Title: Non-residential charging infrastructure provision **IA No:** DfT00411 **RPC Reference No:** RPC-DfT-4407(2) **Lead department or agency:** DfT **Other departments or agencies:** MHCLG	Impact Assessment (IA) **Date:** 24/09/2021 **Stage:** Final **Source of intervention:** EU **Type of measure:** Secondary legislation **Contact for enquiries:** EV-Infrastructure@dft.gov.uk

Summary: Intervention and Options

RPC Opinion: GREEN

Cost of Preferred (or more likely) Option (in 2019 prices)			
Total Net Present Social Value £220m	**Business Net Present Value** £15m	**Net cost to business per year** -£4m	**Business Impact Target Status** Qualifying provision

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

To address the social welfare impacts of emissions from Internal Combustion Engine Vehicles (ICEs) and meet legally binding targets for reducing Green House Gases, the Government has set the ambition that all new cars and vans sold in the UK will be effectively zero emission by 2030. To achieve this, the UK will need a well-developed network of charging infrastructure for Electric Vehicles (EVs), delivered at least cost. Without government intervention, the pace of infrastructure installation by the market could slow the transition to EVs such that government emissions reduction targets are missed and infrastructure is installed at a higher cost to society.

What are the policy objectives and the intended effects?

The EU Energy Performance in Buildings Directive (EPBD) sets minimum requirements for charging infrastructure in new residential and non-residential buildings and some properties undergoing major renovation. Whilst the UK is no longer bound by EU law or the requirements of this directive, the Government believes it is within England's interests to proceed with these policy measures to support the transition to EVs. Therefore, this policy aims to implement regulation to match the EPBD requirements for charging infrastructure in new non-residential buildings. This will ensure that non-residential car parks have the necessary EV charging infrastructure to support future EV uptake. It is expected that if chargepoints become readily available in key destinations, a significant barrier to purchasing an EV will be removed, helping to support further uptake of EVs.

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

This assessment looks at the costs and benefits of implementing regulation to match the EPBD requirements for new non-residential car parks with over 10 spaces. Under new rules, they will be fitted with at least one chargepoint and ducting for cables for one in five parking spaces. This option is compared to a baseline where infrastructure is not installed at the point of construction but is retrofitted at a later date. Alternatives to mandating this through regulation include continued support through grants such as the Workplace Charging Scheme and other investment driving policy which are currently implemented. Further options for mandating more infrastructure have not been considered; there is less certainty around how widespread requirements for non-residential charging provision will be relative to residential charging.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 04/2025

Does implementation go beyond minimum EU requirements?		No		
Is this measure likely to impact on 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:**	**Non-traded:**	

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

Signed by the responsible SELECT SIGNATORY: ________________ Date: 6/12/21

Summary: Analysis & Evidence — Policy Option 1

Description: Transposition of requirements set out in the EU Energy Performance in Buildings Directive: Install one chargepoint and ducting to route cables in 1 in 5 spaces in new non-residential building, and those undergoing major renovation, with more than 10 car parking spaces.

FULL ECONOMIC ASSESSMENT

Price Base Year 2019	PV Base Year 2022	Time Period Years 29	Net Benefit (Present Value (PV)) (£m)		
			Low: -£34m	**High: £516m**	**Best Estimate: £235m**

COSTS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low	£0.1m		£9m	**£160m**
High	£0.3m		£41m	**£754m**
Best Estimate	£0.2m		£25m	**£463m**

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

This includes familiarisation costs, net replacement costs, net operating costs and policy installation costs which are estimated to be £0.2m, £20m, £78m and £365m over the appraisal period. The policy installation costs combined with the baseline retrofit installation costs results in a net benefit which will be explained below. We expect these costs to fall on developers and non-residential car park owners.

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

There may be some small additional maintenance costs to car park owners to ensure the continued functionality of the chargepoints hardware that would not have occurred in the baseline due to chargepoints being fitted at an earlier date in the intervention.

BENEFITS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	£0.0m		£8m	**£126m**
High	£0.0m		£81m	**£1,270m**
Best Estimate	£0.0m		£45m	**£698m**

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

The key monetised benefit is avoided installation costs to non-residential car park owners, estimated to be £698m over the appraisal period. When combined with the policy installation costs mentioned above, this yields a net benefit of £333m over the appraisal period.

