busines__Impact_Target_Statutory__Guidance_January_2019.pdf

87. These measures could also lead to indirect costs and benefits as the removal of lower performing products could also drive innovation in energy efficiency.

88. Our trade sector analysis has lead us to assume a 87% import scenario for lighting products (see Section 9.6).

89. In Table 5 below, we present the direct costs of lighting products, showing a positive Business NPV.

**Table 5**: T**he overall direct costs and benefits to GB businesses.**[31]

| Summary of costs and benefits to GB businesses on a Retail Price Basis (2021 prices)**Costs/benefits, £m** | **Direct to Business** |
|---|---|
| Costs to manufacturers/business purchasers | 300 |
| Costs of increase in non-traded CO2e emissions (extra heating) | 0 |
| **Total Costs** | **300** |
| Value energy savings (net) | 1,167 |
| **Total Benefits** | **1,167** |

90. For GB-based manufacturers selling within the GB, the £300m of direct costs determined to be in scope are the:

- **Ongoing costs of producing policy-compliant products**. These include the increased variable costs of, for example, more expensive component parts and/or more advanced/expensive manufacturing processes.
- **Short-term, transitional costs of changing manufacturing processes and becoming familiar with the draft regulations**. Manufacturers will have to invest resources (staff costs) into understanding how this affects them as well as the physical resources required to adhere to the draft regulations, including testing equipment and new IT/software purchases. These are included in the rounding of costs shown above.

91. Given some lighting products are non-domestic products[32], we consider the associated purchase costs to be direct business costs since the requirements will increase the cost of their purchases. However, business consumers that are the end-users of these products will also see reduced energy costs. Since these energy savings would be automatic through use of their compliant purchases – and not from a change in behaviour – we also consider these to be direct. When considering business purchases from GB manufacturers, we need only consider either the manufacturing or purchase costs to avoid double-counting.

[31] It was not possible to accurately quantify the sole benefits to manufacturers of owning the more energy efficient domestic appliances under Option 2.
Note that totals may not appear to add up due to rounding. Total benefits appear larger than elsewhere in the Impact Assessment due to higher retail energy prices.

[32] Commercial directional, commercial non-directional, industrial non-directional, and street lighting are considered non-domestic lighting products (see Table A.3 for further detail).

92. Reduction in greenhouse gas emissions and improvement in air quality are assumed to be benefits for the wider society and have, therefore, not been considered for businesses.

### 4.9.2 Total costs and benefits to business

93. Direct benefits to businesses are incurred through spending less on energy as end-users of more energy efficient lighting. These benefits appear larger than the social benefits recorded in the net-present-value calculations in section 9.1 because the electricity is valued at retail prices and not long run variable prices. The retail prices account for taxes and other non-variable cost components which businesses will save due to these measures.

94. The impact on GB manufacturers under the lead policy option will likely be moderate, given the GB lighting sector is only partially focused on the manufacture of lighting products, particularly LED luminaires; the majority of the sector is believed to focus on lighting solutions/services rather than manufacturing.

95. Most of the light sources sold in the GB are imported either from Osram's and Philips' plants in Germany and the Netherlands, respectively, or from manufacturing plants in Asia[33]. Though manufacturing of lighting components has to a large extent moved overseas, GB suppliers of light sources and lighting systems are still managing to maintain a large share of component assembly in the GB.

96. A major current issue highlighted by industry is the import of cheap lighting products from the Far East, which is leading to price and quality erosion of products on the GB market (e.g. for LEDs). This means that many GB companies can only engage at the higher end of the market, focusing on high-quality, system solutions and bespoke offerings (e.g. improved quality of lighting) as major selling points.

97. In turn, many customers of GB manufacturers and service providers tend to be located at the higher end of the market, focusing on quality of lighting and customer service provision alongside energy efficiency and price. Examples of major customers of both indoor and outdoor lighting for both GB manufacturers and service providers, include schools, sport facilities, offices, hospitality (hotels, restaurants), care homes, hospitals. Business-to-business trading is important to some suppliers, with key clients being higher-end wholesalers, architects and primarily contractors.

98. According to a leading UK lighting association, speaking on behalf of their members, UK manufacturers are exporting commercial luminaires and

[33] ICF Field Research (October 2018 – January 2019). Research consisted of 37 responses to an e-survey send out to 400 lighting designers, manufacturers and installers either with operations in the UK or selling into the UK market. Additionally, there was 14 telephone interviews with companies. Although the sample size was small and cannot be fully representative of the UK lighting industry, the findings provided good indications of current sector capabilities and strengths, as well as important perspectives.

systems, particularly into the EU ("by far the biggest export market"), followed by the Middle East and USA[34].

99. Table A.5 shows further information on UK domestic production and trade of lighting equipment.

100. Using the BEIS Impact Assessment Calculator, the provisional EANDCB of the lead policy option is set out in below, alongside the Business NPV and Business Impact Target Score (see table footnotes for more details).

**Table 6: EANDCB and Business Net Present Value for Lead Option**

| | 2022 Prices, 2022 present value (£m) |
|---|---|
| Business Net Present Value | 868 |
| EANDCB[35] | -11.4 |
| Score for BIT[36] | -57 |

# 6 Small and micro business assessment

101. Across all sectors, the UK market is dominated by SMBs, making up 99% of businesses at the start of 2021[37].

102. Such businesses are likely to be disproportionately affected by the transitional costs associated with the lead policy option, particularly around testing and, where possible, amending their products to make them compliant. There are also likely to be fewer alternative products for them to market or recoup losses if a product fell outside of the acceptable efficiency range. Similarly, they may also be disproportionately affected by Option 1 (Do Nothing) and the other discarded options in a scenario where further international standards are introduced as smaller businesses might find it harder to capitalise on the lower levels of regulation in the GB compared with elsewhere, for example, through scaling-up production or bargaining with suppliers.

103. Lighting companies active in the GB LED market are generally lighting services SMEs, which provide development, design and/or installation lighting solutions to commercial and outdoor appliances. It is estimated that roughly half of these companies also manufacture LED luminaires, but it is not clear what proportion are small companies.

[34] ICF Field Research (October 2018 – January 2019). Research consisted of 37 responses to an e-survey send out to 400 lighting designers, manufacturers and installers either with operations in the UK or selling into the UK market. Additionally, there was 14 telephone interviews with companies. Although the sample size was small and cannot be fully representative of the UK lighting industry, the findings provided good indications of current sector capabilities and strengths, as well as important perspectives.

[35] The Equivalent Annual Cost is calculated by dividing the net present value through an annuity rate. This rate can be calculated using the formula: a = (1+r)/r * [1- 1/(1+r)^ t], where r is the interest rate (3.5%) and t is the number of years over which the NPV has been calculated (31).

[36] The BIT score is the annualised net cost or saving to business multiplied by the number of years the regulatory provision is in force.

[37] Business Population Estimates for the UK and the Regions 2021. Available at: https://www.gov.uk/government/statistics/business-population-estimates-2021

104. The current uptake of LED lighting technology that has stimulated demand for LED products (e.g. luminaires) will create opportunities, in particular, for innovative small GB companies, focused on developing and providing smart LED lighting solutions, both within the GB market and overseas. This said, some GB-based suppliers, particularly those with a strong foothold in the EU market and a range that also covers fluorescent lighting technologies which are being removed, may still be impacted.

105. Although the lighting products production market is dominated by larger companies, there is potential for SMB producers of lighting products to be negatively affected by the changes in production associated with the lead policy option. However, those that are the end-users of lighting products will benefit from the new regulation through reduced costs over the lifetime of the products. SMB re-sellers/importers, as well as those that install and service lighting products, will benefit from the new regulation through increased business revenue.

106. While the exact number of such businesses affected by the draft regulations is uncertain, Table 10 shows the breakdown for manufacturing and for those specifically related to lighting products and "other electrical equipment".

