Title: Impact Assessment of Proposed Ecodesign and Energy Labelling Requirements for Lighting Products IA No: RPC Reference No: RPC-5014(1)-BEIS Lead department or agency: BEIS Other departments or agencies: DEFRA	[redacted] Date: 18/11/2020 Stage: Consultation Source of intervention: Domestic Type of measure: Secondary legislation Contact for enquiries: Lucy.Birt@beis.gov.uk (policy) and Chris.Nash@beis.gov.uk (analysis)
Summary: Intervention and Options	RPC Opinion: Not Applicable

Cost of Preferred (or more likely) Option (in 2016 prices, 2017 present value year)			
Total Net Present Social Value	**Business Net Present Value**	**Net cost to business per year**	**Business Impact Target Status** Qualifying provision
£1,390m	£708m	-£37m	

What is the problem under consideration? Why is government intervention necessary?

Light Sources and separate control gears ("lighting products") have a substantial environmental impact and, as large numbers are placed on the market annually, present significant potential for improvement in terms of energy performance. In December 2018 the UK, as an EU Member State, voted in favour of new and updated ecodesign and energy labelling requirements for lighting products; these requirements will not automatically apply in Great Britain after the transition period as they begin to apply after 31st December 2020. Therefore, in order for GB to realise in full the associated energy savings, separate GB legislation is required. The measures carry significant benefits in relation to realising the Government's Carbon Budget and Net Zero targets; implementing the requirements in GB law means that we can reap these benefits after the transition period. The costs and benefits of the proposed GB ecodesign and energy labelling requirements for the product listed above have been analysed separately but are included here in the same impact assessment.

What are the policy objectives and the intended effects?

Ecodesign legislation requires manufacturers of energy-related products to meet minimum requirements that result in the improvement of energy efficiency and environmental impacts of their products. Energy labelling requires manufacturers to provide information on energy consumption (and other parameters) to allow consumers to make informed choices based on the energy efficiency of the products. This helps to achieve the UK's objectives of reducing energy bills for businesses and consumers, reducing Carbon Dioxide (CO_2) emissions, minimising the adverse environmental impacts of products and ensuring effective regulation for businesses and consumers. Updating existing ecodesign and energy labelling requirements for lighting products is projected to further increase energy efficiency savings, reduce the UK carbon footprint, and increase innovation and investment into the production of more energy efficient products.

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. There is significant potential for efficiency improvements for lighting products due to the numbers of products (c.**60-80**m) sold each year in the UK. By not legislating, the UK would miss out on the associated energy and carbon emission savings.

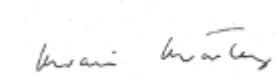
Option 2 - Update ecodesign and energy labelling requirements for lighting products to reflect what the UK agreed at EU level as a Member State in December 2018. This would make it possible for the UK to realise the energy and carbon emission savings from improvements to the energy efficiency of lighting products, contribute to realising the Government's Carbon Budget and Net Zero targets, and maintain high environmental product standards.

Self-regulation was considered, however during the consultation that the Government held with stakeholders before agreeing the EU regulations on lighting products, industry did not propose any self-regulations, nor express an interest in doing so. This option has therefore been discarded.

Will the policy be reviewed? It **will** be reviewed. **If applicable, set review date:** 5 years from application of the draft lighting products regulations.

Does implementation go beyond minimum EU requirements?		No		
Is this measure likely to impact on international trade and investment?		No		
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:** -2.74	**Non-traded:** +0.16	

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 Minister:  Date: 04.11.2020

Description: Update ecodesign requirements for lighting products

FULL ECONOMIC ASSESSMENT

Price Base Year 2021	**PV Base Year** 2021	**Time Period Years** 30	**Net Benefit (Present Value (PV)) (£m)**		
			Low (-20%): 1,340	**High (+20%): 2,171**	Best Estimate: **1,756**

COSTS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low (-20%)	-		-	129
High (+20%)	-	30	-	193
Best Estimate	-		11	**161**

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

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 UK 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 assumed to be negligible compared with the manufacturing costs outlined above. Considered in this assessment are the following: transitional/familiarisation costs of understanding the requirements; distributional impacts (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 Price)	**Total Benefit** (Present Value)
Low (-20%)	**-**		**-**	**1,533**
High (+20%)	**-**	30	**-**	**2,300**
Best Estimate	**-**		**192**	**1,917**

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

Net energy savings are expected to account for 88% of all monetised benefits leading to reduced energy bills for consumers (commercial and domestic). Reduction in CO_2e and improved air quality levels account for the remaining monetised benefits.

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

A key non-monetised benefit is that requirements for lighting products will create open and fair competition with the EU. Additional benefits include a likely increase in innovation due to UK manufacturers having to make substantive improvements to their products.

Key assumptions/sensitivities/risks (Discount rate %)	3.5%

Most quantified costs and benefits have been provided by the Energy Using Products Policy model (described in Annexes 2 & 3). 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 2)

Direct impact on business (Equivalent Annual) £m:			**Score for Business Impact Target (qualifying provisions only) £m:**
Costs:	**Benefits:**	**Net:**	
7	54	-47	-235

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1 Problem under consideration and the rationale for intervention

1. The ecodesign framework sets minimum energy performance standards (MEPS) and other environmental requirements that energy-related products (ERPs) must meet to be placed on the market. This pushes industry to improve the energy efficiency and reduce the environmental impact of products, thereby removing the worst performing products from the market. Ecodesign requirements are currently in place for 28 energy-related product groups including domestic products such as washing machines and TVs, and commercial products such as professional refrigeration and power transformers.

2. Ecodesign and energy labelling requirements have historically been set at a European Union (EU) level through the Ecodesign legislative framework[1] and the Energy Labelling framework regulation[2] respectively. In December 2018, the UK, as a Member State, agreed and voted in favour of new ecodesign and energy labelling regulations for light sources and separate control gears ("lighting products")[3]. The new ecodesign regulation for lighting products is intended to unify and update the existing ecodesign requirements for lighting products which are currently set out in three separate ecodesign regulations[4,5,6]. The new energy labelling regulation for lighting products updates the existing energy labelling requirements for lighting products[7].

3. Prior to agreeing and voting in favour of these requirements, the UK Government consulted stakeholders and carried out an internal cost-benefit analysis (CBA) for lighting products which showed there was potential for improvement in terms of energy performance and resource efficiency and that the proposed regulation would have substantial environmental impact within the UK.

4. As the new and updated EU requirements for lighting products will apply in Member States from 1 September 2021, they will not automatically apply in Great Britain after the transition period ends on 31st December 2020.

5. The UK has always taken a leading role in pushing for both ambitious and realistic product requirements, and this new ecodesign and energy labelling

[1] Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009L0125.
2 Regulation (EU) 2017/1369 of the European Parliament and of the Council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU. Available at: http://data.europa.eu/eli/reg/2017/1369/oj
3 Ecodesign Regulation (EU) 2019/2020 on light sources and separate control gears. Available at: https://eur-lex.europa.eu/eli/reg/2019/2020/oj
Energy labelling Regulation (EU) 2019/2015 on light sources. Available at: https://eur-lex.europa.eu/eli/reg_del/2019/2015/oj
[4] Ecodesign Regulation (EC) No 244/2009 on non-directional household lamps. Available at: https://eur-lex.europa.eu/eli/reg/2009/244/oj
[5] Ecodesign Regulation (EC) No 245/2009 on fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps. Available at: https://eur-lex.europa.eu/eli/reg/2009/245/oj
[6] Ecodesign Regulation (EU) No 1194/2012 on directional lamps, light emitting diode lamps and related equipment. Available at: https://eur-lex.europa.eu/eli/reg/2012/1194/oj
[7] Energy labelling Regulation (EU) No 874/2012 on lamps and luminaires. Available at: https://eur-lex.europa.eu/eli/reg_del/2012/874/oj

regulation reflects this. The UK voted in favour of the new EU requirements as a Member State following a UK specific cost benefit analysis and informal consultation with stakeholders. Furthermore, the measures carry significant benefits in relation to realising the Government's Carbon Budget and Net Zero targets and implementing them in GB law means that we can reap these benefits after the end of the Transition Period. Therefore, the proposed GB regulations for lighting products ("the draft Regulations") reflect what the UK agreed and supported as an EU Member State in December 2018.

6. This is consistent with the Government's intention to uphold common high product standards wherever possible and appropriate, or even exceed them where it is in the UK's interests to do so, following the end of the transition period.

7. This Impact Assessment examines the proposal to make product specific regulations using powers set out in two regulations which will be retained in GB law after the transition period:

- For ecodesign, the Ecodesign for Energy-Related Products Regulation 2010, as amended by the Ecodesign for Energy-Related Products and Energy Information (Amendment) (EU Exit) Regulations 2019[8]; and
- For energy labelling, the Energy Labelling Framework Regulation (EU) 2017/1369[9] as amended by the Ecodesign for Energy-Related Products and Energy Information (Amendment) (EU Exit) Regulations 2019.

8. 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 post-transition period. The costs and benefits in this Impact Assessment are currently calculated on a UK basis. The effect of the NI protocol will be included in the final version of this Impact Assessment following consultation.

9. In addition to the draft Regulations for lighting products proposed in the consultation for September 2021, the Government asks a number of questions to seek stakeholder views on setting better regulations for lighting in the future in order to secure larger carbon savings in GB. However, this Impact Assessment does not include analysis of the potential impacts of future policy relating to these consultation questions as no specific policy proposals are put forward. Any future ecodesign and energy labelling requirements for lighting products would be subject to their own Impact Assessment and consultation.

[8] The Ecodesign for Energy-Related Products and Energy Information (Amendment) (EU Exit) Regulations 2019 No. 539. Available at: http://www.legislation.gov.uk/uksi/2019/539/contents/made

[9] Energy Labelling Framework Regulation (EU) 2017/1369. Available at: https://eur-lex.europa.eu/eli/reg/2017/1369/oj

2 Policy objective

10. Ecodesign requirements help to reduce the energy and resource consumption of energy-related products by setting minimum mandatory requirements on energy efficiency and resource efficiency. This removes poor performing products from the market and drives the market towards more energy and resource efficient products, thereby promoting a sustainable environment through regulation.

11. Energy labels help consumers make more informed decisions to choose more energy efficient products by presenting easily understood information on energy efficiency and product performance at the point of sale.

12. Together, these policies represent a cost-effective way to reduce energy bills and carbon emissions. Current estimates from the Department for Business, Energy & Industrial Strategy (BEIS) show that existing ecodesign requirements will lead to savings of 8 million tonnes of CO_2 in 2020. Existing requirements are also estimated to save the average dual-fuel household £100 on their energy bills in 2020.[10]

13. Updating ecodesign & energy labelling requirements for lighting products is key to making the UK more energy efficient and supporting innovation, contributing in particular to the objectives set out in the Clean Growth Strategy[11] ('accelerating clean growth' and 'helping business become more productive') and the Secretary of State's priorities for BEIS in 2020/21. Doing so will in particular:

- minimise energy bills for businesses;
- reduce greenhouse gas emissions;
- reduce the adverse environmental impacts of products;
- allow consumers to make more informed decisions on energy efficiency;
- ensure effective regulation for industry; and
- drive innovation and support the transition to a low carbon economy.

3 Background

3.1 Lighting products

14. Lighting products are currently regulated under four products regulations: three ecodesign regulations and one energy labelling regulation. These are:

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

[11] Clean Growth Strategy available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/700496/clean-growth-strategy-correction-april-2018.pdf

- Commission Regulation (EC) No 244/2009 on ecodesign requirements for non-directional household lamps;
- Commission Regulation (EC) No 245/2009 on ecodesign requirements for fluorescent lamps without integrated ballast, high intensity discharge lamps and ballasts and luminaires able to operate as lamps;
- Commission Regulation (EU) No 1194/2012 on ecodesign requirements for directional lamps, Light Emitting Diodes (LED) lamps and related equipment; and
- Commission Regulation (EU) No 874/2012 on energy labelling requirements for electric lamps and luminaires.

15. Collectively, the scope of these four regulations covers light sources, control gears, and luminaires.

16. Light sources are products which emit light when electrically operated (e.g. via incandescence, fluorescence, high-intensity discharge, or light emitting diodes (LEDs)). This covers domestic directional and non-directional lighting (where the light is emitted primarily in a single direction vs. not), as well as tertiary sector lighting (e.g. office and street lighting).

17. Control gears are devices which prepare the electrical mains for the light source which is connected to it. This could include transforming the supply and starting voltage, limiting operational and preheating current, preventing cold starting, correcting the power factor and/or reducing radio interference.

18. Luminaires are lighting units which contain one or more light sources, together with the parts designed to distribute, filter or transforms the light transmitted from the light sources. They include all the parts necessary for supporting, fixing and protecting the light sources and, where necessary, the circuit auxiliaries together with the means for connecting them to the electric supply. Examples include table lamps and chandeliers.

19. The existing ecodesign regulations came into force in 2009 and 2012 and gradually phased out some of the less efficient products on the market such as incandescent light bulbs by setting minimum energy performance requirements which manufacturers were required to meet. Energy labels were also introduced in 2012 to inform consumers of the most energy efficient electric lamps and luminaires on the market.