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

Cost savings from installation during construction could also extend to the avoidance of disruption costs/inconveniences caused to the public or building occupants from works involved in retrofitting chargepoints, such as the digging of trenches. Improved access to charging is correlated with sales of EVs; it can be expected that this policy will result in some EV purchases which carry a benefit to society in terms of GHG emissions reductions. This policy may result in faster uptake of EVs and subsequently emissions and fuel savings which we do not monetise. This is because, under the preferred option, installations only occur in new/majorly renovated buildings which are likely to only comprise a fraction of destinations where chargepoints are required. To estimate this impact would likely be disproportionate.

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

It is assumed that the volume of carparks falling within the scope of this legislation will be 2,585 each year (1% of the current stock). All of these car parks are assumed to be in scope (have more than 10 spaces). In new build developments, developers take advantage of cost savings through economies of scale, but in retrofit installations, single unit costs are applied. Impacts are relative to a baseline which assumes the same number of retrofit installations over the appraisal period. Degradation of materials is assumed to happen in line with CIBSE economic life estimates.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			**Score for Business Impact Target (qualifying provisions only) £m:**
Costs: £20m	**Benefits: £24m**	**Net: -£4m**	-£20m

Contents

1. Background

1. The Energy Performance of Buildings Directive (EPBD) is the European Union's (EU's) main legislation for improving energy performance and delivering cost effective Green House Gas (GHG) emission reductions across the EU from buildings.

2. A review of the EPBD in 2016 concluded that buildings legislation could be used to achieve broader objectives in 'contributing to (the) decarbonisation of the transport sector'. It also concluded that legislation could fill a regulatory gap across the EU to support the deployment of charging infrastructure in non-publicly accessible spaces[1]; considered essential given a significant proportion of charging for electric vehicles takes place at home and in private parking areas.

3. Consequently, proposals were made to extend the provisions in the EPBD, including the addition of minimum requirements for charging infrastructure in new residential and non-residential buildings. The requirements were that ducting[2] be installed in every parking space in new residential buildings and residential building undergoing major renovation, with more than 10 parking spaces. In new non-residential developments and those undergoing major renovation, with more than 10 parking spaces, the EPBD set a requirement for at least one chargepoint and ducting for one in five parking spaces. For existing non-residential developments, the requirement was for one chargepoint per car park with more than 20 spaces by 2025.

4. On 23 June 2016, the EU referendum took place and the people of the United Kingdom voted to leave the European Union. The UK remained a full member of the EU while exit negotiations took place and all obligations remained in force. The UK left the EU on 31 January 2020 with a transition period until the EU-UK Trade and Cooperation Agreement (TCA) took effect from 1 January 2021. The UK is therefore no longer bound by EU law or the requirements of this Directive. However, the Government believes it is within England's interests to proceed with these policy measures to support the transition to electric vehicles in line with our ambitious commitments to address climate change.

5. The Government had carried out a consultation[3] on implementation of the EPBD. The consultation focussed specifically on requirements for the installation of chargepoint infrastructure in parking spaces attached to new and existing buildings. Having considered responses to the consultation, the Government now proposes to move forward in line with the guiding principles of the EPBD and bring into law the provisions which require installation in new car parks and those undergoing major renovation. The Government will not bring into law the EPBD provisions for existing non-residential properties. The Government will instead seek to pursue a more tailored solution that better aligns with our electric vehicle transition ambitions and the needs of businesses in England. This Impact Assessment (IA) builds upon the consultation stage IA[4] for non-residential building requirements by considering, where possible, improved evidence and analysis derived from and since the consultation.

6. This IA looks specifically at provisions for non-residential chargepoint infrastructure. There is a separate IA that covers the residential provision.

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[1] http://www.legislation.gov.uk/uksi/2017/897/pdfs/uksi_20170897_en.pdf Alternative Fuels Infrastructure Directive covers public charging provision

[2] Ducting is considered to be any conduit for routing cables from the power supply to the chargepoint. These can include cable trays and subsurface trenches.