**Table 10: Number and proportion of manufacturing businesses (local units, VAT traders and/or PAYE employers) in GB that are small and micro-sized, 2021[38]**

| | Micro (<10 employees) | Small (10-49 employees) | Total |
|---|---|---|---|
| All manufacturing | 113,175 (77%) | 24,490 (17%) | 146,350 |
| Of which … Manufacture of electric lighting equipment | 560 (70%) | 185 (23%) | 800 |
| Of which … Manufacture of other electrical equipment | 560 (72%) | 175 (22%) | 780 |

107. We do not expect the proportion of small and micro businesses impacted by these regulations to change much over the appraisal period. In 2021, 94% of businesses in the lighting sector were classified as small or micro (<50 employees). Business count data over the last 10-years shows that this proportion has increased by just 0.1 percentage points, meaning it has effectively stayed level.[39]

108. To mitigate the impact on small and micro businesses, possible options could be considered including:

[38] ONS: UK business: activity, size and location 2021. Available at: https://www.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/datasets/ukbusinessactivitysizeandlocation Considered UK Local Units in VAT and/or PAYE based Enterprises. All manufacturing includes SIC codes 10-32. Manufacture of electric lighting equipment includes SIC code 2740; Manufacture of other electrical equipment includes SIC code 2790.

[39] NOMIS Business Count Data. Accessed Here: https://www.nomisweb.co.uk/query/construct/submit.asp?forward=yes&menuopt=201&subcomp=

- phasing the transition period; or
- providing an exemption.

109. However, existing regulation relates to products and not manufacturers. An exemption, or a phasing of the regulation, would mean that products would have a 2-tier structure: those manufactured by medium (50-249 employees) and large manufacturers (250+ employees), and those by smaller businesses (10-49 employees). Such an approach would make enforcement activities harder and much more costly as businesses, as well as products, would have to be investigated. Further, if smaller businesses were exempt, such an approach could distort competition between large and SMEs, create a mechanism to bypass the regulations and reduce productivity through loss of economies of scale.

110. We do not expect there to be a difference in the balance of energy savings and purchase costs between small and large businesses. The products covered by these regulations are considered 'disaster purchases', meaning that they are usually only replaced when no longer working. Additionally, a large business is not expected to extract greater energy savings through use of the products. These products are expected to be used at capacity. In a business making efficient use of capital, the size of the business is irrelevant to the energy savings. The consistency through business size across both costs and benefits strengthens the argument that a small business exemption is not necessary.

# 7 Wider impacts

111. This section considers the wider social and environmental costs and benefits of the policy proposal. We have identified five additional assessments which are worth exploring further here because we anticipate that the policy proposal may have some impact. Our analysis is summarised in the sub-sections which follow. The assessments we have undertaken are:

- Competition Assessment Impact Test;
- Small and Micro Business Assessment (SAMBA);
- Wider Environmental Issues Impact Test;
- Statutory Equality Duties Impact Test; and
- Health and Well-being Impact Test.

112. We have not conducted additional analysis for the remaining five assessments for the following reasons:

- Environmental impacts, including greenhouse gas emissions, have already been costed and included in our CBA.
- Sustainable development has also been considered qualitatively. This policy is directly related to energy efficiency and resource efficiency and warrants more in-depth consideration.
- There is no impact on the justice system.

- There is no impact on rural proofing as the policy is not expected to have differential impacts across rural and non-rural areas.
- The policy is not expected to have any impact on human rights.

## 7.1 Competition Assessment Impact Test

113. Considered in this assessment are the effects on competition from our lead policy option. The following questions were considered as to whether the option:[40]

(a) Directly limits the number or range of manufacturers;

(b) Indirectly limits the number or range of manufacturers;

(c) Limits the ability of manufacturers to compete;

(d) Reduces manufacturers' incentives to compete vigorously; and

(e) Limits the choices available to consumers.

114. While the MEPS will remove 50% of the market, inevitably reducing consumer choice in the short run, the concessions ensure that a full range of products is able to remain. We also expect manufacturers to innovate quickly to increase the number of models on the market which can meet the new MEPS. These MEPS should not directly or indirectly limit the number or range of manufacturers because the production of LED chip manufacturing is concentrated amongst a very small number of firms who supply parts to all other lighting product manufacturers (therefore this would not limit new firms' ability to enter the market).

115. Failure to implement the policy could lead to a failure of the fourth Competition and Market Authority condition listed above due to a lack of incentive to continue to improve efficiency when current minimum standards will be far exceeded.

116. It has been concluded that there are no adverse effects on competition from our policy option as manufacturers will still be able to place their products internationally as these will be world leading efficiency standards.

## 7.2 Wider Environmental Issues Impact Test

117. Considered in this assessment are the effects on the wider environment from our preferred policy option. Each of the following questions were considered:

1. Will the policy option be vulnerable to the predicted effects of climate change?

2. Will the policy option lead to a change in the financial costs or the environmental and health impacts of waste management?

3. Will the policy option impact significantly on air quality?

4. Will the policy option involve any material change to the appearance of the landscape or townscape?

5. Will the proposal change 1) the degree of water pollution, 2) levels of abstraction of water or 3) exposure to flood risk?

6. Will the policy option change 1) the amount or variety of living species, 2) the amount, variety or quality of ecosystems?

7. Will the policy option affect the number of people exposed to noise or the levels to which they're exposed?

118. The policy in question has direct benefits accruing from environmental savings. Relevant impacts have been explicitly included in the CBA. Others have not been included (such as the appearance of the landscape and the amount or variety of living species) as they are not in-scope for this policy. It has been concluded that the extent to which environmental impacts are considered in the main body of this assessment is proportionate.

### 7.3 Health and Well-being Impacts

119. Of the social impact tests available, health and well-being impacts have been considered for lighting products. No others are directly related to the regulation of energy-related products and do not appear relevant to this assessment.

120. Health and well-being impacts have been considered with respect to the impact of Temporal Light Modulation (TLM) from lighting products. Temporal Light Artefacts (TLA) are undesired changes in visual perception, induced by a light stimulus whose luminance fluctuates in time (i.e. exhibits TLM), for an observer. TLA is a collective term for three effects that cause fluctuation in visual perception. These effects are:

(b) Flicker – the perception of visual unsteadiness induced by a light stimulus whose luminance fluctuates with time, for a stationary observer in a static environment (approximate frequency range 0-80 Hz);

(c) Stroboscopic Effects - change in motion perception induced by a light stimulus whose luminance fluctuates with time, for a moving object (frequency range 20 – 2000 Hz); and

(d) Phantom Array Effects – perception of a spatially extended series of light spots when making a saccade (rapid eye movement) across a light source that fluctuates with time (frequency range 80 - 11,000 Hz).

121. It is believed that TLM may cause migraine, headaches, eye strain, photo-induced epilepsy or other physiological or behavioural changes in the

observer. There are reports of the adverse effects of flicker, or potentially from the Phantom Array Effect, from lighting at 100 Hz (twice the mains frequency) for photo-sensitive people.

122. There is strong evidence that those who experience headache and migraine symptoms, and possibly some other "non-specific adverse health effects", have the symptoms triggered by flickering light sources at a frequency of 100 HZ and above. The UK Health Security Agency's view is that the number of people affected is probably quite small, but that may be because some people do not attribute the symptoms to the light source.

123. Several further health concerns have been raised, there is however little systematic evidence of additional negative health impacts arising from TLM.

124. Concerns have also been raised regarding the adverse health implications of TLM specifically from LEDs and other energy saving light sources. Light sources that produce flicker that can be perceived, especially strobe lighting, are a well-known risk factor for photo-induced epilepsy.

125. However, current energy saving lighting has not been linked with an increase in cases of photo-induced epilepsy since the flicker frequencies are above those known to trigger the condition[41].

126. Despite this, the existing regulations place functional requirements on LEDs to test for visible flicker. These requirements should reduce the number of lighting products on the market exhibiting some visual effects of TLM and mitigate against any possible health impacts they may bring.

127. We plan to make improvements to the exemption in the current ecodesign regulations which is intended to provide access to non-LED light sources for individuals who are photo-sensitive and affected by LEDs via a medical prescription. The Government received representations from organisations representing people with photo-sensitivity which identified that in GB it is not possible to get a light source on prescription. The consultation on the draft Regulations will propose an alternative means of granting access to alternative light sources for people with photo-sensitivity who are affected by LEDs and will gather evidence on the most practical way the exemption can be implemented. Together these measures are aimed at minimising any health and wellbeing impacts on the population.