20. Several reviews assessing the performance of these regulations were conducted by the EU while the UK was a Member State and were completed

between 2013 and 2015[12,13,14]. While the reviews estimated that the current regulations would still achieve significant energy savings[15], the evaluation of the regulations showed even greater energy savings could be achieved by:

(a) Simplifying the ecodesign regulations by replacing and integrating the 3 ecodesign regulations currently in force. This means there would be a single ecodesign regulation with a scope which covers light sources, control gears, and their combinations. The scope includes the circumstances when light sources and separate control gears are integrated into other products, called containing products. Under this approach, luminaires would be classed as a containing product and either the light sources integrated in the containing product or the entire containing product must meet the MEPS;

(b) Reviewing minimum energy efficiency requirements to reflect technological progress, this includes further phasing out less efficient lamp types;

(c) Rescaling energy label classes back to an homogenous A to G scale (currently products can be rated from A+++ to E) so that products currently in the top energy classes will be rescaled to sit in lower classes. With this rescale, classes A and B would be empty as it would be difficult to develop class A and B products with the current technology landscape; and

(d) Facilitating compliance by improving the definitions for scope and exemptions, and redefining tolerances for compliance verification.

4 Options considered

21. For the purpose of this consultation stage Impact Assessment, two policy options have been considered: (1) Do Nothing and (2) update requirements to reflect what the UK agreed at EU level as a Member State in December 2018. The preferred option (2) has been assessed against the Do Nothing option.

4.1 Rejected Options

22. Under the Ecodesign for Energy-Related Products Regulations 2010, as amended by the Ecodesign for Energy-Related Products and Energy Information (Amendment) (EU Exit) Regulations 2019, the Secretary of State

[12] Review study on the stage 6 requirements of Commission Regulation (EC) No 244/2009, final report, VHK/VITO for the European Commission, 14.6.2013

[13] 'Omnibus' Review Study on Cold Appliances, Washing Machines, Dishwashers, Washer-Driers, Lighting, Set-top Boxes and Pumps, consortium of VHK, VITO, Viegand Maagøe, Wuppertal Institut für Klima, Umwelt, Energie for the European Commission, DG ENER-C3, Brussels/Delft, April 2014.

[14] Market Overview on Directional Mains-Voltage Lamps related to stage 3 of Commission Regulation (EU) No 1194/2012, VHK for the European Commission, 3 September 2015

[15] Estimated 41.2TWh annual final energy savings in 2030 (combined effect of ecodesign and energy labelling) at EU level. See: https://ec.europa.eu/transparency/regcomitology/index.cfm?do=search.documentdetail&Dos_ID=16954&DS_ID=60713&Version=1

must not regulate an energy-related product that is the subject of self-regulation.

23. Directive 2009/125/EC of the European Parliament and of the Council provides for voluntary agreements or other self-regulation measures to be prioritised where they are likely to deliver the policy objectives faster or at lower cost than mandatory requirements. In addition, for self-regulation to be considered, certain non-exhaustive criteria which evaluate the effectiveness of such self-regulation must be met. Any proposed self-regulatory initiative must be open to participation of operators outside the UK market; deliver improved overall environmental performance; represent a large majority of the industry; define clear and unambiguous objectives which can be monitored in affordable and credible ways; be transparent; contain well-designed monitoring systems; be administered in a cost-effective way; respond to ecodesign policy objectives; and be consistent with other incentives affecting the market.

24. To date, industry representatives have not proposed any self-regulation or a voluntary scheme that meets these criteria; no desire for self-regulation from the lighting products sector was expressed during the EU's consultation process prior to the approval of the EU regulations in December 2018. Where self-regulatory initiatives have been considered for other products (i.e. not specifically for lighting) at an EU level, 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 reduced the lighting industry's appetite for self-regulation at this point in time.

25. Lighting products have been regulated in the UK through ecodesign since 2009, and through energy labelling since 1998[16]. Continuing this approach provides clarity and continuity for UK businesses.

26. With mandatory requirements already in place, there is also a risk of free riders reintroducing inefficient products back into the market if a voluntary agreement replaced these mandatory requirements. Free riders would be those who do not sign up to the voluntary agreement but benefit from effects without paying for them. While those who sign up to the voluntary agreement would be required to comply with the relevant requirements, free riders (those who do not sign up to the voluntary agreement) may benefit from this market shift by reintroducing inefficient products back into the market. This option was therefore discarded.

27. 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[17]. 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.

28. We are not proposing at this point in time to exceed the ecodesign requirements for lighting products which reflect what the UK agreed at EU

[16] Energy labelling Directive 98/11/EC on household lamps. Available at: http://data.europa.eu/eli/dir/1998/11/oj

[17] "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

level as a Member State, as we have yet to determine the technical potential for going further and the associated carbon and bill savings to be gained. To do so, we would need to engage extensively with stakeholders to gather the evidence required and ensure that more ambitious requirements offer a significant additional net benefit to the UK.

29. Given the new EU requirements for this product apply from 1 September 2021, we have ruled out, at this point, setting more ambitious GB requirements for lighting products and our priority would to provide clarity and legal certainty to stakeholders who have prepared for this application date, and realise the associated energy and carbon savings the requirements would bring.

30. Although not explored in this Impact Assessment, we are actively exploring how to set better ecodesign and energy labelling regulations in GB for lighting products in the future, including where it would be beneficial to exceed EU standards.

31. A Call for Evidence published in June 2020[18] explores the possibility of raising ecodesign requirements for certain product categories which could yield greater energy, resource, and carbon savings in the UK. Lighting products are included in this Call for Evidence, alongside other products covered by ecodesign regulation. It will also look at how to make energy labels more effective for the consumer.

32. We have included a small number of questions in the consultation which seek stakeholder views on setting better regulations for lighting products in the future. Responses to these questions will supplement the evidence collected by the Call for Evidence. Together, this evidence will support the development of better ecodesign and energy labelling polices in the future. However, this Impact Assessment does not include analysis of the potential impacts of potential future policy.

33. The draft Regulations include a review provision to review them no later than 5 years from the application date. This will allow the Government to consider more ambitious requirements considering technological progress while also allowing sufficient time for all provisions to be implemented and to understand market penetration.

4.2 Option 1 – Do Nothing

34. Under Option 1 no changes would be made to the existing ecodesign and energy labelling requirements for lighting products.

35. The main reason why this option has not been pursued further is that, without regulation, manufacturing decisions and consumer behaviour would likely be dictated by performance and cost rather than energy efficiency or resource efficiency. Several market failures show this to be the case and the associated negative externalities are described below.

[18] Energy-related products: call for evidence. Available at: https://www.gov.uk/government/consultations/energy-related-products-call-for-evidence

36. Without updating ecodesign requirements in line with technological progress manufacturers will be able to place products on the market with energy efficiencies far below what is reasonably achievable in the current landscape.

37. Most end users often prioritise performance and low purchasing cost over reducing energy costs or increasing environmental savings during the use phase[19]. Without updating ecodesign requirements and rescaling energy labels, consumers will not be able to identify and purchase the most energy efficient products on the market.

38. Split incentives between owners of lighting products and clients, who cover energy costs, mean buyers have little concern about energy efficiency. This is especially true in landlord-tenant relationships.

39. Without adopting these ecodesign requirements, the negative externalities of lighting products 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. The new requirements facilitate a more circular economy by setting minimum requirements to reduce energy use and resource use. The aim of a more circular economy is to keep resources in use for as long as possible, extracting maximum value from them. If products are not made to be more durable, repairable, and recyclable then levels of material consumption, emissions, pollution, and waste generation will remain at unsustainable levels, making ambitions to achieve net zero avoidable waste and net zero carbon emissions by 2050 less attainable.

4.3 Option 2 – Update ecodesign and energy labelling requirements for lighting products

40. Under Option 2, existing ecodesign and energy labelling requirements for lighting products would be updated to reflect what the UK agreed as a Member State at EU level in December 2018.

41. These draft regulations would apply from 1 September 2021. A manufacturer must not place on the GB market or put into service a lighting product from this date unless that product complies with the draft regulations and bears the UKCA marking. However, to allow businesses time to adjust to new UKCA marking requirements, the CE mark can still be used until 1 January 2022. Guidance for using the UKCA marking can be found on gov.uk[20].

42. Lighting products already on the GB market before 1 September 2021 that comply with the existing regulations can continue being sold. Lighting products within scope of the draft energy labels regulations must replace existing

[19] EuP Netzwerk Preparatory Studies. Available from: https://www.eup-network.de/product-groups/preparatory-studies/completed/ (see Lot 8/9/19 for lighting products).

[20] Guidance: Using the UKCA mark from 1 January 2021. Available at: https://www.gov.uk/guidance/using-the-ukca-mark-from-1-january-2021

energy labels at the point of sale with the new rescaled energy labels within eighteen months of the application date of the draft Regulations.

43. Advancements in technology for lighting products (rapid advancement of LEDs) have taken products in lower energy classes off the market. This has resulted in many of the appliances sold on the market now having energy ratings within the top classes (A+/A++/A+++). 66% of lighting products, including all LEDs, occupy these top three classes[21]. This population of the top classes greatly reduces the effectiveness of energy labels as consumers are no longer able to differentiate between the most energy efficient products on the market. In addition, it has been found that consumers are less motivated to purchase the most energy efficient products when A+++ is the highest rating rather than A[22]. This results in lower savings for consumers on their energy bills and also results in manufacturers having less of an incentive to invest in products with the best possible energy efficiency.

44. These classes should, therefore, be updated so that products are rescaled, i.e. products in the top energy classes will be rescaled to lower classes to more accurately reflect the relative energy efficiency of products. This will provide consumers with more accurate information and allow them to differentiate more effectively between the most and least energy efficient products. With this rescale, classes A and B would be empty at the time of introduction of the new label. This is because it would be difficult to develop class A and B products with the current technology landscape while also allowing sufficient head room in the scale so that the need to rescale in the short term can be avoided. Additionally, the rescale is expected to incentivise manufactures to produce more efficient goods in order to achieve higher energy classifications.

45. In addition, the new labels will see a return to a homogenous A-G scale removing the A+, A++ and A+++ categories. This will harmonise the scale across different product groups and make it easier for consumers to understand energy label classes. Once energy classes become redundant because the MEPS have removed them from the market, they will be required to be greyed out on the label allowing consumers to see the actual range of energy classes currently available on the market and which products are now the least energy efficient.

46. The requirement to provide an energy label specific to luminaires was repealed as of 25 December 2019 in the UK. This will continue to apply after the end of the transition period as the new energy labelling requirements for lighting products will apply for light sources directly and not the entire luminaire (which houses the light sources). An energy label will only be required for a luminaire when the light source contained within cannot be removed.

47. Option 2 consists of updating existing ecodesign and energy labelling requirements for lighting products, reflecting what the UK agreed at EU level

[21] 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

[22] CLASP 2013 05 EU Energy Labelling Comprehension Study. Available at: https://clasp.ngo/publications/assessing-consumer-comprehension-of-the-eu-energy-label

as a Member State in December 2018, and is our preferred option. The UK agreed and supported the new ecodesign and energy labelling requirements at EU level at the end of a lengthy consultative process. The process included:

- a preparatory study[23] – at an EU level – which explored policy options, markets, users, technologies, the environment, economics, and product design. This process involved several public EU wide stakeholder meetings in which the UK participated;
- an initial ecodesign working draft regulation shared with Member States and relevant stakeholders, (including UK stakeholders), for review prior to the Consultation Forum;
- a Consultation Forum, attended by Member State Officials, key manufacturers and Non-Governmental Organisations (including from the UK);
- notification[24] of the draft regulation to the World Trade Organisation (WTO) for a period of 60 days;
- publication of the draft regulation for the relevant product on European Commission's feedback mechanism portal[25];
- a Regulatory Committee where the EU regulation was discussed and voted on by Member State Officials (including the UK).

48. Although the requirements were agreed at EU level, the UK Government consulted with UK stakeholders and carried out an internal Cost Benefit Analysis prior to voting in favour of the EU regulations. The volume of expertise feeding into the studies, along with a substantive EU consultation, also reduces the risk of these draft regulations being disproportionate or unrealistic.

49. We are proposing to implement these requirements in GB law after the end of the transition period as they carry significant benefits in relation to realising the Governments Carbon Budget and Net Zero targets. This approach also reflects the commitment made in the Clean Growth Strategy to maintain existing high standards or go further where it is in our interests.

50. The Do Nothing option has also been considered and the impacts assessed. Under this scenario, the current EU regulations for lighting products will be

[23] European Commission, 2015. Preparatory Study on Light Sources for Ecodesign and/or Energy Labelling Requirements ('Lot 8/9/19'). Available at: http://ecodesign-lightsources.eu/documents

[24] Lighting products WTO notification. Available at: https://ec.europa.eu/growth/tools-databases/tbt/en/search/?tbtaction=search.detail&Country_ID=EU&num=606&dspLang=en&basdatedeb=&basdatefin=&baspays=&basnotifnum=&basnotifnum2=&bastypepays=ANY&baskeywords=light%20sources

[25] European Commission feedback mechanism for lighting products. Available at: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/1551-Review-of-ecodesign-requirements-for-lighting-products

incorporated into GB law at the end of the transition period and would continue to apply in GB. None of the new and updated requirements for lighting products agreed by the UK as a Member State at EU level in December 2018 would automatically apply in GB after the transition period. The impacts of the UK and the EU having different ecodesign and energy labelling requirements have been taken into account when assessing the Do Nothing option.