[3] https://www.gov.uk/government/consultations/energy-performance-of-buildings-changes-to-the-energy-performance-of-buildings-regulations-2012-no-3118

4 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/817071/impact-assessment-non-residential.pdf

2. Problem under consideration

7. The electrification of road transport, particularly for cars and vans, is regarded as a crucial component in meeting legally binding CO2 reduction targets set out in the Climate Change Act (2008). In 2018, Government set out the Road to Zero strategy, our first detailed plan to decarbonise road transport. This set out ambitions for 50%-70% of new cars and vans to be Ultra-Low Emission Vehicles (ULEVs) by 2040 and all new cars and vans to be effectively zero emission by 2050. However, Government is going further and faster to decarbonise transport and announced in 2020 that it would phase out the sale of new petrol and diesel cars and vans by 2030, and, from 2035, require all new cars and vans must be zero emissions at the tailpipe.

8. With Electric Vehicles (EVs) expected to be the most cost effective zero emission alternative to Internal Combustion Engine Vehicles (ICEs) for most cars and vans, this transition will require a widespread deployment of charging infrastructure; and it is expected that government intervention will be necessary to support this so that charging infrastructure is installed at a pace which supports the uptake of EVs in line with Government targets. This intervention will address consumers' range anxiety around purchasing EVs and ensure that cost savings are realised where possible.

9. The transition to zero emission has started; there are currently more than 400,000 ultra-low emission vehicles (ULEVs) registered in the UK[5] and the UK has one of the largest markets for EVs in the EU[6]. However, ULEVs still represent just 1% of all registered vehicles in the UK[7]. A perceived lack of accessible and convenient charging infrastructure is repeatedly cited in consumer surveys as a barrier to purchasing an electric car[8]. Addressing this barrier by making it as easy as possible for consumers to charge at home, their workplace, destinations (e.g. supermarkets, train stations), on roadsides and on the strategic road network[9] is therefore crucial if Government EV uptake ambitions are to be met in the coming years.

3. Policy Objective and Context

10. The policy objective is to prepare for the transition to EVs by ensuring a suitable provision of charging infrastructure in new/majorly renovated non-residential buildings with an associated car park where appropriate; as well as to increase consumer confidence by raising the visibility of charging infrastructure and improving public perception of chargepoint availability.

11. The Government has intervened several times to promote the installation of chargepoints in both public and private spaces. A widespread public chargepoint network is particularly important for drivers who do high mileage, travel long distances and/or have no access to chargepoints at home or work. Government funding and leadership, alongside private sector investment has supported the installation of more than 22,700 public chargepoints[10]. This includes over 4,200 rapid chargepoints - one of the largest networks in Europe.

12. Early public installations were supported by the Plugged in Places Scheme. These networks were initially owned and run by consortia largely led by local authorities. Over time ownership of many of the publicly available/destination parts of these networks have shifted to industry.

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[5] Department for Transport, Vehicles statistics, Ultra-low emissions vehicles (ULEVs), VEH0130, Q4 2020, https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01

[6] https://www.statista.com/topics/2298/the-uk-electric-vehicle-industry/

[7] Department for Transport, Vehicles statistics, Ultra-low emissions vehicles (ULEVs), VEH0101 and VEH0130, Q4 2020, https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01

[8] In a recent Go Ultra Low Attitudinal tracking survey When asked why you wouldn't consider buying an EV, 64% of respondents said lack of chargepoints.

[9] The strategic road network in England is around 4,300 miles long and is made up of motorways and trunk roads, the most significant 'A' roads

[10] Department for Transport, Electric vehicle charging statistics, April 2021, https://www.gov.uk/government/statistics/electric-vehicle-charging-device-statistics-april-2021/electric-vehicle-charging-device-statistics-april-2021

Today, the majority of public chargepoints are financed by the private sector. The Government provides support for the installation of workplace charging through the Workplace Charging Scheme (WCS). The Government has also provided £40m of funding via the Go Ultra Low city scheme to eight cities across the UK to support uptake of ultra-low emission vehicles in those cities. To date, over 300 chargepoints have been installed as part of this scheme. Additional charging hubs are being installed across the country, including in York and Milton Keynes.