## 7.4 Statutory Equalities Duties Impact test

128. We consider there be no impact on groups with the following protected characteristics as a result of the policy proposal, as no evidence has been found to demonstrate any impact: age; gender reassignment; marriage or civil partnership; pregnancy and maternity; race; religion or belief; sex; or sexual orientation.

129. However, we have considered evidence in relation to the policy proposal's impact on the protected characteristic of disability. This is because the impacts of TLM outlined above in the Health & Well-being Impact section can, in some

[41] The Scientific Committee on Health, Environmental and Emerging Risks: Opinion on potential risks to human health of Light Emitting Diodes (LEDs). Available at: https://op.europa.eu/en/publication-detail/-/publication/5b9dfd58-3978-11e9-8d04-01aa75ed71a1/language-en/format-PDF/source-87840423

cases, be considered as a disability (e.g. severe migraines) and is therefore relevant to the Public Sector Equality Duty (PSED). In addition, there is some anecdotal evidence to suggest that LED lighting may cause adverse health impacts for people with a range of photo-sensitivity conditions, with effects ranging from discomfort to seizures and chronic pain. This is relevant to the PSED because some types of photosensitivity condition are considered to be disabilities.

130. Much of the evidence available to support this assessment is anecdotal; the link between LED lighting and these health impacts has not been demonstrated by scientific studies. Nevertheless, on the weight of the evidence gathered, we anticipate that there would be some negative impact on this group as a result of the policy. This negative impact is expected to be small and the evidence to support it is not strong. Therefore, we do not judge there to be a disproportionate impact on groups with the protected characteristic of disability as a result of the policy proposal; and the evidence in favour of the policy benefits is strong enough to justify implementing the proposal, with appropriate mitigations in place. The policy will benefit consumers and businesses by reducing the energy demand from lighting, resulting in lower energy bills. For society as a whole, the reduction in energy demand will reduce carbon emissions from power generation, therefore contributing to climate change mitigation and improved air quality.

131. Further, this negative impact is not introduced for the first time by the policy proposal. The existing ecodesign regulations for lighting products phased out many non-LED technologies from the market across the EU and in the UK and introduced an exemption to mitigate the impact of this on people with a photosensitivity condition. As the policy proposal extends the phase-out of non-LED light sources in GB even further, the negative impacts are not new but are exacerbated slightly.

132. As the negative impacts are experienced by a small group (the exact size of which is not known) and cannot be directly linked to LED lighting, we think it is proportionate to continue the existing mitigation of an exemption to enable this group to access non-LED light sources in a controlled way (i.e. they would only be available to people in this group). We are undertaking work to reform this exemption in response to feedback from stakeholders representing people with a photosensitivity condition, which highlighted barriers to the operation of the exemption in its current form. We will seek to improve the operability of the exemption so that it supports people with a photo-sensitivity condition to access the products they need, whilst also maintaining the integrity of the policy intention to move the market for lighting products to higher levels of energy efficiency. We feel this approach is proportionate to the problem, as far as it has been evidenced.

133. We have considered alternative options which could also avoid the negative impact on this group. Firstly, we could provide an exemption for people with a photosensitivity condition but not deploy this in a controlled way, which would further reduce barriers to this group being able to access non-LED light sources however would be at high risk of being used as a loophole for suppliers to continue selling highly inefficient light sources to the general

public, which would have an adverse impact on consumer and business energy bills and on the reduction of energy demand and emissions.

134. Secondly, we could remove the need for an exemption and allow these non-LED light sources to remain on the market (by requiring them to meet a much lower, achievable energy efficiency standard). This would enable people with a photosensitivity condition to easily access non-LED light sources and would enable their continued use in public spaces and buildings. For the majority of the population, access to these light sources would not be necessary and so the impact of this option would be that consumers and businesses would continue to install inefficient lighting products, which would cause them to miss out on reductions in their energy bills and energy demand, leading to lower carbon emissions savings across the economy.

# 7 Summary and Implementation Plan

## 7.1 Summary

135. There is potential for further environmental improvement within the lighting products market. In a Do Nothing scenario, the existing ecodesign requirements would continue to apply to lighting products placed on the GB market but would become increasingly unambitious as technological progress increases lighting product efficacy over time; in 2022, the current minimum energy performance standards in force already lag behind what is technically feasible, meaning that many inefficient products remain on the market despite the availability of more efficient alternatives. Without updating the requirements, businesses will not be incentivised to produce more energy and resource efficient products and consumers would be exposed to low cost energy-inefficient lighting products.

136. The preferred policy option addresses these market failures by updating the ecodesign requirements to set higher minimum energy performance standards for lighting products.

137. The main analysis used is taken from the EUPP model (see Annex 1, and Annex 2)

138. The benefits identified are:

- reduced energy costs[42] due to improved energy efficiency;
- likely increase in innovation due to manufacturers having to produce more efficient products;
- traded carbon savings / reduction in greenhouse gas emissions[38], and
- improved air quality[38];

139. The costs identified are:

- expected increased manufacturing costs[38] to produce more efficient products (this is inclusive of transitional costs and assumed to be

[42] This cost/benefit was quantified.

passed onto consumers through the supply chain resulting in increased prices[38]);

- transitional (one-off) costs of implementing the policy, including familiarisation costs of understanding the requirements;
- reduction in consumer choice as some product types will be removed from the market; however, these are likely to be replaced by new, more efficient products;
- 
- enforcement costs of imposing requirements, but these have a net zero cost.

140. Quantified costs and benefits give a NPV of £1,454M over the appraisal period (2021/22 to 2050/51).

## 7.2 Implementation and Delivery Plan for Lead Option

141. To implement the lead option, BEIS must consult on draft secondary legislation before laying this in Parliament. During the public consultation process, BEIS will undertake stakeholder engagement to gather views on the proposal to inform the final policy and its Impact Assessment. This engagement will raise stakeholders' awareness of the proposed policy change and will ensure any previously unidentified risks or impacts are brought to the Department's attention ahead of delivery. Engagement with trade bodies will be key to ensuring product suppliers are aware of the proposed policy changes.

142. Once the legislation is approved by Parliament, the Office for Product Safety and Standards (OPSS), which is the appointed UK Market Surveillance Authority responsible for the enforcement of ecodesign requirements, will communicate the policy change and key dates to suppliers to ensure they are ready for the change.

143. Once the new regulations are in force, the OPSS will be responsible for enforcing the new requirements via their enforcement policy[22]. The aim of this is to undertake risk-based enforcement activities which may lead to the use of proportionate sanctions alongside supporting stakeholders to understand and comply with the requirements through the provision of advice and guidance. Enforcing the policy in this way will ensure the estimated energy bill and carbon emissions savings are realised.

144. The costs associated with enforcement may increase due to checks connected with additional product functionality and product information requirements. However, these costs are unlikely to be significant; the opportunity cost of staff familiarisation with the new guidance would form part of OPSS's routine activities after the new measures are implemented. Further, the new regulations will replace the existing regulations, so there will not be an increase in the scope of products that OPSS must enforce.

### 7.3 Post Implementation Review

145. We plan to undertake a light-touch Post Implementation Review (PIR), conducted no later than two years after the application date of the second tier of these Regulations. The preferred option will introduce two consecutive tiers of minimum energy performance standards in 2023 and 2027 respectively, which means that there is already a future update built into the policy at the point of implementation. It therefore makes sense to initiate a PIR process after the second tier has come into force in 2027. This review would inform any adjustments or updates needed to the policy to ensure it continues to meet its objectives.