5 Overview of costs and benefits

51. 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). More specific information is provided in Section 6 (lighting products).

52. The draft Regulations will apply in Great Britain only. In accordance with the NI Protocol, EU Ecodesign and Energy Labelling Regulations will continue to apply in Northern Ireland post-transition period. The costs and benefits in this Impact Assessment are currently calculated on a UK basis. The effect of the NI protocol will be included in the final version of this impact assessment following consultation.

53. A 30-year appraisal period (2021/22 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, see Table 19 in Annex 2). Table 1 provides a breakdown of estimated lifetimes for the lighting product sector.

Table 1: Estimated lighting product lifetimes[26] and electronic display lifetimes

Lighting Product Sector	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.

[26] 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

54. Based on the above, 30 years broadly represents a timeframe over which most of the existing stock of both products will be replaced with product models that are compliant under the new requirements, and the full energy savings realised over their lifetime (see Figure 1). Further, even though some domestic lighting product models are expected to have longer lifetimes than the 30-year appraisal period, the majority of the energy savings are expected to be realised before 2050 (see Figure 1).

55. We are aware that the lifetimes for domestic lighting may appear to look substantially high. However, the EUPP model accounts for product failures earlier than the assumed product lifetime as well as product failures that occur later than the assumed product lifetime. Lamp lifetimes and usage assumptions were based on the Model for European Light Sources[27], which was prepared by the light sources review study authors. These values are associated with actual rated lifetimes and usage data (see Annex 2 for further detail). For example, an average household lamp burns around 500 hours per year, so an LED lamp with a relatively low lifetime of 10,000 hours would on average last 20 years. Non-domestic lighting product lifetimes are less than domestic lifetimes, predominately since non-domestic lighting products are assumed to be in use for more hours a year than domestic products[27], for example, lighting in an office.

56. At present, we assume additionality of 50% for lighting products in this Impact Assessment. Additionality reflects the adjustment we make to the overall costs and benefits of the policy intervention to reflect the fact that a proportion of these would occur in the counterfactual (in this case due to the fact that the regulations will be in force in the EU regardless of whether GB implements them or not, and the concerned markets are global ones). Therefore, we estimate that 50% of the total costs and benefits to business and consumers would be realised for lighting products.

57. We assume 50% additionality for lighting products because research currently suggests that 75% of lighting products are imported into the UK (see Section 5.1). This means that the additionality for lighting products is largely attributed to imported products and since we currently have not identified evidence to suggest that there is a targeted sole UK market for lighting products, then it is likely that overseas manufacturers will choose to comply with the EU ecodesign requirements, regardless of whether GB implements them or not. However, if GB did not implement the ecodesign requirements under Option 2, then there would be potential for overseas manufacturers to export lighting products that do not meet the higher EU ecodesign requirements but meet the unchanged GB ecodesign requirements, which would have negative impacts on carbon and energy bill savings. Therefore, by preventing lower energy efficient lighting products reaching the GB market, there will be positive effects on carbon and energy bill savings. Hence, we assume 50% additionality currently to account for the potential that overseas manufacturers may only

[27] 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 MELISA. The reports are available at: http://ecodesign-lightsources.eu/documents

export lighting products to the GB market, and also for the prevention of lower energy efficient products reaching the GB market.

58. The 50% additionality assumption also takes into account domestic production, given only 75% of lighting products are assumed to be imported (see Section 5.6). This is primarily because the EU will also be implementing ecodesign requirements for lighting products, so there may be many companies in the UK, and companies outside of the UK, that will choose to comply with the EU directive, regardless of whether GB implements ecodesign requirements for lighting products. This will most likely be because they already export their products to countries within the EU.

59. If a company only sells lighting products in GB, they will most likely choose to comply with the GB ecodesign requirements, resulting in positive effects on bills and carbon savings. However, we expect most manufacturers would have some interest in the EU market and so expect these positive savings to be small compared with the savings outlined above.

60. We will assume this additionality estimate until further evidence is gathered during the consultation. An example of such evidence that would help to inform our current estimate would be further information around the current number of UK manufacturers of lighting products. Information around the extent to which manufacturers export lighting products would also be helpful to inform our current estimate. This estimate may then be revised based on feedback from UK stakeholders and any further evidence provided, including on the impact of the NI protocol, that can inform further analysis.

61. A change in the additionality factor causes the Net Present Value (NPV) to either decrease or increase proportionally, but it cannot result in the NPV becoming negative. For example, 50% additionality would reduce the NPV by half, relative to the 100% additionality scenario. Or for example, 25% additionality would reduce the NPV by three quarters, relative to the 100% additionality scenario.

5.1 Option 1: Do Nothing

62. The ‘Do Nothing’ option represents no regulatory change for lighting products. The existing regulations would continue to apply to certain classes of lighting products. This option would, therefore, have no direct impact on manufacturers although there would be an indirect impact from not having open and fair competition – potentially impacting on competitiveness and innovation. For those that sell solely in GB, the current regulations for lighting products would continue to apply in GB in the same way as before EU Exit. UK manufacturers that export their product to the EU could face trade complications given that GB’s requirements would differ from the EU’s.

63. The main reason why this option has not been pursued further has been explained in Section 4.2. The market failures identified include technological progress, consumer purchasing habits, split incentives, and the products lack of resource efficiency.

64. Further, under the ‘Do Nothing’ option, the overall NPV would be lower. This is because there would not be as great a market drive to improve energy

efficiency which would reduce benefits. This would also make costs higher and result in consumers having higher energy bills in the long term.

65. Additionally, another key reason this option has not been pursued is the assumed UK proportion of lighting products that are imported. Currently, BEIS desk-based research suggests that the UK imports around 75% of lighting products (see Section 6.5). If non-UK manufacturers either choose not to plan or fail to plan and adjust to the new EU regulations, there may be an excess supply of products that do not comply with the new EU regulations which could reach the UK market. This would have negative impacts on carbon and energy bill savings.

66. In a Do Nothing scenario, there may be scope to assume that UK manufacturers of lighting products who do not export, may be less motivated to innovate and produce products that comply with global requirements, as focus is likely to be shifted to price competition over increasing energy efficiency. For UK manufactures who do not export, there will be an opportunity to undercut higher priced, more efficient products with cheaper, less efficient products. This targets consumers who would rather pay less at the point of purchase rather than pay more up-front for a more efficient product that will accumulate energy savings (hence bill savings) over its lifetime. Hence, the market and regulatory failures would persist, harmonised information on energy consumption would not be systematically generated and consumers would not be able to differentiate between high efficiency and low to average efficiency appliances. Therefore, the potential carbon emission and energy bill savings (shown in Table 3) would not be realised.

67. Under the Do Nothing option, there may also be scope for assuming that UK manufacturers would comply with the new EU requirements once they come into force. This could be due to economies of scale and the potential ease of meeting the requirements and/or because energy consumption is viewed as an important factor for such products. This would have the effect of GB having the same requirements as the EU without regulation. If this was to occur, broadly the same costs would still apply as under Option 2 (since enforcement and compliance costs are negligible compared with overall costs). There is a risk that businesses would not comply with EU requirements under the Do-Nothing Option, although we consider the likelihood of this to be low and will test this during the consultation.

5.2 Summary of costs and benefits of Option 2

68. Table 2 outlines the key costs and benefits that have been identified as relevant to Option 2. The final column indicates how these have been considered in this Impact Assessment.

69. The draft regulations will impose a real cost (see Table 3) on any UK manufacturers of lighting products. 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 (consumers or firms), not whether they are incurred.

Table 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.	Described Qualitatively (although assumed to be passed on to consumers[28] and therefore accounted for in the CBA).
	Cost of applying new rescaled energy labels to products. However, this is assumed to be negligible compared to the cost of manufacture, as energy labelling processes already exists for lighting products.	Described Qualitatively.
	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[28].	Included in CBA.
	Benefits	
	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.

[28] We assume that manufacturers would only have two choices – (1) absorb any additional costs and reduce profits or (2) pass the cost on to consumers. Since competitors will all be facing similar cost pressures given the regulations apply across the respective industry, it is reasonable to assume that manufacturers would not choose (1), as the most profitable scenario for the sector is for everyone to pass on the additional costs. Further, the costs of the concerned products are assumed to be moderate relative to the potential bill savings for consumers (see Table 3).

Group	Type of cost / benefit	Included in CBA or 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 bills over the lifetime of the product due to increased energy efficiency performance.	Included in CBA.
	Rescaling of energy labels should also allow consumers to purchase the most energy efficient products, thus lowering energy bills.	Described Qualitatively.
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.
	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.

70. Table 3 provides the high-level cost and benefit estimates of Policy Option 2 according to the costs and benefits outlined above for lighting products. Option 2 (costed against the Do Nothing option) shows a Net Present Value (NPV) of £1,756m with a benefit-cost ratio of around 12:1. Electrical energy savings are expected to be around 21,900 GWh over the appraisal period (2021/22-2050/51) amounting to 2.6 million tonnes of Carbon Dioxide equivalent (CO_2e). More detail is provided in the sections which follow.

Table 3: Estimated Costs and Benefits of Policy Option 2, 2021/22 to 2050/51

2021 prices (£m), 2021 present value year **Costs/benefits, £m**	**Option 2 (£m)**
Costs to manufacturers (assumed to be passed onto consumers)	149
Costs of increase in non-traded CO_2e emissions (extra heating)[29]	12
Total Costs (A)	**161**
Value of energy savings (net)	1,688
Value of reduction in CO2e emissions	152
Net benefits of air quality improvements	77
Total Benefits (B)	**1,917**
Net Present Value (B–A)	1,756
Benefit Cost Ratio (B/A)	12

Data in the main body of this Impact Assessment are presented in 2021 prices and present value (and, therefore differ from those on the front page which are 2016 prices and 2017 present values). Total figures may appear to not add up due to rounding.

71. All calculations were sourced from the BEIS Energy Using Products Policy (EUPP) Model which takes into consideration the costs and benefits associated with updating existing ecodesign requirements for each product separately.

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

- forecasted sales/stock figures;
- estimates for additional costs arising from producing products compliant with the draft regulations under Option 2 compared with Option 1;
- forecasted level of usage (in hours/year);
- estimates for the energy usage (in kWh/year/unit), again for products compliant with the draft regulations under Option 2 compared with Option 1; and
- the expected lifespan of products (before a replacement is required).

[29] 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.

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

5.3 Non monetised costs and benefits

74. This section examines the additional costs and benefits that, for proportionality reasons, have not been monetised. To indirectly take these into account in the CBA, sensitivity analysis has been undertaken (in Section 5.4).

5.3.1 Transitional Impacts

75. 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.

76. For lighting products, we expect that a rise in transition costs would be offset by increases in product prices, and these are implicitly included within these increases in prices.

77. Given that the draft Regulations would be a revision of existing regulations, transitional costs are expected to be minimal as the general processes are already established. Manufacturers are already required to provide technical details and energy labels so the information required would be readily available to them. The EU's additional assessment of their review study into regulations for lighting products[30] concluded that additional costs such as approbation, changes in packaging, marking etc would be negligible.

78. The EU expects transitional costs to be moderate, particularly for small and micro sized businesses (SMBs), given the increasing difficulty that manufacturers face in accessing new technologies and efficient components in the highly competitive market, for which prices are increasing[15]. Based on this, we assume that UK SMBs are involved in the same market, so we expect their transition costs to be moderate too. We are testing our assumptions of these costs as part of the consultation process.

5.3.2 Resource Efficiency

79. Resource efficiency covers requirements such as those to ensure that lighting products are designed in such a way as to facilitate reuse, repair and recycling of the product. Resource efficiency also includes information requirements where specific information is required in instruction manuals and on free-to-access websites. This includes information about the manufacturer, product type, and parameters related to energy efficiency. Resource efficiency is an important aspect as these measures can increase the lifespan of the product and reduce a product's end of life environmental impact.

[30] COMMISSION REGULATION (EU) - 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 and repealing Commission Regulations (EC) No 244/2009, (EC) No 245/2009 and (EU) No 1194/2012Available at: https://ec.europa.eu/info/law/better-regulation/initiative/1551/publication/5780453/attachment/090166e5c7e39ceb_en

80. Introducing circular economy principles to a product's supply chain ultimately means 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. From a supply chain point of view the circular economy has implications for the design, production, operation and maintenance, and end-of-life disposal of products.

81. The overall savings of resource efficiency requirements have not been quantified. Lighting products are already in the scope of Waste Electronic and Electrical Equipment Regulations 2013 (WEEE), in which these savings were assessed qualitatively and predicted to be modest in comparison to the energy savings.

82. The removability of main components is key to recyclability and is addressed in the Waste Electronic and Electrical Equipment Regulations 2013, which cover certain lighting products. These regulations will continue to apply at the end of the transition period.