4. Rationale for Intervention

13. The overarching rationale behind government action to decarbonise road transport is to address the social cost of emissions from the private consumption of road transport from ICE vehicles. ICE vehicles will be over-consumed due to the private costs of their use being lower than the social costs, as the majority of pollution costs are borne by society.

14. To this end Government is has announced the end of ICE vehicle sales by 2030. Given our current proximity to this date, the most likely alternative fuelled vehicle is going to be battery electric and a Battery Electric Vehicle fleet will require a large chargepoint infrastructure to be deployed. This is a unique and unprecedented systemic transition driven by government targets and not by the market, as such the market lacks price signals and other incentives to ensure appropriate deployment of infrastructure, in a way that will maximise the likelihood of minimising transition costs to society.

15. In the case of chargepoint infrastructure in new buildings, the retrofitting of chargepoints and the relevant infrastructure for them is more costly than installation during building construction. Additionally, there is a lack of consumer confidence in chargepoint availability which constitutes a barrier to the purchase of electric vehicles, which in turn reduces market willingness to supply chargepoints.

16. Due to these reasons we expect in the absence of intervention for the market to install chargepoints in the future, when it is more costly (even accounting for time preference) than installing them at the point of construction. The market failures could be characterised as follows:

- **Network externalities and first mover disadvantage:** Chargepoint supply and EV demand are interdependent. With low EV take-up, chargepoint infrastructure is unprofitable for the market to install, or in this case, conversely without adequate provision of chargepoint infrastructure consumer demand for electric vehicles will not materialise. This interdependence between charging infrastructure and EV purchases means that EV purchasers and charging infrastructure providers suffer a 'first mover disadvantage'. This is where the first movers in building chargepoint infrastructure (or buying EVs) contribute to EV demand (or chargepoint infrastructure supply), but these first movers do not see the full benefit of the market they're helping to develop. Therefore, they cannot fully recover the cost of their investment and society benefits from their first move, creating a positive externality. This means, without intervention, EV uptake and chargepoint infrastructure will be done below the socially optimal level.

- **Information failures:** With perfect information, given the likelihood of the electrification of road transport and the cost effectiveness of installing the necessary infrastructure at the point of construction, we would expect car park owners to install this infrastructure during construction. However, consultation revealed no evidence to support that this was taking place. It is also possible that we can infer from this that imperfect information is preventing the car park owners from installing chargepoint infrastructure in anticipation of future demand. Without this demand, developers would be reluctant to provide chargepoints as a default in new builds, as it will represent a construction cost they are unable to charge a premium for. This means we can expect without intervention there will be an under provision of chargepoints.

- **Bounded rationality and uncertainty:** When constructing non-residential buildings, businesses may only consider a finite number of factors and have a short-term focus. As such, they may not undertake a full lifetime value for money assessment that weighs up the additional cost of retrofitting chargepoints at a later date against savings from installing chargepoints at the point of construction. Without intervention, if decisions are made with a short-term focus, we can expect under-investment in chargepoints at the point of construction.

4.1 Options

17. The only option considered is compliance with the minimum provision of the EPBD. The impacts are costed by comparison with a 'do nothing' scenario in which no policy is implemented. The EPBD also requires installation of chargepoint infrastructure in all existing public car parks by 2025. Due to the fact that 2025 falls outside of the expected transition period for the UK to leave the EU, there is no legal requirement to comply with this part of the directive. As discussed, the Government will bring forward a more tailored policy for supporting the roll out of chargepoint infrastructure in existing carparks.

18. **Option 0 – Do nothing baseline:** The baseline against which the policy is compared is a scenario in which carpark owners retrofit chargepoints at a rate that rises in line with a projection of % ZEVs, as a share of total car stock, such that the total number of installations in the counterfactual reaches the same level as in the policy on scenario, though installations happen at a slower rate.

19. **Option 1 – Regulations match the EPBD requirements for new non-residential carparks only:** This option transposes the EPBD requirement that new and majorly renovated non-residential car parks attached to a building must have at least one chargepoint and ducting for 1 in 5 spaces installed during construction. It is expected that this will yield benefits in promoting consumer confidence in charging at destinations and with some avoidance of cost from reduced civils costs from installation of ducting. This is explored below.