146. We considered setting the date for the PIR to allow enough time to adjust the MEPS, concessions or exemptions before tier two requirements come into force in 2027, where evidence suggested this would be appropriate. However, this approach has several challenges. Firstly, we expect the market to take one to two years to adjust to the new MEPS, which means we may not be able to gather meaningful data to inform a PIR until 2025/2026. This would only allow a short time for consultation on proposed changes and for legislation to be taken through Parliament before any changes were to take effect in 2027. Secondly, given the level of ambition within the preferred policy option, suppliers of lighting products will need to invest in re-developing products to meet the tier two requirements in 2027, which they will be incentivised to do in order to avoid severe market impacts. This means that suppliers will benefit from certainty around what requirements will apply and when; whereas planning a PIR mid-way through the interval would remove some of this certainty, which could impede investment in technological advancements.

147. Between 2023 and 2029, we will undertake light-touch market monitoring of the policy. If we found market information which suggested that changes were required to the policy ahead of tier two being implemented in 2027, we could bring forward this review and undertake a fuller investigation to inform an appropriate policy response.

148. We have opted to plan a PIR to take place two years after implementation of tier two in 2027 as this will allow enough time for the market to adjust to the new requirements. Whilst this PIR would commence data gathering shortly after tier two has come into force in 2027, we anticipate that the market will have prepared well in advance for this tier so market data should clearly show the impact by that time.

149. Considering the expected impacts of the Regulations, we think a light touch PIR will be proportionate. We expect the review will largely be a qualitative assessment of the impacts of the draft Regulations supported by quantitative analysis where possible.

150. The PIR will use available evidence to assess the impacts of the Regulations - in particular, whether they have met the objective of phasing out lower energy efficiency lighting products from the market and shifting production to higher efficiency models. The PIR will also review the case for maintaining the concessions for certain lighting technologies and other exemptions which may no longer fulfil the policy objective or may even have become obsolete by 2028. It will aim to assess the extent to which the Regulations have led to

increased uptake of more energy efficient lighting products. The review will interrogate whether these Regulations remain the best option for achieving energy, carbon and bill savings from lighting products. The findings of the review will be used to inform future policy development.

151. In order to assess the impacts of the Regulations, the PIR will aim to assess the energy consumption of lighting products on the market at the time of the review and to compare this to the predictions made in this Impact Assessment. To do this sales data, stock data, product lifespan estimates, product energy consumption, and market observations will be obtained at the time of the review.

152. However, this quantitative analysis will have limitations due to the difficultly in isolating the direct impacts resulting from the Regulations. The sales data will be impacted by external factors including, but not limited to, advancements in technology and changes in consumer preferences (for example as consumers become more climate aware). To address this, the PIR will use a qualitative analysis to assess the extent to which the Regulations were a significant factor in any changes in the market.

153. We anticipate that the PIR will also use market observations (for example breaches such as putting products on the market that do not fully comply with the requirements of the Ecodesign regulation) as well as consultation with industry. We expect the review will focus on whether the Regulations have resulted in only lighting products that comply with the requirements being placed on the market, rather than attempting to quantify the energy savings of their use.

154. We predict that measuring direct energy savings from improved ecodesign requirements for lighting products would be difficult in the context of the GB energy market due to the relative size of savings to total energy use as a whole. We also believe it would be disproportionate to launch a GB-wide study evaluating the quantitative impact of the Regulations in a more fair and representative way. Hence why the PIR would largely be a qualitative assessment, supported by quantitative analysis where possible.

155. In addition, we expect the review to consider whether, as a result of technological advances, further savings could be made by setting better Ecodesign and Energy Labelling requirements, or whether these Regulations remain the most effective option for achieving greater traded carbon savings from lighting products. To achieve this, data on the contemporary stock of lighting products at the time of the review would need to be collected, making sure that the information includes energy efficiency of the products. The PIR would seek to understand the scope for future energy and resource efficiency improvements in the product through a combination of market research and consultation with relevant stakeholders.

156. Further, an assessment on the development of global regulatory standards, particularly in the EU, may help to inform GB policy and whether GB legislation requires updating, for example by increasing the stringency of the requirements, broadening the scope of the requirements, or introducing further circular economy principles. This will help to establish if the objectives of the regulation remain appropriate.

# Annex 1 Additional Information

157. This annex sets out additional information which compliments the main text of the IA. The supplementary tables below give light to the arguments for intervention provided in the impact assessment.

### Table A.1 :Estimated lighting product lifetimes[43]

| Lighting Product Sector[44] | Lifetime (years) |
|---|---|
| **Domestic non-directional** | 36 - 40 |
| **Domestic directional** | 6 - 37 |
| **Non-domestic non-directional (office)** | 7 - 9 |
| **Non-domestic industrial** | 3 - 5 |
| **Non-domestic directional** | 2 - 5 |
| **Non-domestic street** | 8 - 10 |

Data in Table 1 above represents a typical product lifetime. However, these lifetimes can vary due to product. For example, products sometimes fail and require early replacement. Another example is people moving to a new home, or property buyers (e.g landlords), who choose to purchase brand new products (lightbulbs for example) for their new property.

### Table A.2: Summary costs and benefits of updating the ecodesign requirements for lighting products (Option 2)

| Group | Type of cost / benefit | Included in CBA or described qualitatively? |
|---|---|---|
| **Business/ industry** | **Costs** | |
| | Transitional (one-off) costs of implementing the policy, including familiarisation costs of understanding the requirements. These are likely to be minimal, however, as requirements for lighting products already exist. | Included in CBA |
| | Increased manufacturing costs including any such transitional costs. These are assumed to be passed onto consumers - any increase in costs however would be offset by energy savings. | Included in CBA. |
| | **Benefits** | |

[43] Lighting product lifetimes are presented as ranges because various products are included under each 'Lighting Product Sector'. For example, domestic directional lighting includes HAL, GLS and LED lamps. See the Task 2 report (para 2.6) and Task 3 report (para 3.2 and 3.3) for detailed descriptions on individual lighting product lifetimes and usage in the Model for European Light Sources (MELISA). The reports are available at: http://ecodesign-lightsources.eu/documents

[44] See paragraph 16 for definitions of lighting products.

| Group | Type of cost / benefit | Included in CBA or described qualitatively? |
|---|---|---|
| | Product requirements facilitating trade through greater regulatory equivalence. | Described Qualitatively. |
| | Possible increased innovation leading to longer lasting, more efficient products in order to compete in the global market. | Described Qualitatively. |
| | Environmental benefits of improved resource efficiency, for example, improved recyclability and repairability. | Described Qualitatively. |
| **Consumers (including businesses who purchase products)** | **Costs** | |
| | Higher price of products at the point of purchase (although offset by lower energy bills). | Included in CBA. |
| | Reduction in consumer choice (if some product types are removed from the market). This is balanced against the benefit above of innovation, leading to new products on the market. | Described Qualitatively. |
| | **Benefits** | |
| | Lower energy use over the lifetime of the product due to increased energy efficiency performance. | Included in CBA. |
| **Wider society** | **Costs** | |
| | Enforcement costs of imposing requirements. Costs are assumed to be negligible compared with the costs of products especially since efficiency requirements already exist for lighting products. | Described Qualitatively. |
| | **Benefits** | |
| | Lower electricity system costs – due to a reduction in energy use of the products. | Included in CBA. |
| | Traded Carbon savings/reduction in greenhouse gas emissions. | Included in CBA. |
| | Air quality improvements. | Included in CBA. |
| | Possible creation of new jobs driven by the need to innovate and improve. | Described Qualitatively. |

## Table A.3: Lighting Products Model Technologies and Regulations

| Model Sector | Regulation in the baseline scenario | Sub-technology |
|---|---|---|
| **Domestic non-directional** | The Ecodesign for Energy-related Products and Energy Information (Lighting Products) Regulations 2021 | GLS (general lamp service – incandescent)<br>Halogen<br>CFL (compact fluorescent)<br>LED (light emitting diode) |
| **Domestic directional** | The Ecodesign for Energy-related Products and Energy Information (Lighting Products) Regulations 2021 | GLS, halogen, LED |
| **Non-domestic non-directional (office)** | The Ecodesign for Energy-related Products and Energy Information (Lighting Products) Regulations 2021 | Linear fluorescent lamps including T12, T8 Halophosphor, T8 Triphosphor, T5, and LED equivalents |
| **Non-domestic industrial** | The Ecodesign for Energy-related Products and Energy Information (Lighting Products) Regulations 2021 | Mercury vapour, metal halide, high pressure sodium, low pressure sodium, LED equivalents |
| **Non-domestic directional** | The Ecodesign for Energy-related Products and Energy Information (Lighting Products) Regulations 2021 | Low voltage halogen, mains voltage halogen, compact metal halide, low voltage LED, mains voltage LED |
| **Non-domestic street** | The Ecodesign for Energy-related Products and Energy Information (Lighting Products) Regulations 2021 | Mercury vapour, metal halide, high pressure sodium, low pressure sodium, LED equivalents |