83. The proposed requirements for lighting products introduce measures that aim at facilitating the reuse and the disposal of luminaires and not light bulbs as they are covered in the WEEE regulations. The provisions are presented below:

- Manufacturers and importers of containing products shall ensure that light sources and separate control gears can be removed without being permanently damaged for verification purposes by market surveillance authorities. For containing products, instructions shall be available on request on how light sources and separate control gears can be removed for verification without these being permanently damaged.
- Manufacturers and importers of containing products shall ensure that light sources and separate control gears can be dismantled from containing products at end of life. Instructions shall be available on request.
- Manufacturers and importers of containing products shall provide information about the replaceability or non-replaceability of light sources and control gears by end-users or qualified persons without permanent damage to the containing product. Such information shall be available on free-access websites. For products sold directly to end-users, this information shall be on the packaging, at least in the form of a pictogram, and in the user instructions.

84. The aim is to stimulate manufacturers to find solutions and design for dismantlable and reusable luminaires so that they do not have to be disposed of once the light source inside fails. Better design can make products more durable or easier to repair, upgrade, or remanufacture. For example, lighting products are more suited to recycling if they are built using LEDs. LEDs are

built from more robust materials – plastic, and rigid semiconductor strips and metal strip terminators – compared to the more fragile copper wires and thin glass bulbs that exist in halogens and GLS bulbs. Therefore, they are physically stronger and better suited to end of life recycling.

85. GLS and halogen lamps are rarely recycled, being more typically disposed at a landfill, or incinerated[31]. Furthermore, it is estimated that just under a quarter of all lamps (CFL, LFL, HID) are currently recycled in the EU. Recycling of glass and metals within CFL, LFL and LED lamps is encouraged, but enforcement is a challenge, as nothing prevents households to dispose such lamps in the normal bins. Currently, approximately 1% of all the lamp waste recycled is composed of LEDs, but this number is expected to increase in the coming years, reaching 10% in five years' time and 40% in ten years. However, the overall volume of lamp waste will reduce, as LEDs gain market share, because LEDs have much longer lifetime than legacy lamps

86. CFL and LFL lamps contain small amounts of mercury. This means that these should be collected separately for disposal, as per WEEE. Currently, lighting represents 8% of all EU mercury emissions[31]. Assuming that the same percentage applies at the UK level, it is estimated that the use and end of life disposal of lighting products is responsible for the emission of just under half a tonne per year of mercury[32].

87. The proposed requirements do not directly address the problem so remain non-monetised. However, they promote taking steps to create a circular economy for lighting products. Under the draft Regulations, luminaires should be openable to allow failed light sources to be replaced. However, if the manufacturer clearly explains why the light source is not removable, and the client has access to this information, then luminaires that cannot be opened can be sold, provided they have end of life dismantling instructions. The ecodesign requirements will: (i) resolve the problem that market surveillance authorities have to test light sources when these are not accessible; (ii) resolve the issue of an unfair level playing field for industry when the same light source type is otherwise accessible; and (iii) support consumers in their conscious choice when buying integrated luminaires.

88. For the reasons discussed above, the costs associated with resource efficiency are expected to be small in relation to overall costs and benefits of the policy option. Monetising such costs is, therefore, considered disproportionate. However, any such costs may fall disproportionately on to smaller businesses and are therefore considered in the Small and Micro Business Assessment (SAMBA).

5.3.3 Enforcement and Compliance Costs

89. Enforcement and compliance costs are not easily quantified. Enforcement action is undertaken where the market surveillance authority (MSA) believed

[31] European Commission, 2015. Preparatory Study on Light Sources for Ecodesign and/or Energy Labelling Requirements ('Lot 8/9/19'). Final report, Task 5 Environment & Economics (base case LCA & LCC).

[32] Based on UK's National Atmospheric Emissions Inventory (NAEI), available at: http://naei.beis.gov.uk/overview/pollutants?view=summary-data&pollutant_id=15. [Accessed 1 March 2018]

there was sufficient risk-based justification to do so, in line with their enforcement policy[33] (see Section 8.2 for further detail). Additional costs are, however, considered minimal given that requirements already exist for both products and would continue to apply under the Do Nothing Option.

90. There are two changes to energy labelling requirements for lighting products in the draft Regulations. These are the rescaling of energy label classes, and the return to a homogenous A-G scale. However, due to existing requirements for lighting products, energy labels already have to be provided with the respective product at the point of sale, so we consider the costs to manufacturers/businesses of energy labelling to be negligible. This is because we expect there to be little administrative burden in printing the new rescaled energy labels, since the system (via a website) to print energy labels for the respective products is already in place.

91. As well as this, the costs attributed to these changes are expected to be low when compared to the more substantive ecodesign requirements under Option 2.

92. The proposed ecodesign requirements are an update and unification of the existing ecodesign requirements set out in the three ecodesign regulations currently in force. The norms, scope, and exemptions were previously set out in different regulations, and used different formulae to calculate energy efficiency. This made it difficult for industry to easily understand the scope of the regulations and also made it difficult for MSAs to effectively undertake enforcement. Conformity assessment is also an expensive and time-consuming process for MSAs and has led to difficulties for MSAs to respond to market changes in good time. The draft Regulations look to address these problems by unifying, and therefore simplifying, the ecodesign regulations into a single set of Regulations and also by redefining the tolerances for compliance verification. These changes should reduce compliance costs given that draft Regulations are unified with a clearer scope. MSAs should also be able to undertake more effective enforcement. These costs have not been monetised, however, as they are considered modest in comparison to the overall costs and benefits of the draft Regulations.

93. Additionally, for lighting products the requirement to no longer provide a specific label for luminaires is already in force in the UK. This cost has therefore not been monetised.

94. Testing costs may increase under Option 2 but any potential extra cost is expected to be absorbed by the respective industry. Even under the Do Nothing Option, manufacturers will be obliged to test products because this is already required under the existing Regulations. We will use the consultation process to assess whether testing costs have been adequately considered.

95. Overall testing costs would be expected to be moderate, given UK imports are assumed to be around 75% (see Section 6.5).

[33] 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.

96. On the other hand, the expected increase in frequency of testing or increase in the cost of testing, is expected to positively benefit UK SMBs involved in these sectors, who would have the opportunity to profit from the increased demand.

97. Finally, at present, BEIS desk-based research indicates that there are few UK manufacturers of lighting products, so an 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 7).

98. As suggested in HM Government's OIOO (One-In, One-Out) Methodology[34], 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 5.4 and the corresponding section for lighting products).

5.3.4 Distributional Impacts

99. In setting ecodesign requirements, the European Commission took distributional impacts 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 the life cycle cost of the product[1]. Although more efficient products may have marginally higher up-front cost, businesses and consumers will see savings from their energy bills.

5.3.5 Trade Impacts

100. In terms of impact on UK trade with the EU, the proposed Ecodesign requirements are expected to facilitate UK-EU trade of lighting products[35]. In terms of total import and export quantity (tons), the UK imports 39% of lighting products from the EU and exports 77% of lighting products to the EU. But in terms of monetary value (£), 51% of the UK's total imports of lighting products are imported from the EU, and 75% of the UK's total exports of lighting products are exported to the EU[35]. The majority of the remaining non-EU UK imports and exports of lighting products (for both quantity and value) are largely comprised of UK-US and UK-Asia trade.

101. Therefore, the UK imports and exports large quantities of lighting products from and to the EU, and the value of trade with the EU is very high, given around half of UK imports and around three quarters of UK exports are attributed to trade with the EU. Since the EU will be committing to the proposed Ecodesign requirements, UK imports of lighting products (both in terms of quantity and value) will likely not change significantly, given that prices are not

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

[35] All trade data was sourced from the International Trade Centre (ITC) Trade Map using the following 6-digit level HS codes: 701190; 850410; 853921; 853922; 853929; 853931; 853932; 853939; 853950. For both quantity and value, a 2017-2019 average total was taken where applicable. ITC Trade Map available at: https://www.trademap.org/

expected to rise significantly[21]. For similar reasons, UK exports too are unlikely to change significantly, as it would most likely not be in UK businesses' best interest to forego nearly three quarters of the sector's export value, unless there was certainty that this value of trade could be achieved elsewhere. If the proposed Ecodesign requirements were not adopted in GB, we assume that many UK businesses exporting lighting products to the EU would be likely to voluntarily comply with the EU's new requirements in order to maintain this level of exports to the EU.

102. As a result, we do not believe the proposed Ecodesign requirements are likely to have more than a negligible impact on trade. We will seek to test this hypothesis further through consultation with stakeholders, including by seeking more information about who exactly imports and exports lighting products.

5.3.6 Further Impacts

103. We have not attempted to monetise the direct costs, under Option 2, of the potential effect that the updated GB requirements for lighting products could have on innovation. Requiring UK manufacturers to improve efficiency would create considerable opportunities to innovate, which has possible benefits such as improved consumer choice, investment in industry, and knowledge spill-over. However, it was considered disproportionate to quantify this given the complexity and the uncertainty in the level of innovation that might be achieved.

104. For the same reasons, it was considered disproportionate to attempt to quantify the additional benefit of Option 2 in ensuring open and fair competition with EU manufacturers (in particular for ease of trade with the EU) or, similarly, the costs of Option 1 in manufacturers having different requirements to comply with.

105. The potential benefits of energy labelling were not monetised because it was impossible to quantify the effects. However, there has been a huge increase in the number of products in the higher efficiency classes (see paragraph 43) since requirements were introduced.

106. We also recognise the importance of energy labelling, which is recognised globally as one of the most effective policy tools in the area of energy efficiency[21]. The energy label allows UK industry to distinguish itself based on quality and innovation rather than solely on price.

107. For manufacturers and retailers, the energy label is one of the main market drivers and an important quality feature, as energy labels are a powerful tool to help drive innovation because they secure recognition for the best performing products. For consumers, the energy label offers a unique opportunity to make an informed choice as to which products offer the best environmental and energy performance allowing them to save money in the long run. Due to the current overpopulation of the top energy classes, energy efficiency improvement cannot be shown to consumers and will therefore not be rewarded in the price of the product. It is expected that the policy will give sufficient incentive for manufacturers to improve the energy efficiency of their

products as to reach the new A and B levels that can then be sold at a higher price.

5.4 Sensitivity analysis

108. Annex 1 provides an overview of the model used for the CBA and, as expected, several considered modelling assumptions have been made which carry varying 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 19.

109. Table 4 below indicates the relative sensitivity of a variable and how this affects the overall costs/benefits. 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. Variables used in the modelling are proportional to the NPV, therefore those with a higher risk rating are more sensitive to variations in modelling.

110. From Table 4, Cost and Energy Use are the variables which are likely to have the biggest impact on NPV and could change by ±15%. In isolation, either one would change the NPV by the same percentage. The other variables are less likely to change so would therefore affect the NPV less.

Table 4: Outline of the sensitivity of the model by variable

Variable	Risk rating	Impact on Costs	Impact on benefits	Comment
Cost (£)	High	The cost value could change by up to ±15%, resulting in a ±15% change to overall costs.	None.	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.
Sales/Stock	High	The sales/stock value could change by up to ±10%, resulting in a ±10% change to overall costs.	The sales/stock value could change by up to ±10%, resulting in a ±10% change to overall benefits.	Overall costs and benefits are directly proportional to the size of the Sales/Stock.

Use (hours/year)	Medium	None.	The use value could change by up to ±10%, resulting in a ±10% change to overall benefits.	The number of hours in a year per product is used and has no effect on costs (since use does not affect the lifetime in the model nor on sales/stocks) but is directly proportionate to the overall energy use, and hence benefits.
Energy Use (kW)	Medium	None.	The energy use value could change by up to ±10%, resulting in a ±10% change to overall benefits.	The power used by a product has no effect on costs (to buy the product) but is directly proportionate to the overall energy use, and hence benefits.
Lifespan	Medium	Related.	Related.	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	High	Directly related.	Directly related.	A change in the additionality assumption has a proportional effect on the costs and benefits, and therefore NPV. We consider it possible that additionality of each product could vary by +/-25%[36].

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.

111. 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.

5.5 Risks

112. In the following sections, we consider the specific risks associated with the model behind lighting products. However, in general and for the reasons that

[36] The variation in our additionality estimate will primarily depend on the extent to which the ecodesign requirements under Option 2, and the effect of the NI protocol, prevent less energy efficient products reaching the UK.

follow in this section, we consider a reduction in the NVP for lighting products unlikely.

113. Figures assume all costs will be incurred by UK consumers. Some costs may be absorbed by non-UK businesses (manufacturers and/or retailers in the supply chain) which will reduce the costs to the UK.

114. Future sales figures are, perhaps, the most uncertain of the input variables. However, as described in Annex 1, these affect both costs and benefits in the same proportion. While any such changes may well affect the scale of the NPV, they alone should not result in the NPV becoming negative.

115. Similarly, lower than 100% compliance figures would likely affect costs as well as benefits. Although some consumers may still end up buying products which do not meet the requirements, they are likely to do so at a lower cost.

116. The costs included in Table 3 do not include those incurred by businesses potentially adhering to multiple requirements (under Option 1) or the additional benefits that ease of trade with the EU under this option would bring. Further, there are additional benefits of Option 1 with respect to innovation and increasing competitiveness, in line with the UK's Industrial Strategy. While hard to monetise, their impact (of increasing the NPV for Option 2) cannot be ignored when considering these scenarios.