20. Evidence gathered supports an expectation that charging at home and over night will be the preferred mode of charging for EV users[11]; however, there is a higher degree of uncertainty around the level of chargepoint infrastructure provision required at non-residential sites.

21. No evidence has been found to suggest that going beyond the requirements set out in the EPBD at non-residential sites would facilitate uptake, or significantly save costs. This compares with the EPBD provisions for residential sites, where there is a clear expectation that chargepoint installation in domestic parking spaces is inevitable because of the speed of charging and the fact that charging can be done cheaper at home, overnight. This means a higher probability expectation that residential chargepoint installation during construction/major renovation will save costs to consumers (through avoided higher retrofit costs) and facilitate EV uptake.

22. We also consider that stronger incentives exist for non-residential site owners/users to have chargepoint infrastructure installed, due to the functional nature of these sites (for example, retail centres may wish to attract customers through provision of chargepoints at a later date).

23. Consequently we do not consider any measures additional to the EPDB requirements for non-residential sites; however we do expect to monitor and further develop the evidence

[11] See Residential Charging Impact Assessment, DfT, 2021

base around consumer charging requirements at non-residential sites and whether the market will deliver these; along with continuing to consider non-regulatory measures where necessary.

5. Evidence Base

24. This section outlines the expected impacts of the preferred option as well as the supporting evidence base and methodology used to monetise those impacts. Monetisation centres around (1) charging infrastructure costs that have been gathered from consultant-led research and stakeholder engagement; and (2) forecast installation with and without the preferred option, which are derived from public car park data for non-residential sites.

25. There are a number of impacts which are not currently monetisable due to limited data, though we do consider evidence to support their existence and explore how they may affect the costed impacts in sensitivities. There are five impacts considered in this IA, three of which are monetised and two of which are non-monetised.

Monetised impacts;

(i) The cost of installing one chargepoint and ducting for one in five parking spaces in new non-residential car parks at the point of construction, compared to a counterfactual where that one chargepoint is retrofitted at a later point;

(ii) Familiarisation costs, incurred by developers to familiarise themselves with the new processes for installing the relevant infrastructure and;

(iii) Material replacement costs due to hardware and component degradation that happens earlier than in the counterfactual, where the chargepoint would have been fitted at a later date.

Non-monetised impacts;

(iv) Impacts on EV uptake and subsequent emissions savings – it is not possible to estimate exactly how many additional EVs would be bought by consumers over the period as a result of implementing the policy, though evidence exists to suggest that availability and visibility of chargepoints contribute favourably to EV purchase decisions and;

(v) Avoided disruption costs as a result of the chargepoint installations that take place at the point of construction rather than whilst occupants/customers are present.

26. The appraisal period selected for this IA is 29 years (2022-2051); this is a typical appraisal period for energy and Net Zero related interventions, since energy infrastructure typically has a long useful life and the currently UK aims to end its contribution to global warming by 2050.

27. All costed impacts are discounted using the suggested Green Book discount factor of 3.5% to a base year of 2022.

28. As discussed above, we use costs of chargepoint infrastructure components, applied to forecast volumes of installations both with and without the policy to derive monetised impacts, the approach to gathering and estimating these is set out below.

5.1 Costs of Charging Infrastructure

29. DfT commissioned consultants, Steer, to research the costs of elements of charging infrastructure. Through desk research and stakeholder engagement they were able to identify and provide approximate estimates for four elements of charging infrastructure which are

relevant to the proposed policy options, 'Ducting', 'Cabling', 'Hardware' and 'Grid Connection' costs.

30. Costs were gathered in a three stage process, first through literature review, then through initial interviews with relevant trade bodies, and finally through detailed interviews and/or data gathering from 14 stakeholders who represented electricity network operators (such as National Grid or UK Power Networks), entities engaged in procuring or having chargepoint infrastructure installed (such as Greater London Authority and Berkley Homes), and chargepoint operators (such as Podpoint and Chargemaster).