## Table A.4: Manufacturers' by value, Lighting Products (2016)

| Lighting Product | Lighting Manufacturing - Sales, 2016 | |
|---|---|---|
| | £ '000 | % |
| **Ceiling and wall lighting (chandeliers, luminaires)** | **400,125** | **32%** |
| **Electric lamps and lighting fittings** | **319,815** | **26%** |
| **Illuminated signs** | **215,869** | **17%** |
| **Other light fittings** | **42,201** | **3%** |
| **Light sources** | **64,251** | **5%** |
| **CFL** | - | N/A |
| **GLS** | - | N/A |
| **HAL** | 6,608 | 1% |
| **LED** | 15,831 | 1% |
| **Other lamps** | 1,170 | 0% |
| **Filament other** | 1,115 | 0% |
| **LFL** | - | N/A |
| **Discharge other** | 11,862 | 1% |
| **UV IR ARC** | 27,665 | 2% |
| **Other light products** | **199,071** | **16%** |
| **Total** | **1,241,332** | **100%** |

## Table A.5: UK imports and exports of lighting technologies (£m, 2014-2016)

| Category | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|
| **Imports** | **2,024** | **2,245** | **2,349** | **2,627** |
| **EU** | 1,033 | 1,142 | 1,117 | 1,254 |
| **Non-EU** | 991 | 1,103 | 1,232 | 1,373 |
| **Export** | **697** | **788** | **812** | **850** |
| **EU** | 417 | 482 | 499 | 511 |
| **Non-EU** | 280 | 306 | 313 | 339 |
| **Trade deficit (IMP-EXP)** | **1,327** | **1,457** | **1,537** | **1,777** |
| **EU** | 616 | 660 | 618 | 743 |
| **Non-EU** | 711 | 797 | 919 | 1,034 |
| **Trade deficit (EXP/IMP)** | **34%** | **35%** | **35%** | **32%** |
| **EU** | 40% | 42% | 45% | 41% |
| **Non-EU** | 28% | 28% | 25% | 25% |

Source: ONS, 2017. UK Trade in goods by Classification of Product by Activity time series dataset, Quarterly and Annual. Available at: https://www.ons.gov.uk/businessindustryandtrade/internationaltrade/datasets/uktradeingoodsbyclassificationofproductbyactivity [Accessed 22 March 2020]

## Table A.8: Impacts considered and included in our assessment

| Does your policy option/proposal have an impact on…? | Assessed? | Section |
|---|---|---|
| Statutory equality duties | | |
| Statutory Equality Duties Impact Test guidance | Yes | Section 7 |
| Economic impacts | | |
| Competition Assessment Impact Test guidance | Yes | Section 6 |
| Small and Micro Business Assessment | Yes | Section 6 |
| Environmental impacts | | |
| Greenhouse Gas Assessment Impact Test guidance | No | - |
| Wider Environmental Issues Impact Test guidance | Yes | Section 7 |
| Social impacts | | |
| Health and Well-being Impact Test guidance | Yes | Section 7 |
| Human Rights Impact Test guidance | No | - |
| Justice Impact Test guidance | No | - |
| Rural Proofing Impact Test guidance | No | - |
| Sustainable development | | |
| Sustainable Development Impact Test guidance | No | - |

# Annex 2 Key assumptions and modelling approach for Lighting Products

158. This annex sets out the modelling approach used in this Impact Assessment, the detail of the costs and benefits analysed in the CBA as well as the key assumptions made.

## A2.1 The model

159. For 20 years, the UK has been developing end-use energy models to examine the likely impact from policy measures addressing energy consumption of Energy Using Products (EUP) such as lighting and household appliances. The model used in this Impact Assessment has gone through various iterations including via the Government's Market Transformation Programme (MTP) and, currently, the Energy Using Products Policy (EUPP).

160. In 2012, the model was extensively peer-reviewed which has led to further improvements and was awarded a rating of over 90% by BEIS's independent Modelling Integrity Team in June 2018 – the level required for all business-critical models. All inputs and data sources for the modelling carried out for this assessment were reviewed and quality assured before modelling runs were implemented.

161. The main purpose of the model is to assess the impact of policies around EUPs. Its outputs include the likely costs (in particular, higher costs resulting from the purchase of new products); and benefits (primarily in the form of energy and traded carbon savings from using more energy-efficient products).

162. The model uses a "bottom-up" approach, allowing detailed scenarios to be modelled for specific products such as the setting of minimum energy performance standards (MEPS). Each product and scenario require specific inputs to be calculated/estimated, including:

- Stocks and/or sales of EUP being modelled (including breakdown by technology type);
- The lifespan of the EUP;
- The energy consumption of EUP (including by mode type and mode such as "on" or "standby");
- The level of usage of EUP (hours/year); and
- The price and value estimates, to calculate costs and benefits.

163. Comparing the outputs of the model under different scenarios, the model quantifies the:

- **Additional purchase/production costs** associated with new products (typically incurred by the consumer, and/or other groups such as industry or government);
- **Benefits of energy savings** over the lifetime of the products from switching to more energy efficient products;
- **Costs and benefits of non-monetary factors** such as improved air quality and a reduction in emissions; and

- **Costs of the additional heating requirements** due to the heat replacement effect. This is the extra heating required in the colder months to replace the reduced waste heat loss from more efficient products. It is only considered for domestic products since, for non-domestic use, it is considered to be cancelled out by reduced cooling costs in the warmer months.

## A2.2 Input variables

### Stocks and/or sales

164. The stock of EUPs refers to the number of products, along with their technical characteristics, owned by consumers and businesses during a given year. Flows into the stock include new purchases (sales) and flow out of the stock arise from disposals. Stock/sales figures are independent of other inputs, such as costs.

165. The composition of the stock in terms of its energy efficiency and the level of usage of the products is also required to determine energy use from a class of EUPs. The average energy efficiency of the stock evolves according to the rate at which EUPs at one level of energy efficiency are replaced by EUPs of another level of energy efficiency.

166. In the context of EUPs, the rate of increase in energy efficiency over time depends on the rate at which older, less energy-efficient products are replaced by newer, more energy-efficient products which, in turn, may be affected by the policy being assessed.

167. If the data on the stock of EUPs from year to year are more complete than the data on new purchases (sales), then stock data and projections are used as an input to the model and sales in each year are calculated according to the rate of disposal and end-of-year stocks. This is called a “sales from stock” model. Alternatively, if the sales data are more complete than the stock data, then these figures are used as inputs and the stock is calculated as the sum of sales and disposals. This is called a “stock from sales” model.

## A2.3 Lifespan (years)

168. The lifespan of a cohort of EUPs is modelled according to a normal distribution. Each cohort has a mean lifespan (the age at which half of the cohort is disposed of) and a corresponding standard deviation indicating the level of variance in that lifespan. The model considers the technical/economic lifespan, accounting for products being replaced before they are irreparable (for example, a mobile phone being replaced at the end of a fixed-term contract).

## A2.4 Costs (£)

169. The following prices are considered in the model:

- the **purchase costs of new products** represent the per-unit cost of inflows to the EUP stock;
- **energy prices** which are applied to the energy savings relative to the counter-factual case;

- **carbon prices** to monetise the benefits of lower emissions as a result of the energy savings;
- the **value of improved air quality** from the energy savings; and
- real prices are used as at the baseline year for the model and are discounted, as per Green Book guidance, at the social time preference rate of 3.5%[45].