117. The energy consumption modelled under Option 1 does not consider a potential increase in stock of less efficient products entering the UK market under this scenario. The realised benefits of Option 2 are, therefore, likely to be an underestimate.

118. Although future energy costs are uncertain, changes would affect both options considered in the CBA.

119. 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.

120. Resource efficiency is only considered qualitatively, as the environmental benefits are disproportionate compared to energy savings, and there was difficulty in quantifying all resource efficiency measures.

5.6 Impact on UK businesses

5.6.1 Direct Costs and Benefits to UK Businesses

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

122. As per the guidance from BEIS37, we consider only the direct costs to businesses here. These include manufacturing costs which, elsewhere, are assumed to be passed onto consumers.

123. During the consultation process, we will seek views on the proportion of lighting products that are imported into the UK. Currently, we are able to identify information that provides evidence of the existence of UK manufacturers involved in the lighting products sector, which has led us to assume a 75% import scenario for lighting products (see Section 6.5).

124. In Table 5 below, we present the direct costs of lighting products, showing a positive Business NPV. Analysis suggests that for lighting products, a 0% import scenario would still produce a positive NPV. Given that 75% is currently considered a conservative estimate though, we are confident that the true proportion for imported lighting products is not 0%. The impact on UK businesses is, therefore, positive overall.

125. For UK-based manufacturers selling within the UK, the 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. As per Section 5.3, these costs are not monetised here as they are considered negligible in this case.

126. Given some lighting products are non-domestic products[38], 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 UK manufacturers, we need only consider either the manufacturing or purchase costs to avoid double-counting.

[37] 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

[38] Commercial directional, commercial non-directional, industrial non-directional, and street lighting are considered non-domestic lighting products (see Annex 2 for further detail).

127. 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.

5.6.2 Other costs and benefits to business

128. Other benefits of Option 2 to manufacturers (see Section 5.3) include maintaining consistency with respect to these particular products with manufacturers outside of the UK and a likely increase in innovation, raising competitiveness. Since these are indirect costs, they have not been considered here.

5.6.3 Total costs and benefits to business

129. Table 5 below shows the overall direct costs and benefits to UK businesses[39]. Section 6.5 provides greater detail for lighting products.

Table 5: Summary of costs and benefits to UK businesses (2021 prices)

Costs/benefits, £m	(Option 2) Overall costs (£m)	Direct Business Costs (£m)
		Lighting products
Costs to manufacturers/business purchasers	**149**	125
Costs of increase in non-traded CO2e emissions (extra heating)[40]	**12**	0
Total Costs (A)	**161**	125
Value energy savings (net)	**1,688**	1,019
Value of reduction in CO2e emissions	**152**	0
Net benefits of air quality improvements	**77**	0

[39] It was not possible to accurately quantify the sole benefits to manufacturers of owning the more energy efficient domestic appliances under Option 2.

[40] 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.

Total Benefits (B)	**1,917**	1,019
Net Present Value (B–A)	**1,756**	895

Note that totals may not appear to add up due to rounding. A 75% import scenario is assumed for lighting products.

130. Table 6 below shows the related Business Net Present Value and Business Impact Target Score.

Table 6: Equivalent Annualised Net Direct Cost to Business (EANDCB) and Business Net Present Value for Option 2

	Total [2021 Prices, 2021 present value (£m)]
Business Net Present Value	895
Equivalent Annualised Net Direct Cost to Business (EANDCB)[41]	-47
Score for Business Impact Target (BIT)	-235

Note that totals may not appear to add up due to rounding. A 75% import scenario is assumed for lighting products.

6 Lighting products

131. Section 5 provided an overview of the costs and benefits of Option 2. This section examines those specifically for lighting products. It begins with a detailed description of the product itself and the proposed requirements.

6.1 Lighting products: Overview

132. Lighting products are light sources and separate control gears. Containing products are also included in the scope of the regulations. The definitions of these products are as follows:

- Light Source: A light source means 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.

[41] 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).

- Control Gear: A control gear means 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.
- Containing product: A containing product is 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 source.

133. The scope of the draft ecodesign Regulations covers the following:
- Light sources.
- Separate control gears.
- Light sources and control gears placed on the market in containing products.

134. The scope of the draft energy labelling Regulations covers the following:
- Light sources with or without integrated control gear.
- Light sources placed on the market in a containing product.

135. A list of lighting products which are exempt from the ecodesign and energy labelling requirements are set out in the. draft Regulations.

136. UK lighting product annual sales are worth around £1.25bn[42] (source ONS 2018 and PRODCOM), with lighting products responsible for 18% of all the electricity consumed in the UK[43].

137. The Lighting Industry Association (LIA) estimates that the lighting sector in the UK encompasses 1,700 companies across the supply chain and is worth

[42] 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

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

£2.3bn to the economy[44]. The 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.

138. HMRC statistics[45] on total UK imports and exports shows that:

- The European Community is the UK's key trading partner for lighting products, representing 46% of imports and 57% of exports of lighting products by value.
- Within Europe, Germany is a key trade partner, representing 11% of imports and 10% of exports. France and Netherlands are also significant partners each accounting for 5-6% of imports and 7-10% of UK exports of lighting products by value.
- China is the top single source of UK imports of lighting products, representing 36% of UK lighting imports by value, but represents only 3% of UK's exports of lighting products.
- The US is a significant destination for UK's exports of lighting products, with 10% of such exports going to that country.

139. The European Commission's most recent preparatory studies[46] on lighting products concluded that even though the existing regulations have had a positive impact on the environment, more carbon savings could be achieved if the regulations were updated. The studies showed that, due to technological progress, the existing regulations required updating to secure further energy savings and that by simplifying the regulations, greater compliance could be achieved.

140. The uptake of LED technology has increased greatly in recent years[46] and along with this increase in demand has come a rapid increase in LED efficiency[47]. The average energy efficiency of LEDs quadrupled between 2009 and 2015, with their average price dropping during the same period[48]. Due to this technological progress, the MEPS in the current lighting products regulations need updating to reflect the current technological landscape and to maximise potential carbon savings.

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[44] 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

[45] HMRC data by Standard /international Trade Classification (SIC) code (2016). Available at: https://www.gov.uk/government/publications/hmrc-data-catalogue

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

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

48 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

141. The increase in highly efficient lighting products available on the market also means the highest energy classes, those A+ rated and above, are now over-populated. This makes energy labels less effective in promoting the most efficient lighting products to consumers as anything rated as A+ and above is viewed as efficient enough, with consumers identifying little difference between products rated A+, A++, and A+++.

142. Currently there are three separate ecodesign regulations for lighting products, each covering different types of lighting products and each with a different formula to calculate energy efficiency. This has made it difficult for industry to understand the norms and exemptions within ecodesign for lighting products and for the MSAs to ensure compliance. Conformity assessments are also demanding as the number of parameters and length of testing procedures make the process expensive and time consuming. Unifying and updating the existing ecodesign regulations is therefore required to facilitate greater compliance within industry and make verification less burdensome.

143. The draft Regulations propose to adopt a containing product approach. Light sources can be contained, for example within a luminaire. Under the existing ecodesign regulations a light source, whether contained or not, is subject to ecodesign requirements. Products such as fully integrated luminaires make testing the light sources contained within them difficult because the light source cannot be accessed without damaging the product. This, therefore, makes a situation where some lighting products cannot be monitored by MSAs and so there is unequal treatment of a light source within a luminaire and a light source which is not. The containing product approach is used to solve this issue by focusing the regulation upon light sources, control gears, and their combinations. Under this approach, luminaire manufacturers would have to ensure that either the light sources that are integrated into the luminaire (i.e. the containing product) meet the MEPS or the entire luminaire meets the MEPS.

144. The proposed updated requirements as set out in Option 2 would require manufacturers to:

- ensure that the declared power consumption of a light source does not exceed the maximum allowed power as set out in the draft GB regulations;
- ensure that a separate control gear operating at full load meets the minimum energy efficiency requirements set out in the draft GB regulations;
- ensure that a light source meets the functionality requirements set out in the draft GB regulations;
- ensure that light sources and separate control gears display the information as set out in the draft GB regulations on the product, packaging, and/or on a free to access website as specified in the draft GB regulations;
- ensure light sources and separate control gears can be removed from containing products with the use of common available tools and without

damage to the containing product unless a technical justification why this is not appropriate is provided;

- provide information about the replaceability or non-replaceability of light sources and separate control gears on free-access websites or packaging;
- ensure light sources and separate control gears can be dismantled from containing products at end of life with instruction available on free-access websites; and
- ensure that each light source with or without integrated control gear, and each light source placed on the market in a containing product is supplied with an energy label in the format set out in the draft regulations and that the obligations of suppliers as set out in the draft regulations are met.

145. Proposed updated requirements as set out in Option 2 would require dealers in GB to:

- ensure that at the point of sale each light source bears a label provided by the supplier in accordance with the draft regulations and that the obligations of dealers as set out in the draft regulations are met;
- ensure that any visual advertisement and any technical promotional material concerning a specific model of a light source contains the energy efficiency class of that model and the range of energy efficiency classes available on the label; and
- ensure that existing labels on light sources at the point of sale are replaced by the rescaled energy labels in such a way as to cover the existing label within eighteen months after the application of the draft regulations.

6.2 Lighting products: Costs and benefits of Option 2

146. The Energy Using Products (EUP) CBA model was based on one model, split into six sub-models, which were subsequently split into domestic and non-domestic sectors (see Annex 2), examining the impact of the regulatory changes on lighting products. They were segmented again in order to group different lamp types into their typical end-uses, so that usage and lifespan inputs could be consistently applied to each lamp type. They were also grouped so that only one of the three lighting regulations would be included in the Do Nothing scenario. The lamp types included in each sub-model are presented in Table 7 below.

Table 7: Lighting Products Model Technologies and Regulations

Model Sector	Regulation in the baseline scenario	Sub-technology
Domestic non-directional	Ecodesign [244/2009]	GLS (general lamp service – incandescent) Halogen CFL (compact fluorescent) LED (light emitting diode)
Domestic directional	Ecodesign [1194/2012]	GLS, halogen, LED
Non-domestic non-directional (office)	Ecodesign [245/2009]	Linear fluorescent lamps including T12, T8 Halophosphor, T8 Triphosphor, T5, and LED equivalents
Non-domestic industrial	Ecodesign [245/2009]	Mercury vapour, metal halide, high pressure sodium, low pressure sodium, LED equivalents
Non-domestic directional	Ecodesign [1194/2012]	Low voltage halogen, mains voltage halogen, compact metal halide, low voltage LED, mains voltage LED
Non-domestic street	Ecodesign [245/2009]	Mercury vapour, metal halide, high pressure sodium, low pressure sodium, LED equivalents

147. Each model uses the following inputs which are generated from raw data:

- forecasted sales/stock figures;
- estimates for additional costs arising from producing products compliant with new/updated regulations under Option 2 compared with Option 1;
- forecasted level of usage (in hours/year);
- estimates for the energy usage (in kWh/year/unit), again for products compliant with the regulations under Option 2 compared with Option 1; and
- the expected lifespan of products (before a replacement is required).

148. A more detailed description is provided in Annex 2.

149. The numbers below in Table 8 and Table 9 show the effects of the proposed revision to the existing ecodesign requirements for lighting products compared with Option 1 (Do Nothing). Low and high scenarios of ±10% have been presented as indicative variances from the central estimate due to unknown uncertainty. Based on more in-depth sensitivity analysis provided in Section 5.4, which considers the sensitivity of each variable used in the modelling, ±10% is the maximum expected range for which costs and benefits could vary.

Figure 1 and Figure 2 show the cumulative costs/benefits and energy savings respectively for the central estimate.

Table 8: Discounted costs summary for lighting products (2021 prices)

2021 prices (£m), 2021 present value year	**Low (-10%)**	**Central**	**High (+10%)**
Costs to manufacturers (assumed to be passed onto consumers)	134	149	164
Total costs of increase in non-traded CO_2e emissions	11	12	13
TOTAL	**145**	**161**	**177**

Table 9: Discounted benefits summary for lighting products (2021 prices)

2021 prices (£m), 2021 present value year	**Low (-10%)**	**Central**	**High (+10%)**
Value of energy savings	1,519	1,688	1,857
Value of reduction in CO_2e emissions	136	152	167
Net benefits of air quality improvements	70	77	85
TOTAL	**1,725**	**1,917**	**2,108**

Figures have been rounded so may not appear to sum correctly.

Figure 1: Estimated energy use under Options 1 (Do Nothing)[49] and 2 (updating ecodesign requirements) for lighting products and the cumulative energy savings of implementing Option 2.

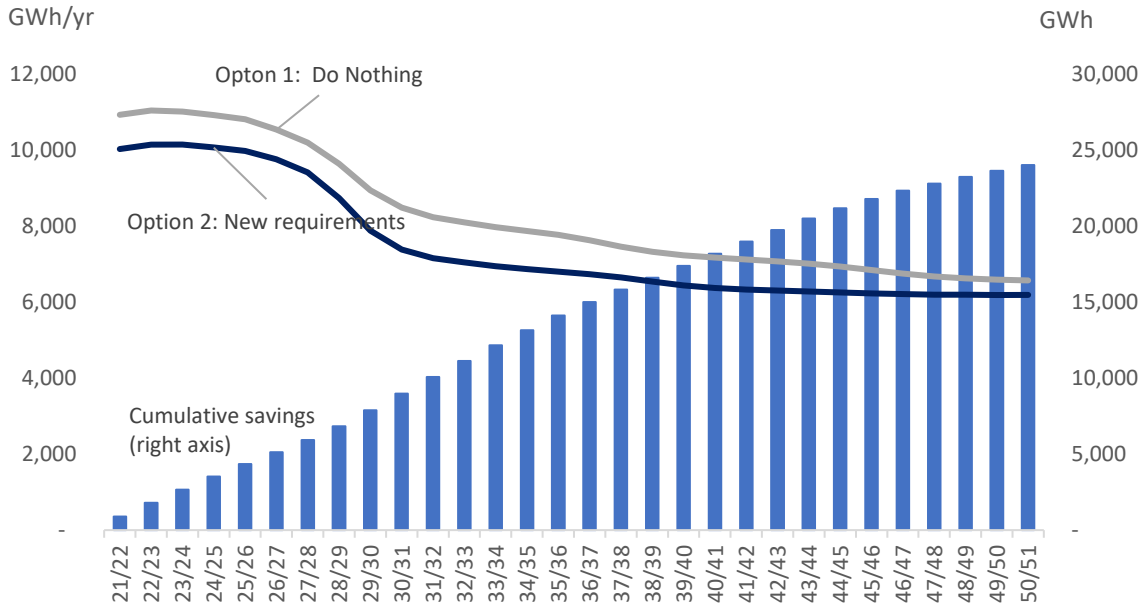
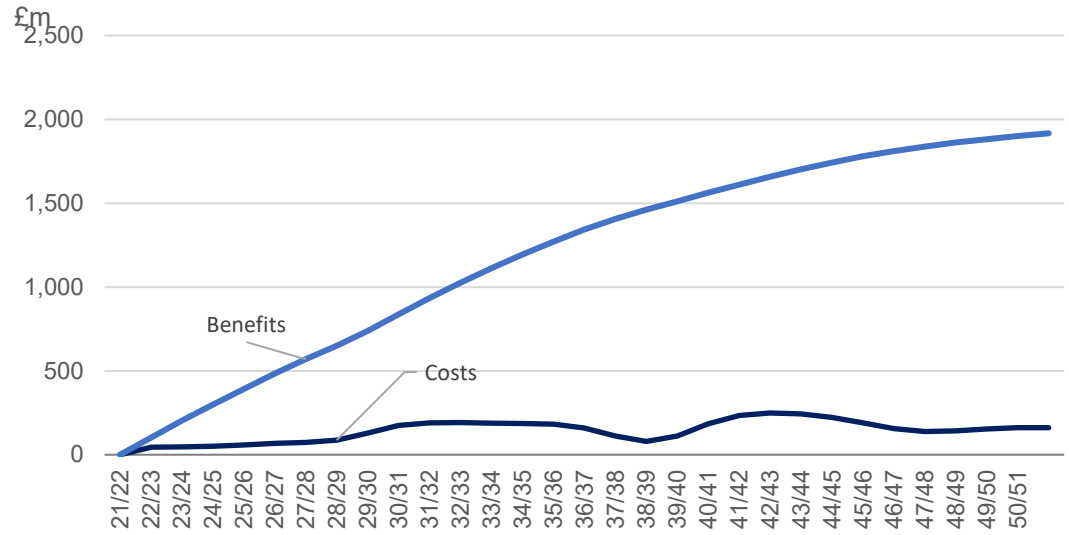


Figure 2: Cumulative costs and benefits of Option 2 for lighting products (2021 prices).



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.

[49] 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.

150. The draft Regulations for lighting products deliver an estimated NPV of £1,756m and is expected to save around 21,900 GWh of electrical energy and 2.6 million tonnes of CO_2e over the appraisal period (2021/22 to 2050/51). Annual energy savings amount to around 400 GWh a year by the end of the appraisal period.

151. Energy savings occur for both Option 1 (Do Nothing) and Option 2, as we assume that some consumers will take into account energy efficiency when purchasing. But the savings forecast for Option 2 are greater because the energy efficiency improvements in lighting products occur earlier than they otherwise would under Option 1 (Do Nothing). Figure 1 shows the importance of this initial improvement in lighting products under Option 2 in delivering greater energy savings over the appraisal period (2021/22 to 2050/51), which maintains greater energy savings than Option 1 (Do Nothing).

152. Annual energy savings (the difference between the estimated energy use of the two options) increase year-on-year at the start of the appraisal period (

153. Figure 1) as the non-compliant stock gradually gets replaced by lighting products which meet the requirements under Option 2. Once the stock has largely been replaced (by around 2038/39) annual energy savings remain broadly static but there are still savings. Additional costs are upfront under Option 2, occurring at the point of purchase only, but the energy saving benefits accrue over the lifetime of the product. As a result, a positive NPV is achieved from the onset (where benefits exceed costs) from 2022 onwards. Therefore, to account for costs accumulating over the appraisal period, the modelling scales down costs towards the end of the appraisal period, so that the NPV is not offset (as shown in Figure 2). Not scaling would result in all the costs, yet only part of the benefits, being considered for products purchased towards the end of the appraisal period, negatively affecting the NPV.

154. These are stock based models, meaning sales are calculated by the model based on lifespan inputs. The up and down movement of the costs curve in Figure 2 occurs due to the replacement rates of lamps, as they reach the end of life cycle where costs are incurred to replace them. This is impacted by the variation in lifespan in technologies (i.e. non-compliant lamps will have a much shorter lifespan than the compliant LED ones).

6.2.1 Lighting products: Non-monetised costs and benefits

155. This section examines the additional costs and benefits that, for proportionality reasons, have not been monetised. To indirectly take these into account in the CBA, sensitivity analysis has been undertaken in Section 6.3.

156. Specifically, for lighting products, there would be costs associated with meeting the information requirements as set out in the draft Regulations. Energy labels would also have to be provided for lighting products within scope of the draft Regulations.

157. Manufacturers are already required to provide the technical details and the information required by the draft Regulations, therefore this information would be readily available to them. Lighting products are also already subject to

energy labelling requirements, so it is expected that the costs associated with providing the new, rescaled energy labels would be minimal.

158. Although the draft Regulations are a revision of existing regulations and so the general processes is already established, transitional costs are not expected to be minimal.

159. However, these costs will be small in relation to overall costs and benefits of the policy option. Monetising such costs is therefore considered disproportionate. However, any such costs may fall disproportionately on to smaller businesses and are therefore considered in the Small and Micro Business Assessment (SAMBA) in Section 7.

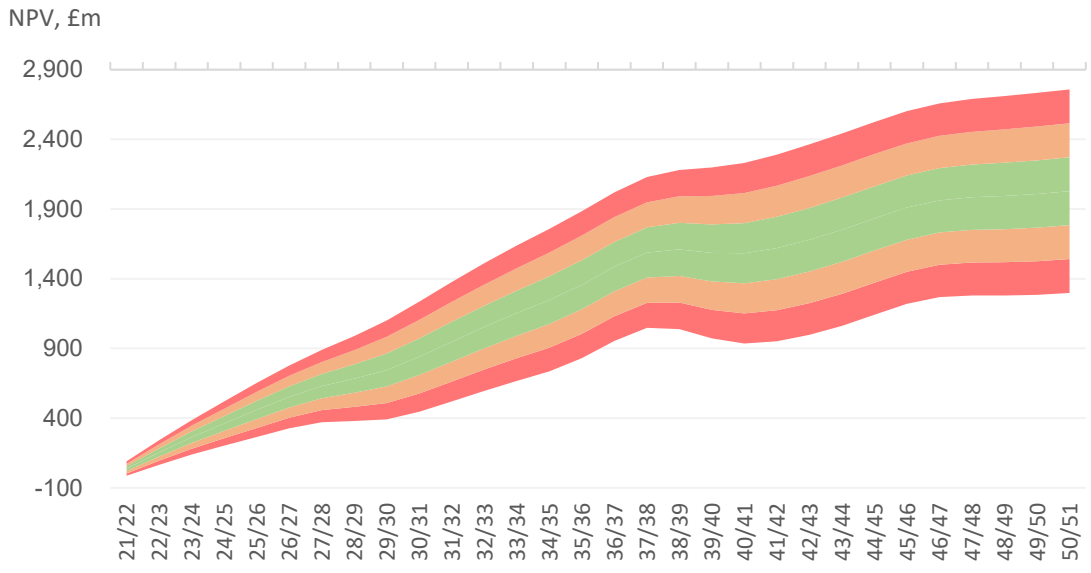
160. Further, compliance and distributional costs were considered negligible as outlined in Section 5.3.4. Similarly, additional benefits of innovation due to UK manufacturers being required to improve efficiency and in maintaining consistency for these particular products with non-UK manufacturers (particularly for ease of trade with the EU) were not considered.

6.3 Lighting products: Sensitivity analysis

161. Figure 3 below indicates the impact on the NPV over the appraisal years with up to 30% adjustments from the central costs and benefit estimates. Note that the extremities of the bands constitute a 10/20/30% increase (decrease) in costs along with a 10/20/30% decrease (increase) in benefits.

162. The 20% scenario is the highest expected variation in the costs and benefits, and therefore NPV. Higher variation than this is considered unrealistic based on the assumptions used in modelling but is represented by the 30% increase/decrease scenario. See Section 5.4 for further detail.

Figure 3: Chart showing the range of the NPV over the appraisal period with up to 30% adjustments from the central cost and benefit estimates (2021 prices).



The green area shows the range of NPV where costs/benefits vary up to 10% from the central estimates, orange within 20% and red, 30%.

163. Table 10 below provides more detailed costs for the +/- 20% scenario (the orange areas in Figure 3) compared with the central estimates.

Table 10: Costs, benefits and NPV for lighting products under high (+20%) and low (-20%) scenarios over the entire appraisal period (2021/22 to 2050/51).

2021 prices (£m), 2021 present value year	**Lighting products**
Low (-20%) costs	129
Central Costs	**161**
High (+20%) costs	193
Low (-20%) benefits	1,533
Central Benefits	**1,917**
High (+20%) benefits	2,300
Low NPV (high costs, low benefits)	1,340
Central NPV	**1,756**
High NPV (low costs, high benefits)	2,171

164. Under the high costs (+20%) and low benefits (-20%) scenario (Low NPV), there would be an estimated NPV of £1,340M over the appraisal period (2021/22 to 2050/51) compared with £1,756M under the expected scenario. This would arise from, say, a 20% increase in costs of the products under Option 2 compared with the Do Nothing, along with a combined 20% decrease in the expected energy savings from the legislation (due to, for example, a 20% reduction in the expected annual energy use). A reduction in costs by 20% and a similar proportional increase in energy savings would, however, deliver an NPV of around £2,171M.

165. An increase in costs of around 120%, with no change in benefits, represents the NPV tipping point between a positive and negative value. A 92% decrease in the benefits, with no change in costs, has the same effect. The next section examines the likelihood of such a divergence.

166. Table 11, below, shows that the total benefits of implementing policy option 2 increase more than the total costs as the length of the appraisal period increases. Total costs are £92 million in a 10-year appraisal period (ending in 2030) and rise to £161 million in a 30-year appraisal period (ending in 2050), an increase of £69 million. Total benefits are £934 million in a 10-year appraisal period and £1,917 million in a 30-year period, an increase of £983 million. The net present value rises from £842 million in a 10-year appraisal period to £1,756 million in a 30-year appraisal period, a 109% increase. We

have not modelled past a 30 year appraisal period, but it is expected that in a longer appraisal period the net present value would continue to rise.

Table 11: Estimated Costs and Benefits of Policy Option 2, Appraisal Period Analysis

2021 prices (£m), 2021 present value year	**Appraisal period (£m)**		
	10-year	**20-year**	**30-year**
Costs to Manufacturers (passed on to consumers)	84	147	149
Costs of increase in non-traded CO2e emissions (extra heating)	8	11	12
Total Costs (A)	**92**	**158**	**161**
Value energy savings (net)	823	1,415	1,688
Value of reduction in CO2e emissions	80	133	152
Net benefits of air quality improvements	30	62	77
Total Benefits (B)	**934**	**1,611**	**1,917**
Net Present Value (B–A)	**842**	**1,453**	**1,756**
Benefit Cost Ratio (B/A)	**10.2**	**10.2**	**11.9**

167. The estimated costs and benefits of policy option 2 are partially dependent on projected long run variable supply costs of fossil fuels.[50] This analysis is consistent with the central price forecast scenario. Given the scale of uncertainty over future fossil fuel prices, a sensitivity analysis of the high and low fuel cost scenarios has been included.

168. Table 12, below, shows that both costs and benefits are larger when energy prices are assumed to be higher. Furthermore, the increase in benefits exceeds the increase in costs. Total costs fall by £14 million in the low energy price scenario and increase by £8 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 £262 million in the in the low energy price scenario and rise by £187 million in the high energy price 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. The net present value is 15% lower in the low energy scenario and 10% higher in the high energy price scenario.