### Level of usage (hours/year)

170. The number of hours that each product is in use per year is estimated.

### Energy consumption (kW)

171. In each year, energy demand is given by annual usage (hours/year) multiplied by the average efficiency of the stock. The annual usage figures can be differentiated by technology and operating mode (e.g. "on" versus "standby") and may also differ over time. Estimates of greenhouse gas emissions are calculated from the energy demand figures by applying emissions factors to the series from the *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal*[46].

## A2.5 Modelling assumptions

172. The model does not link Costs and Stocks/Sales, i.e. if the cost of a product increases in the model, stocks/sales figures are unaffected and vice-versa. Similarly, the model assumes that a change in the price of energy will only lead to a change in the value of energy savings (and not the effective lifespan of products).

173. The model does not address decisions about whether to replace a product before the end of its life, if it becomes cost effective to do so, or which of the candidate technology types is the preferred replacement choice.

174. All manufacturing costs are assumed to be passed on to consumers through the price of the product.

## A1.7 Specific modelling for lighting products

175. In this section, specific details are provided for the modelling of lighting products.

176. The proposed ecodesign requirements for lighting products set minimum energy performance standards.

177. The draft Regulations use threshold efficacy limits (Lumens/Watt) and concessions to account for light source characteristics. The limits, inclusive of the various factors, comprised the set of minimum energy efficiency standards affecting lighting. These limits, when compared against typical values of different lamp types, showed that some lamp technologies would be removed from the market whilst others would remain. The proposed ecodesign

[45] The Green Book: Central Government Guidance on Appraisal and Evaluation, March 2022. Available at: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-govemnent.

[46] Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal, October 2021. Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal.

requirements are to be enacted in two stages (1 September, 2023 and 1 September, 2027).

178. Analysis of the ecodesign requirements, inclusive of the various factors, suggested the phase-out of the following lamp types:

- High-pressure sodium (HPS), metal halide (MH) and low-pressure sodium (LPS) lamps

179. These are commonly used in street and industrial lighting applications but would be phased out in the absence of policy anyway due to lowering LED costs and improving functionality.

180. The ecodesign requirements suggest efficacy improvements will be required for other types of lamps:

- LEDs: Minimum efficiency requirements increased by 15%. This will be ambitious for DLS LED, but less so for non-directional light sources (NDLS) and linear fluorescent tubes (LFLs).

181. The models were based on the removal of the lamp types above as well as performance improvements in LEDs. It is also worth noting that the expected uptake of LEDs over time was also included in the models.

182. The following table shows the high-level inputs into the model along with the sources behind the values.

183. The models were stock-based and were derived using a variety of sources which are outlined in Table 18.

**Table A2.1: Overview of the key inputs into the CBA for lighting products**

| Variable | Source(s) | Values/assumptions |
|---|---|---|
| **Stocks/sales (Same under both options)** | [1] Highways Electrical Association (HEA) Yearbook (2006-2015)<br>[2] Department for Transport (DfT) Growth Rates of Roads in Great Britain (2005-2014)<br>[3] US Department of Energy Solid State Lighting Projections<br>[4] Building Energy Efficiency Survey (BEES) (2015)<br>[5] Valuation Office Agency (VOA)<br>[6] Building Energy Efficiency Survey (BEES) (2017)<br>[7] Lighting Industry Federation Study of Installed Directional Bulbs in GB Households (2010)<br>[8] Lighting Industry Federation Study of Installed Directional Bulbs in GB Households (2007)<br>[9] Lighting Industry Association (LIA) | LED uptake was included in the models.<br><br>For street lighting, data points for 2006-2015 were used and then for 2016-2050, projections were based on [1] using a 0.14% annual growth rate, derived from [2].<br><br>For commercial directional lighting, it was assumed that halogen lamps remained on the market until the end of 2020 (to allow suppliers to sell off existing stock), with sales falling to zero in 2021. We assumed sales shifted to mains voltage (MV) LEDs because swapping to low voltage halogens (LV HAL) would require installation of a new fixture (with an MR16 2 pin fitting instead of GU10) and transformer to convert mains voltage to low voltage. The existing regulation allows LV HAL to continue being sold in the reference scenario. Proportions by type of lamp to 2015 were taken from the 2012 Non-dom Directional lighting model policy scenario. Post-2015, the proportions were adjusted using [3] in order to incorporate the LEDs. The proportions were combined with absolute stock values derived from [4]. Pre-2015 and post-2015 values were based on the stock from [4] and an average growth rate was derived from [5].<br><br>For commercial non-directional lighting, the reference scenario included the impact of the existing light sources regulation and the removal of the fluorescent lamp exemption in the RoHS Directive. The light sources regulation bans T8 lamps from the market in a single |

| | | |
|---|---|---|
| | | stage in 2023 and the model was updated to reflect this. It was assumed that all lamps would shift to LED T8 retrofits as this meant purchasers could use the same luminaire. A shift to T5 lamps would require either a change in luminaire or changes to sockets and ballasts. The labour and extra cost were additional reasons to keep the same luminaire. The proposed T8 ban in 1 September 2023 was assumed to begin in 2024 as suppliers are allowed to sell off existing stocks. Thus, sales proportions of T8 Triphosphor lamps (T8 Tri) drop to zero in 2026. All former T8 Tri sales were assumed to shift to LED lamps because T5s cannot be retrofitted to T8 fixtures without extra parts (socket adaptor, £1, and new ballast, £10) and labour. The expected cost of extra parts, labour and T5 lamp itself (£1) appear to exceed the cost of a LED T8 replacement (£11). Because they match or exceed T5 performance, we assumed T5s would not be used to replace T8s. Finally, T5 phaseout in the reference and policy scenario was based on the uptake of LED lamps for this sector based on [3].<br><br>For industrial lighting, stock values were based on floor areas (m2) from [6] and typical lux levels in industrial end-uses (based on the SLL Lighting Handbook (2018) to estimate the number of lamps required to illuminate the total floor area. The reference scenario contained impacts from the single eco-design regulation. No high intensity discharge lamps (HIDs) were removed from the market.<br><br>Domestic directional and non-directional stock proportions were based on historical splits from [7]. |

| | | |
|---|---|---|
| | | Growth over time based on expert assumption that directional lamps never exceed non-directional ones.<br><br>For domestic directional lighting, reference scenario values included the impact of the single eco-design regulation. The ecodesign regulation will prohibit the re-stocking of all directional halogens from the market on 1 September 2021. However, suppliers will still be allowed to sell their existing stocks. Given that mains voltage lamps are still available from smaller retailers and online despite being banned in 2016, it was assumed that a decreasing proportion of halogen lamps will still be sold for 3 years after the ban is enforced. The decreasing proportion was based on the inverse lifespan of a halogen lamp (1/3.5) as no evidence was available to suggest a more precise approach. LEDs consume around 10% of the electricity of halogens, meaning the reference scenario consumption is lowered considerably. Note that GLS lamps were banned in the baseline due to the previous regulation (1194/2012). As such, no savings or costs were attributed to the GLS ban (where the stocks fall to zero by 2020).<br><br>For domestic non-directional lighting, UK Household and avg. bulbs/hh values were combined to estimate total UK domestic stock. Bulbs per HH based on two datapoints (2006, 2012) with compound annual growth rate (CAGR) used to interpolate. Post 2013 values held static due to lack of evidence. Non-directional new sales were split into different technologies, based on stock by technology proportions. These proportions were based on two datapoints from [8][7] in 2007 and 2010 with gaps filled in |

| | | |
|---|---|---|
| | | using linear interpolation. New sales data from [8] was applied to estimate new stock.<br><br>The reference scenario assumptions assumed a shift to majority LED sales in 2019 (1 year after the stage 6 halogen ban from the previous ecodesign regulation comes into force. The shift to mostly LEDs instead of CFLs was assumed because the price was comparable but the LED light quality and start up times were much better than CFLs. CFL sales post 2019 reduces using an inverse lifespan assumption until sales fall to zero by 2024. It was assumed there would be no new sales in the baseline of CFIi (CFLs with integrated ballast), so the policy scenario is assumed to have no impact on domestic non-directional lamps. Therefore, the sales splits were assumed to be the same as the reference scenario.<br><br>**Risk: Low – High.** A variety of data was used, with some data being more robust. The risk is deemed low for street lighting and for LED directional/non-directional uptake. There is medium risk for commercial and industrial lighting as the data is older. Finally, the risk is high for domestic directional/non-directional because there was limited data on lamps per UK household and some proportions were only based on old data, with new data only accounting for LED technology. |
| **Level of usage in hours/years (same under both options)** | [1] Model for European Light Sources Analysis (MELISA) (2015) | The average usage of all other lighting products per year were based on 2006-2030 projections. |

| | | |
|---|---|---|
| | [2] Analysis of street lighting in the United Kingdom Section 4.2 (1997)<br>[3] MTP Street Lighting Model (2010)<br>[4] BRE Retail Lighting Survey (2010) | For all directional and non-directional lighting, weighted values were calculated based on average values from [1]. Street lighting values were based on [2][3]. Commercial and industry lighting usage values were based on [4].<br><br>**Risk: Low - Medium** as usage affects the model savings significantly. Data was of a good quality, but some data was older. Usage for street lighting is also unlikely to change over time. |
| **Cost of product (different under both options)** | [1] US Department of Energy Solid State Lighting Projections<br>[2] Lighting Industry Association (LIA)<br>[3] Model for European Light Sources Analysis (MELISA) (2015)<br>[4] Department of Business, Energy and Industrial Strategy (BEIS) GDP Deflators<br>[5] Department of Business, Energy and Industrial Strategy (BEIS) Emissions and Valuation Projections (2018) | Cost was measured in £s. Cost inputs were the basis for the cost estimates in the CBA analysis. Cost assumptions were simple and held static over time, which may over-estimate costs.<br><br>For street lighting, improvement costs for LED lamps and ballasts were estimated using [1] for 2012-2050. Non-LED lamps were based on LIA 2019 data.<br><br>For commercial directional lighting, the model only contains policy costs where product switching occurs, as the proposed policy does not affect lamp efficacies.<br><br>For commercial non-directional lighting, lamp prices replacements were artificially inflated due to assigning a proportion of replacements being LED Luminaires. However LFL LED lamp 2022 model updates assumes no impact due to MEPS as all product switching is attributed to RoHS exemptions removal in Feb 2023. Therefore no costs should be incurred.<br>For industrial lighting, because there was no impact assumed due to the proposed single lighting regulation, no costs were assumed. |

| | | |
|---|---|---|
| | | For domestic directional lighting and non-directional lighting, 2019 lamp prices were averaged from the first 5 months of 2019 [2] and inflated each year using [5].<br>○ For directional, policy costs were incurred via product switching from halogen to LEDs. No additional costs were assumed to be incurred as LED efficacy improvements were expected to occur naturally and not as a result of the regulation. Costs only change over time due to inflation. No reductions due to learning curves or economies of scale were assumed.<br>○ For non-directional, it was assumed that there were no policy costs because the MEPS requirements did not exceed the efficacies in the reference scenario. In addition, no technology switching was expected to occur due to the regulation as it was expected the majority of purchases would shift to LEDs after the halogen ban in the reference scenario.<br><br>**Risk: Low – Medium** as the costs for all, except street lights, were based on 2019 lighting models |
| **Technology (different under each option)** | [1] US Department of Energy Solid State Lighting 2016 Projections<br>[2] Model for European Light Sources Analysis (MELISA) (2015)<br>[3] European Commission 'How Many Lumens Do You Need?'<br>[4] BRE Retail Lighting Survey | For street lighting, the lamp technology remained the same under both Option 1 and Option 2, except for LED lamps which were included in Option 2, using [1].<br><br>For commercial directional lighting, LED values were based on [1]. Post 2030 values were kept static to 2050 due to lack of evidence. Other lamp types were based on [4]. |

| | | |
|---|---|---|
| | | For commercial non-directional lighting, average wattages and usage values from [2] were used to develop an average energy demand per year: Average energy demand x average usage = per unit kWh/yr energy consumption. These values were held constant over time due to lack of better data. The exception was LFL LED, which uses [1]. These improvements were expected to take place without regulation, so are included in the reference and policy scenarios. Lamp types that were banned in the policy scenario would not be attributed energy consumption values in the model if there was no attributable stock.<br><br>For industrial lighting, changes resulting from the policy scenarios required technology switching to LEDs.<br><br>For domestic directional lighting, Halogen and GLS average new demand values were taken from [2]. Directional lamp wattages were averaged using different directional lamp types if they were available. LED efficiencies and average new demand values from [2] based on 2013 estimates of 63 lumens per watt and 9.55 typical wattages for residential directional lighting. The reference scenario LED efficacies were improved over time in line with [1]. Historical values were in line with EU levels, so it was assumed that the projections (based on historic datapoints and a logarithmic curve) were comparable to EU/UK.<br><br>For domestic non-directional lighting, wattages from [2] were used in the reference scenario for GLS, HAL (noting HAL uses 35W instead of 36W so the LED estimates |

| | | |
|---|---|---|
| | | were like for like) and CFL as they tracked the same lumens across different technologies. LED values were estimated based on [3] and then updated using [1]. Because GLS technologies will be removed over time in the policy scenario, this impact was captured based on the stock weighted GLS wattages in the 2007 (No MEPS) and 2010 data (MEPS). The rate of reduction was assumed to stay the same over time, until all GLS lamps become banned.<br><br>**Risk: Low – Medium**. Wattage affects the model consumption and therefore savings, which is significant. But the values used for the different inputs come from reliable data sources, with the exception of the street lighting data being older. |
| **Lifespan (same under both options)** | [1] MTP Street Lighting Model (2010)<br>[2] European Expertise Centre (EPEC) Energy Efficient Street Lighting<br>[3] Model for European Light Sources Analysis (MELISA) (2015) | For all products, a weighted average lifespan was calculated for the period 2006-2050 with the units being years. These averages were estimated by calculating stock times per unit energy demand times usage.<br><br>For street lighting, average annual energy demand for each lamp technology were calculated from [1][2].<br><br>For all other lighting, lifespan values were taken from [3].<br><br>**Risk: Low - Medium**. Reliable data sources were used, with the exception of some data being older. |

# Annex 3 Definitions

| | |
|---|---|
| Light source | An electrically operated product intended to emit, or, in the case of a non-incandescent light source, intended to be possibly tuned to emit, light, or both, with the optical characteristics set out in the draft regulations. |
| Control gear | One or more devices, that may or may not be physically integrated in a light source, intended to prepare the mains for the electric format required by one or more specific light sources within boundary conditions set by electric safety and electromagnetic compatibility. It may include transforming the supply and starting voltage, limiting operational and preheating current, preventing cold starting, correcting the power factor and/or reducing radio interference.<br><br>The term 'control gear' does not include power supplies within the scope of Commission Regulation (EC) No 278/2009 (14). The term also does not include lighting control parts and non-lighting parts (as defined in Annex I), although such parts may be physically integrated with a control gear or marketed together as a single product.<br><br>A Power over Ethernet (PoE) switch is not a control gear in the sense of this Regulation. 'Power-over-Ethernet switch' or 'PoE switch' means equipment for power-supply and data-handling that is installed between the mains and office equipment and/or light sources for the purpose of data transfer and power supply. |
| Sperate control gear | A control gear that is not physically integrated with a light source and is placed on the market as a separate product or as a part of a containing product. |
| Containing product | A product containing one or more light sources, or separate control gears, or both. Examples of containing products are luminaires that can be taken apart to allow separate verification of the contained light source(s), household appliances containing light source(s), furniture (shelves, mirrors, display cabinets) containing light source(s). If a containing product cannot be taken apart for verification of the light source and separate control gear, the entire containing product is to be considered a light source. |
| Light | Electromagnetic radiation with a wavelength between 380 nm and 780 nm. |