Table 12: Estimated Costs and Benefits of Policy option 2, Energy Price Analysis

2021 prices (£m), 2021 present value year	**Energy price scenario (£m)**		
	Low	**Central**	**High**
Costs to Manufacturers (passed on to consumers)	149	149	149
Costs of increase in non-traded CO2e emissions (extra heating)	6	12	18
Total Costs (A)	**155**	**161**	**167**
Value energy savings (net)	1,509	1,688	1,793
Value of reduction in CO2e emissions	69	152	234
Net benefits of air quality improvements	77	77	77

[50] Table 9: Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal

Total Benefits (B)	**1,655**	**1,917**	**2,104**
Net Present Value (B–A)	**1,500**	**1,756**	**1,937**
Benefit Cost Ratio (B/A)	**10.7**	**11.9**	**12.6**

6.4 Lighting products: Risks

169. This section outlines the potential risks associated with the costs and benefits of the policy along with possible mitigations. The main risks identified with the analysis in this Impact Assessment relate to the cost and benefit estimates, particularly whether the costs identified could be higher and/or benefits lower than expected, resulting in the NPV becoming negative.

170. The risks around each variable have been considered in Table 19 of Annex 2 through the assumptions log along with mitigations where relevant. The following high-level results can be drawn from the log:

- 3 low-medium risk assumptions have been identified: usage, technology, and lifespan.
- 1 low-high risk assumption has been identified: Stock and sales figures. However, these affect both costs and benefits proportionately and, given the sensitivity analysis above, we consider it unlikely that these risks, if realised, will cause the net benefit of the policy to be negative.
- 1 medium-high risk assumption has been identified: cost.

6.5 Lighting products: Impact on UK businesses

171. The impact on UK manufacturers under Option 2 will likely be moderate, given the UK lighting sector is partially focused on the manufacture of lighting products, particularly LED luminaires. However, the majority of the sector is believed to focus on lighting solutions/services rather than manufacturing.

172. Most of the light sources sold in the UK are imported either from Osram's and Philips' plants in Germany and the Netherlands, respectively, or from manufacturing plants in Asia[51]. Though manufacturing of lighting components has to a large extent moved overseas, UK suppliers of light sources and lighting systems are still managing to maintain a large share of component assembly in the UK.

173. The trend in lighting sales in the UK reflect that of EU and non-EU countries, with LED technologies displacing conventional lighting technologies. Lighting companies active in the UK LED market mostly provide development and design lighting solutions to commercial and outdoor applications. It is estimated that roughly half of these companies also assemble or manufacture

[51] 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.

LED luminaires. However, it is not clear to what extent the UK LED manufacturing facilities are dedicated to the actual manufacture of LED lamps, and there are indications most facilities focus on the assembly of luminaires, sourcing components, including the actual LED lamps, from suppliers outside the UK. These companies are expected to benefit from a higher stringency of the revised lighting regulation. Furthermore, the UK hosts several small-sized innovative service providers specialising in smart LED lighting solutions. The effects of the proposed ecodesign requirements on such providers are considered in Section 7.

174. The UK lighting manufacturing capacity consists mostly of the assembly of luminaires, luminous signs and other light fittings. Ceiling and wall lighting (e.g. luminaires, chandeliers) goods represent nearly a third of all sales in the sector (with a total £400m), followed by electric lamps and lighting fittings (£320m) and illuminated signs (£215m)52. The UK has very little manufacturing capacity on light sources (e.g. light bulbs), which accounts for no more than 2% of UK manufacturer sales (see Table 13).

Table 13: 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%**

175. 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 UK market (e.g. for LEDs)51. This means that many UK 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.

176. In turn, many customers of UK manufacturers and service providers tend to be located at the higher end of the market, focusing on quality of lighting and

[52] ICF, based on ONS, 2018. UK Manufacturers' Sales by Product (PRODCOM). Available at: https://www.ons.gov.uk/businessindustryandtrade/manufacturingandproductionindustry/datasets/ukmanufacturerssalesbyproductprodcom

customer service provision alongside energy efficiency and price. Examples of major customers of both indoor and outdoor lighting for both UK 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.

177. According to a leading UK lighting association, speaking on behalf of their members, UK manufacturers are exporting commercial luminaires and systems, particularly into the EU ("by far the biggest export market"), followed by the Middle East and USA51.

178. National statistics indicate that 41% of all domestic production of electric equipment is exported53. Assuming that the same percentage applies to lighting products, it can be estimated that, out of the total £1.2bn of lighting products manufactured in the UK, just under £0.5bn is exported and the remainder (£0.7bn) supplies the domestic demand. This represents 23% of the total domestic demand for lighting products, indicating that the remainder (77%, or £1.9bn) is imported. In that same year (2016), the UK imports of lighting equipment amounted to £2.6bn; while the UK exports of lighting equipment amounted to £0.8bn, denoting that the UK is a net importer of lighting products.

179. Additionally, considering the estimate above, that £0.5bn of the domestic manufacture is exported, and given that the UK exports of lighting products amounted to £0.8bn (2016), then this would mean that the remainder £0.3bn (or 37%) is actually composed of imported goods, which are then re-exported.

180. Table 14 below shows further information on UK domestic production and trade of lighting equipment.

Table 14: 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%**

[53] ONS, 2013. United Kingdom Input-Output Analytical Tables (2013). Available at: https://www.ons.gov.uk/economy/nationalaccounts/supplyandusetables/datasets/ukinputoutputanalyticaltablesdetailed

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]

181. Table 15 below splits out the total costs and benefits into those which fall directly to businesses, showing three different import scenarios for comparison. A 75% import scenario has been assumed in the modelling.

Table 15: Summary of costs and benefits directly impacting UK businesses for likely import scenarios – lighting products (2021 prices)

Costs/benefits, £m	**Option 2**	**Of which direct business costs (£m) if…**		
		70% imported	**75% imported**	**80% imported**
Costs to manufacturers/business purchasers	149	126	125	123
Costs of increase in non-traded CO2e emissions (extra heating)	12	0	0	0
Total Costs (A)	**161**	**126**	**125**	**123**
Value energy savings (net)	1,688	1,019	1,019	1,019
Value of reduction in CO2e emissions	152	0	0	0
Net benefits of air quality improvements	77	0	0	0
Total Benefits (B)	**1,917**	**1,019**	**1,019**	**1,019**
Net Present Value (B–A)	**1,756**	**893**	**895**	**896**

Note that totals may not appear to add up due to rounding.

182. Using the BEIS Impact Assessment Calculator, the provisional EANDCB of the preferred policy option (Option 2) is set out in below, alongside the Business NPV and Business Impact Target Score.

183. We will actively look to address the uncertainty around the scale of UK imports during the consultation process since this significantly affects the EANDCB and BIT score (see Table 16).

Table 16: EANDCB and Business Net Present Value for Option 2 (under the 75% import scenario) – lighting products

	2021 Prices, 2021 present value (£m)
Business Net Present Value	895
EANDCB[54]	-47
Score for BIT	-235

7 Small and micro business assessment

184. Across all sectors, the UK market is dominated by SMBs (defined as having up to 49 Full Time Equivalent (FTE) and 10 FTE employees respectively[55]), making up 99% of businesses at the start of 2019[56].

185. Such businesses are likely to be disproportionately affected by the transitional costs associated with Option 2, 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) as smaller businesses might find it harder to capitalise on the lower levels of regulation in the UK compared with elsewhere, for example, through scaling-up production or bargaining with suppliers.

186. Lighting companies active in the UK 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. However in general, these companies are expected to be flexible and agile enough to respond to the opportunities offered from the proposed ecodesign requirements under Option 2[51], so the burden of the efficacy requirements will be more likely to fall on larger manufacturers producing actual light sources.

187. UK companies sell a product range at a high efficiency level (A++ luminaires are the bestselling product), with most producing/supplying an efficient product that is equally efficient as the Best Available Techniques (BAT) currently on the market.

[54] 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).

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

[56] Business Population Estimates for the UK and the Regions 2019. Available at: https://www.gov.uk/government/statistics/business-population-estimates-2019

188. Based on this, 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 UK companies, focused on developing and providing smart LED lighting solutions, both within the UK market and overseas. This said, some UK-based suppliers, particularly those with a strong foothold in the EU market and a range that also covers both fluorescent and metal halide technologies, will still be impacted.

189. 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 Option 2. 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.

190. While the exact number of such businesses affected by the draft regulations is uncertain, Table 17 below shows the breakdown for manufacturing and for those specifically related to lighting products and "other electrical equipment".

Table 17: Number and proportion of manufacturing businesses (local units, VAT traders and/or PAYE employers) in the UK that are small and micro-sized, 2019[57]

	Micro (<10 employees)	Small (10-49 employees)	Total
All manufacturing	95,370 (82%)	20,490 (18%)	115,860
Of which … Manufacture of electric lighting equipment	515 (76%)	160 (24%)	675
Of which … Manufacture of other electrical equipment	505 (73%)	150 (22%)	695

191. Given the above figures, it could be estimated that over 80% of businesses affected by the regulatory changes in general would be small or micro in size.

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

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

193. 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)

[57] ONS: UK business: activity, size and location 2018 (see Table 4). 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.

and large manufacturers (250+ employees), and those by smaller businesses (10-49 employees). Such an approach would make enforcement activities harder as businesses, as well as products, would have to be investigated. Further, if smaller businesses were exempt, such an approach could have the perverse incentive of stifling growth.

194. The EU's proposed legislation applies regardless of the manufacturer's size and that will continue to be the case in the EU under their regulations. If an exemption or phase-in period were in place for UK-manufacturers, they would be unable to export their products to the EU market, affecting their competitiveness.

195. While we cannot completely rule-out small or micro UK businesses being affected, for the reasons outlined above, we have decided not to mitigate.

196. The consultation process will aim to gather views from stakeholders to better aid the understanding around the impact that the policy – as well as the Do Nothing Option – would have on all types of businesses.

8 Wider impacts

197. Table 18 below summarises the wider social and environmental costs and benefits, some of which have, while others have not, been considered in this assessment.

Table 18: 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	No	Section 8
Economic impacts		
Competition Assessment Impact Test guidance	Yes	Annex 3
Small and Micro Business Assessment	Yes	Section 7
Environmental impacts		
Greenhouse Gas Assessment Impact Test guidance	No	-
Wider Environmental Issues Impact Test guidance	Yes	Annex 4
Social impacts		
Health and Well-being Impact Test guidance	Yes	Section 8
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	-

198. Of the above assessments, only four have been identified as worth exploring further:

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

199. Of the remaining six additional assessments, no additional analysis has been conducted for the following reasons:

- Environmental impacts 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.
- Regulating ERPs has no direct or indirect disproportionate effect on any protected characteristics under equality legislation. Some visual effects from lighting are believed to be linked to adverse health symptoms such as epileptic fits and migraines. These can be forms of disability, which is a protected characteristic. However, the proposed Regulations include mitigations to minimise this impact – these are set out below.

8.1 Health and Well-being Impacts

200. 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.

201. 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:

(a) 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);

(b) 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

(c) 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).

202. 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.

203. 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. Public Health England's perception 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.

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

205. 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, is a well-known risk factor for photo-induced epilepsy.

206. 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[58].

207. Despite this, the draft regulations place functional requirements on LEDs to test for visible flicker and the stroboscopic effect. 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.

208. Exemptions have also been included in the draft GB regulations to allow individuals who are photo-sensitive to purchase incandescent light sources via medical prescriptions. Together these measures are aimed at minimising any potential health impacts for photo-sensitive people.

209. These requirements build on the provisions for people with light sensitive health conditions are included in the existing EU ecodesign regulation (EU) 1194/2012 on domestic directional lighting.

[58] 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

9 Summary and Implementation Plan

9.1 Summary

210. In a Do Nothing scenario, lighting products placed on the GB market would be subject to outdated ecodesign and energy labelling requirements. Without updating the requirements, businesses will not be incentivised to produce more energy and resource efficient products and consumers will not have easy access to information about the most efficient products on the market.

211. Policy Option 2 addresses these market failures by revising ecodesign and energy labelling requirements for lighting products to reflect those agreed by the UK as a Member State at EU level in December 2018.

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

213. The benefits identified are:

- reduced energy costs[59] due to improved energy efficiency;
- consistency between GB and EU requirements and global standards;
- likely increase in innovation due to manufacturers having to produce more efficient products;
- carbon savings / reduction in greenhouse gas emissions[59];
- improved air quality[59]; and
- increased repairability and recyclability.

214. The costs identified are:

- increased manufacturing costs[59] to produce more efficient products are expected. This is inclusive of transitional costs and assumed to be passed onto consumers through the supply chain resulting in increased prices[59];
- transitional (one-off) costs of implementing the policy, including familiarisation costs of understanding the requirements;
- possible reduction in consumer choice if some product types are removed from the market, however, these are likely to be replaced by new, more efficient products;
- distributional impacts should be expected; and
- enforcement costs of imposing requirements are also considered but have a net zero cost.

[59] This cost/benefit was quantified.

215. Quantified costs and benefits give a NPV of £1,756M over the appraisal period (2021/22 to 2050/51).

9.2 Implementation and Delivery Plan for Option 2

216. The Office for Product Safety and Standards (OPSS) within BEIS is the appointed UK Market Surveillance Authority responsible for the enforcement of ecodesign and enforcement of energy labelling requirements for suppliers (enforcement of energy labelling requirements for dealers is the responsibility of Trading Standards) and so would be responsible for ensuring manufacturers, authorised representatives, or importers comply with the updated ecodesign and energy labelling requirements for lighting products. They will do so through applying their enforcement policy[33], the aim of which is to undertake risk-based enforcement activities including supporting stakeholders through the provision of advice and guidance as well as employing proportionate sanctions. This regime will ensure the estimated energy bill and carbon emissions savings are realised.

217. This activity forms part of business as usual activity for the OPSS, and while it is expected there will be minimal opportunity cost as staff familiarise themselves with the new guidance, it is not anticipated there will be further additional costs associated with enforcement of the draft Regulations.

218. The Local Weights and Measures Authorities (Trading Standards), and, in relation to Northern Ireland, the Department of Economy, are responsible for ensuring that dealers comply with the requirements of energy labelling regulations.

219. The revised ecodesign and energy labelling requirements for lighting products are proposed to apply from 1 September 2021, at the same time as the EU's implementation dates. The Government is carrying out a consultation whereby manufacturers and other stakeholders can comment on the Government's proposals. We are also working with trade bodies to ensure our intention to regulate is communicated to their members.

220. Once the draft Regulations are made, OPSS will issue a notice informing manufacturers and importers of the new requirements that apply. As the proposed ecodesign requirements reflect what the UK, as a Member State, agreed at EU level in December 2018 following extensive consultation we anticipate a good level of awareness among manufacturers. We intend to launch a communications campaign to inform consumers and stakeholders about the changes to energy labelling.

221. Considering technological progress for lighting products, the Government will review the draft regulations no later than 5 years from the application dates of the draft regulations. This is to allow sufficient time for all provisions to be implemented and to understand market penetration. The review date reflects the rate of technological progress for lighting products.

222. As set out in both the Ecodesign for Energy-Related Products Regulations 2010, as amended by the Ecodesign for Energy-Related Products and Energy Information (Amendment) (EU Exit) Regulations 2019 and in the Energy Labelling Framework Regulation (EU) 2017/1369, as amended by the Ecodesign for Energy-Related Products and Energy Information

(Amendment) (EU Exit) Regulations 2019, the proposed requirements will be brought forward using secondary legislation.

9.3 Post Implementation Review

223. We consider a proportionate Post Implementation Review (PIR), conducted no later than 5 years after application suitable in this instance, as set out in the draft Regulations. The PIR would be based on a qualitative assessment of the impacts of the draft Regulations. As net energy savings are relatively low in the context of the UK's total energy use, we predict that measuring direct energy savings from improved ecodesign requirements for lighting products would be difficult in the context of the UK energy market.

224. The PIR should aim to assess if the draft regulation has effectively achieved its objectives of phasing out lower energy efficiency lighting products and use this to inform future policy development. We anticipate that the PIR will be based on market observations – breaches, for example – and 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. In addition, we expect the review to consider whether, as a result of technological advances, further savings could be made by raising the minimum energy efficiency requirements. To achieve this, data on the contemporary stock of lighting products would need to be collected, making sure that the information includes energy efficiency of the products.

225. Further, an assessment on the development of global regulatory standards, particularly in the USA and 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 circular economy principles. This will help to establish if the objectives of the regulation remain appropriate and are still required.

Annex 1 General modelling approach and key assumptions

226. 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.

A1.1 The model

227. 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 EUPP.

228. 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.

229. 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 carbon savings from using more energy-efficient products).

230. 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.

231. 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.

A1.2 Input variables

Stocks and/or sales

232. 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.

233. 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.

234. 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.

235. 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.

A1.3 Lifespan (years)

236. 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).

A1.4 Costs (£)

237. 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%[60].

Level of usage (hours/year)

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

Energy consumption (kW)

239. 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*[61].

A1.5 Modelling assumptions

240. 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).

241. 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.

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

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[60] The Green Book: Central Government Guidance on Appraisal and Evaluation, March 2019. Available at: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-govenent.

[61] Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal, January 2018. Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal.

A1.6 Modelling example

243. This section includes an example of how the model calculates the costs and benefits. 2023 has been used as the example year. (All figures have been rounded.)

Costs

244. As an example, let us assume that 20 million products were purchased in 2023. Due to the regulatory changes, the additional costs of buying a product (over those under Option 1 where there are no regulatory changes) are estimated, on average, to be £0.25 (2017 prices). This gives,

- Total cost (2017 prices) = 20.0m units * £0.25 = £5.0m.

245. Converting to 2021 prices, however, gives:

- Total cost (2021 prices) = £5.0m * 1.07[62] = £5.3m.

246. Since, in the main body of this assessment, costs have been provided with a present value year of 2021, these prices must be discounted at an annual rate of 3.5%63 giving:

- Discounted cost = £5.3m * $(1/1.035)^2$ = £5.0m

247. Costs in other years are calculated in the same way, taking into consideration the estimated number of sales and discounting the costs accordingly.

Benefits:

248. Average annual energy consumption is estimated to be, on average, 1.50 kWh/yr less under the draft regulations. Therefore:

Energy savings (in 2023 for those products purchased in 2023)
= 1.50 kWh/yr * 20.0m units = 30m kWh/yr

249. Using the Green Book supplementary guidance:

Value of energy savings (discounted) =
30m kWh * 1.08 £/kWh[64] * 1.03[65] * (1/1.035)^2 = £3.2

Value of reduction in CO2e emissions (discounted) =

62 Table 19 (2021 price scaling factor, compared with 2017), Green book supplementary guidance, 2018.

63 As per Green Book guidance: Discounting is used to compare costs and benefits occurring over different periods of time – it converts costs and benefits into present values. It is based on the concept of time preference, that generally people prefer to receive goods and services now rather than later.

64 Table 9 (Long-run variable cost, Central Estimate, Domestic, 2023), Green book supplementary guidance[62].

65 Prices in the Green book are expressed in 2018 prices which then have to be converted to 2021 prices using Table 19 (2021 price scaling factor, compared with 2018), Green book supplementary guidance, 2018[62].

30m kWh * 0.255/1000 tCO2e/kWh[66] * 34.0 £/tCO2[67] * 1.03[65] * (1/1.035)^2 = £0.3m

Net benefits of air quality improvements (discounted) =
30m kWh * 0.0052[68] £/kWh * 1.03[65] * (1/1.035)^2 = £0.2m

Total benefits (of 2023 cohort in 2023, discounted) =
£3.2m + £0.3m + £0.2m = £3.7

250. Energy savings for this cohort (products purchased in 2023) are then applied in subsequent years reduced by the number of products which were estimated to have reached the end of their lifetime. This is calculated using a normal distribution with an associated mean and standard deviation. After the mean number of years, it is assumed that the annual energy savings will apply to only half of the 20.0M units and, after the mean added to two standard deviations, only 2%.

251. Note that, although these benefits are lower than the costs, total benefits from 2023 will include those cohorts of products purchased in earlier years and, correspondingly, benefits from the 2023 cohort will be realised in subsequent years.

Annex 2 Specific modelling for lighting products

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

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

254. Additionally, the proposed regulation includes requirements regarding information provided by manufacturers, their authorised representatives and importers. This information is intended for use by professional buyers.

255. There are currently three separate ecodesign regulations69 in place to regulate lighting in the UK. The draft Regulations propose to consolidate the three separate ones.

256. The draft Regulations use threshold efficacy limits (Lumens/Watt) and end loss factors for different lamp types in conjunction with correction factors (to account for light source characteristics) and colour rendering factors (to account for the quality of light output by lamp technology). 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

[66] Table 1 (Long-run marginal, Domestic, 2023), Green book supplementary guidance, 2018[62].

[67] Table 3 (Traded, Central estimate, 2023), Green book supplementary guidance, 2018[62].

[68] Table 15 (electricity, National average. 2023), Green book supplementary guidance, 2018[62].

[69] Ecodesign Regulation (EC) 244/2009 on domestic non-directional lamps; Ecodesign Regulation (EC) 245/2009 on non-domestic non-directional lamps; and Ecodesign Regulation (EU) 1194/2012 on directional lamps.

ecodesign requirements are to be enacted in a single stage (1 September, 2021).

257. The models reflect the ban of 2-,4-, and 5- foot FL T8 lighting products from 1 September 2023. The models were updated to reflect this and the CBA values updated.

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

- Halogens: Halogen capsules (G9, G4, GY6.35), low voltage (LV) directional light source (DLS).
- Fluorescents: T8 with 2' 4' 5' lengths and CFLi (Compact fluorescents with integrated controls). T8 sizes have the most LED retrofits available.

259. 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).

260. The ecodesign requirements suggest there will be no phase-out of other lamp types. This meant that high pressure sodium (HPS), metal halide (MH) and low-pressure sodium (LPS) lamps commonly used in street and industrial lighting applications will all remain on the market. However, these lamps will be phased out in absence of any policy anyway due to lowering LED costs and improving functionality. Further, low pressure sodium lamps will not continue, as these yellow lamps will not meet the chromaticity requirements.

261. 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.

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

263. The models were stock-based and were derived using a variety of sources which are outlined in Table 8.

Table 19: 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) [2] Department for Transport (DfT) Growth Rates of Roads in Great Britain (2005-2014) [3] US Department of Energy Solid State Lighting Projections [4] Building Energy Efficiency Survey (BEES) (2015) [5] Valuation Office Agency (VOA) [6] Building Energy Efficiency Survey (BEES) (2017) [7] Lighting Industry Federation Study of Installed Directional Bulbs in GB Households (2010) [8] Lighting Industry Federation Study of Installed Directional Bulbs in GB Households (2007) [9] Lighting Industry Association (LIA)	LED uptake was included in the models. 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]. For commercial directional lighting, it was assumed that these lamps remained on the market until the end of 2017 (to allow suppliers to sell off existing stock), with sales falling to zero in 2018. 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]. For commercial non-directional lighting, the reference scenario included the impact of the existing Tertiary Lighting regulation. The policy scenario modelled the impact of the proposed single ecodesign regulation. This 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 2024. 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 (£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]. For industrial lighting, stock values were based on floor areas (m2) from [6] and typical lux levels in industrial end-uses to estimate the number of lamps required to illuminate the total floor area. The reference scenario contained impacts from the proposed single eco-design regulation. No high intensity discharge lamps (HIDs) were removed from the market. 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. For domestic directional lighting, reference scenario values were included the impact of the proposed eco-design regulation and the existing one (1194/2012). The proposed 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. Considerable savings will occur as LEDs consume around 10% of the electricity of halogens. Note that GLS lamps were banned in the baseline due to the existing regulation (1194/2012). As such, no savings or costs were attributed to the GLS ban (where the stocks fall to zero by 2020). 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. 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.

		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) [2] Analysis of street lighting in the United Kingdom Section 4.2 (1997) [3] MTP Street Lighting Model (2010) [4] BRE Retail Lighting Survey (2010)	The average usage of all other lighting products per year were based on 2006-2030 projections. 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]. **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 [2] Lighting Industry Association (LIA) [3] Model for European Light Sources Analysis (MELISA) (2015) [4] Department of Business, Energy and Industrial Strategy (BEIS) GDP Deflators [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. For street lighting, improvement costs for lamps and ballasts were estimated using [1] for 2012-2050. For commercial directional lighting, the model only contains policy costs where product switching occurs, as the proposed policy does not affect lamp efficacies. For commercial non-directional lighting, lamp prices were taken from [2] from the first 5 months of 2016. These were

		inflated annually using [4]. Policy costs were incurred via product switching from banned Low voltage halogens (LV Hal) to LV LEDs. The per unit costs by technology were the same in both scenarios. Policy costs are the price difference per unit between a compliant product (LV LEDs) compared to the reference product (LV Hal). This price difference was multiplied by annual sales estimates to develop annual policy cost figures. 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, 2016 lamp prices were averaged from the first 5 months of 2016 [2] and inflated each year using [5]. o 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. o 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. **Risk: Medium – High** as the costs for all, except street lights, were based on 2008 lighting models (non-directional) and 2012 lighting models (all other lighting products)

Technology (different under each option)	[1] US Department of Energy Solid State Lighting 2016 Projections [2] Model for European Light Sources Analysis (MELISA) (2015) [3] European Commission 'How Many Lumens Do You Need?' [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]. 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. For industrial lighting, there was no changes resulting from the policy scenario as no HID lamps were removed or require efficiency improvements. 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.

		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. **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) [2] European Expertise Centre (EPEC) Energy Efficient Street Lighting [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. For street lighting, average annual energy demand for each lamp technology were calculated from [1][2]. For all other lighting, lifespan values were taken from [3]. **Risk: Low - Medium**. Reliable data sources were used, with the exception of some data being older.

Annex 3 Competition Assessment

264. Considered in this assessment are the effects on competition from our preferred policy option (Option 2). The following questions were considered as to whether the option:

(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; and

(d) Reduces manufacturers' incentives to compete vigorously.

265. It has been concluded that there are no adverse effects on competition from our policy option as none of the above conditions are satisfied.

Annex 4 Wider Environmental Impacts Assessment

266. 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?

267. 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.

Annex 5 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. 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. 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.

Annex 6 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
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