| | |
|---|---|
| Directional light source (DLS) | A light source having at least 80 % of total luminous flux within a solid angle of π sr (corresponding to a cone with angle of 120°). |
| Non-directional light source (NDLS) | A light source that is not a directional light source. |
| Luminance | Luminance (in a given direction, at a given point of a real or imaginary surface) means the luminous flux transmitted by an elementary beam passing through the given point and propagating in the solid angle containing the given direction divided by the area of a section of that beam containing the given point (cd/m2). |
| Chromaticity | The property of a colour stimulus defined by its chromaticity coordinates (x and y). |
| Incandescence | The phenomenon where light is produced from heat, in light sources typically produced through a threadlike conductor (‘filament’) which is heated by the passage of an electric current. |
| Halogen light source | An incandescent light source with a threadlike conductor made from tungsten surrounded by gas containing halogens or halogen compounds. |
| Fluorescence or fluorescent light source (FL) | The phenomenon or a light source using an electric gas discharge of the low-pressure mercury type in which most of the light is emitted by one or more layers of phosphors excited by the ultraviolet radiation from the discharge. Fluorescent light sources may have one (‘single-capped’) or two (‘double-capped’) connections (‘caps’) to their electricity supply. For the purposes of this Regulation, magnetic induction light sources are also considered as fluorescent light sources. |
| High intensity discharge (HID) | An electric gas discharge in which the light- producing arc is stabilised by wall temperature and the arc chamber has a bulb wall loading in excess of 3 watts per square centimetre. HID light sources are limited to metal halide, high-pressure sodium and mercury vapour types, as defined in Annex I. |
| Inorganic light emitting diode (LED) | A technology in which light is produced from a solid state device embodying a p-n junction of inorganic material. The junction emits optical radiation when excited by an electric current. |
| Organic light emitting diode (OLED) | A technology in which light is produced from a solid state device embodying a p-n junction of organic material. The junction emits optical radiation when excited by an electric current. |

| | |
|---|---|
| High pressure sodium light source (HPS) | A high intensity discharge light source in which the light is produced mainly by radiation from sodium vapour operating at a partial pressure of the order of 10 kilopascals. HPS light sources may have one ('single-ended') or two ('double-ended') connectors to their electricity supply. |
| Compact fluorescent light source | A single-capped fluorescent light source with a bent-tube construction designed to fit in small spaces. CFLs may be primarily spiral-shaped (i.e. curly forms) or primarily shaped as connected multiple parallel tubes, with or without a second bulb-like envelope. CFLs are available with (CFLi) or without (CFLni) a physically integrated control gear. |
| T2, T5, T8, T9, T12 | A tubular light source with a diameter of approximately 7, 16, 26, 29 and 38 mm respectively, as defined in standards. The tube can be straight (linear) or bent (e.g. U-shaped, circular). |
| LFL | A linear fluorescent light source. |
| G4, GY6.35, G9 | An electrical interface of a light source consisting of two small pins at distances of 4, 6.35 and 9 mm respectively, as defined in standards. |
| Circular Economy | A circular economy is based on keeping products and materials in use, while designing out waste and pollution from product life-cycles. |

# Annex 4 Glossary of Terms

| | |
|---|---|
| BEIS | Department for Business, Energy and Industrial Strategy |
| BIT | Business Impact Score |
| CBA | Cost-Benefit Analysis |
| CFL | Compact Fluorescent Lamp |
| EANDCB | Equivalent Annual Net Direct Cost to Business |
| ERP | Energy-Related Products |
| EU | European Union |
| EUP(P) | Energy Using Products (Programme/Policy) |

| | |
|---|---|
| FTE | Full Time Equivalent |
| GB | Great Britain |
| GLS | General Lighting Service |
| IA | Impact Assessment |
| LED | Light-emitting Diode |
| MSA | Market Surveillance Authority |
| NPV | Net Present Value |
| MEPS | Minimum Energy Performance Standards |
| MTP | Market Transformation Programme |
| OIOO | One-In, One-Out |
| OPSS | Office for Product Safety and Standards |
| PIR | Post Implementation Review |
| SMB | Small and Micro Sized Businesses |
| WTO | World Trade Organisation |
| USA | United States of America |

# Annex 7 Concessions

## 8 Background information

184. At the time of the last update to ecodesign regulations for lighting products, and again in the Energy-related Products Policy Framework, we made an ambitious proposal for future MEPS for lighting products: 120 lm/W in 2023 followed by a second tier of 140 lm/W in 2025; we also proposed removing the current correction factors so that more legacy lighting technologies would be removed from the market, leading to greater traded carbon savings (and associated benefits).

185. Feedback from industry-based stakeholders was mixed, with concerns raised about the removal of correction factors for a number of lighting technologies. Without a correction factor, a lighting technology would need to meet the MEPS level set on the face of the regulations (120 lm/W in 2023 under our proposal) and would not benefit from any modifications to this.

186. However, for technologies that previously benefitted from a correction factor, one of two issues arises:

- Light sources of this technology cannot meet the MEPS level due to inherent technological limitations, meaning they are removed from the market completely; or
- Only a small proportion of the current market for the technology can meet the MEPS level, meaning only a small proportion of products can remain on the market [which we define as less than 50%].

187. Both issues give rise to significant business impacts, resulting from the proportion of products removed from the market. However, many inefficient legacy lighting technologies are already heading for 'extinction' and have readily available substitutes which are much more efficient (and can meet the MEPS level). Therefore, of greater concern is where there are no readily available substitutes for a technology, meaning that either the technology is banned, making all relevant fittings/fixtures obsolete, or such a small proportion of technologies remain on the market meaning that, relative to before, choice is heavily restricted (which may/may not also cause a significant increase up-front costs or competition issues).

188. Discussions with industry-based stakeholders have led to consideration of concessions in order to avoid the greatest distortions in the market as a result of the policy. A "concession" here means a specific reduction in the MEPS which apply to that technology, thereby allowing a greater proportion of products to remain on the market after our policy is introduced. The intention of the concessions is to allow more specialist models to remain on the market, whilst ensuring MEPS are set at an ambitious level.

## 9 Criteria used when making concessions

189. All of the following factors have been used in determining whether to apply a concession with equal weight attributed to each one ((a) to (e) are not cumulative):

a. Without a concession, there would be a large impact on the market, with all three of the following condition being met:
   i. A large proportion (more than 50%) of models on the market would be removed without a concession;
   ii. There are no readily available substitutes for this technology (and none are expected by 2023/2027); and
   iii. Giving a concession is unlikely to have a significant impact on traded carbon savings.
b. With no concession, the products which remain on the market have significantly higher life-cycle costs, in particular significantly higher up-front costs, than those products being removed from the market;
c. With no concession, the products which remain on the market are, or require, a proprietary technology; or are made by a select few firms (therefore affecting competition);
d. With no concession, it is likely there would be a negative impact on innovation;
e. With no concession, it is likely there would be a disproportionate negative impact on any of the protected characteristics in the Equality Act 2010.

f. With no concession, it it likely there would be disproportionate impacts, for example on certain groups of people, activities or market segments.

190. This takes account of the market and business impacts of the policy, as well as guidance provided by the Cabinet Office on regulatory divergence.

191. The concessions set out in the sections below are **additive**, meaning if a light source meets more than one of the qualifying criteria, all those concessions can apply.

192. Our analysis of where concessions are necessary was informed by analysis conducted by CLASP using the EPREL database, gathered in March 2022 for B22 and E27 lamps, and directional light sources that were registered on the database from 2019 onwards. The figures also assumed a 3.5% increase of annual efficacy. The number of models that would be able to remain on the market as a result of these concessions were compared against the number of models that would remain on the market with no concessions. The analysis looked at how large the concession needed to be in order to allow around 50% of models to remain on the market, relative to 2022.

193. The table below summarises the concessions which will be given to different lighting technologies under the preferred policy option.

| Criteria | Concession |
|---|---|
| Mains voltage light source | 20 lm/W |
| Directional light source | 10 lm/W |
| Connected light source | 5 lm/W |
| CRI ≥ 93 | 10 lm/W |
| CCT ≤ 2000K | 5 lm/W |
| Lumen output ≤ 400 lm | 10 lm/W |

194. The application of these concessions will be limited to light sources only, with luminaires and certain non-domestic lighting technologies being excluded on the basis that they are more efficient, therefore a smaller proportion of their market would be removed by the new MEPS.