31. For each cost component, estimates were captured for upfront installation (during construction) and 'retrofit' installation (after construction) for four types of parking location associated with private houses, and buildings which have multiple occupancy parking;

- **'Multi-occupancy surface'** – a surface level carpark with multiple spaces
- **'Multi-occupancy underground'** – an underground carpark with multiple spaces
- **'Multi-occupancy multi-storey'** – an above ground multi storey car park

32. In order to capture economies of scale from multiple installations, Steer provided high/low estimates for each cost category on a cost 'per unit', and a cost 'per 100x units' basis; with the 'per 100x unit' costs factoring in economies of scale.

33. Costs gathered are summarised in cost summary tables which were provided by Steer and amended by DfT analysts through consultations (see annexes). A number of assumptions were applied to derive 'unit costs' from cost data provided, in order to apply them to each option ('option-costs'), these are set out in later in this IA, and in further detail in the 'option-cost summaries' in the annexes.

34. During public consultation and in follow up discussions the majority of respondents stated they had no comment on the costs. Several respondents remarked that costs looked 'lower than expected' but provided no further evidence to support this, leaving us with no firm basis upon which to alter our cost estimates, especially given support by the majority of relevant stakeholders. Nevertheless, given costs contain a degree of uncertainty which cannot be mitigated at this stage they will be monitored as part of the post implementation review.

35. Unit cost optimism bias was considered as part of this evidence gathering; however the works undertaken in chargepoint installation are standardised, replicable and have been tested with stakeholders, many of whom have incurred the cost of installation numerous times. The track record in installing ducting and chargepoints means a greater level of confidence that we have captured the cost variability in ranges used than might be expected for other capital spend.

36. For modelling purposes, it is assumed all chargepoints installed will have 7kW speed and be 'smart' (i.e. have the capacity to pause charging to benefit from cheaper tariffs/assist with load management). These are regarded as appropriate assumptions and were tested during consultation, and align with forthcoming regulation which will mandate that new chargepoints are smart (see policy interactions). An explanation of the work undertaken by consultants, assumptions and relevant sources is outlined in the annexes.

37. For the purpose of this IA, we do not consider technology learning rates, whereby costs decrease over time due to learning in production, processes or material use. A request was made at consultation for information on learning rates and whether they should be applied. No substantive response was received. We do however consider the impact of learning rates in sensitivities.

5.2 Monetised Impacts

38. This section assesses monetised impacts (i)-(iii) set out above, explaining the evidence used to monetise these impacts, the methodology and risks and sensitivities.

39. In this section we provide an overview of the methodology and detail the approach to forecasting installations over the appraisal period both with and without the policy. This section also outlines the application of costs to these forecasts in order to arrive at the monetised installation cost savings and replacement costs. Finally, we discuss the cost of regulatory familiarisation that might be incurred.

5.2.1 Monetised Impact (i) Net cost from new non-residential residential installations

Overview of methodology

40. The policy requires installation of one chargepoint and ducting for 1 in 5 spaces in car parks with over 10 spaces, attached to new or majorly renovated buildings.

41. The impact of this regulation is estimated from the difference in aggregate costs of installation between a scenario where we implement the regulation and a scenario where we do not (the baseline). The implicit assumption is that without the regulation, chargepoint infrastructure is installed by sites after construction.

42. Our evidence suggests it is cheaper to install infrastructure during construction compared to retrofitting post-construction. For this IA we estimate a net benefit for this reason, since we assume that without the policy, infrastructure is retrofitted post-construction, discussed below.

43. In our baseline, annual installations are slower in the first half of the appraisal period and rise in line with a DfT-developed scenario of the % proportion of the fleet which is Battery Electric (EV). This scenario has been developed to align with a 2030 phase out of ICEV sales.

44. We assume that car park owners ultimately purchase and install, at least, the same volume of charging infrastructure as in the 'policy-off' scenario because there is a full transition to EVs over the appraisal period. We expect this to be the case because as the country moves to end sales of ICE vehicles; (a) there are opportunities to generate revenue by providing charging services, and (b) the provision of charging services may be necessary to attract customers to their establishments. If this does not happen, then there could be an over installation of charging infrastructure as a result of this policy leading to 'stranded assets' (we deal with this in risks and sensitivities, however we expect this risk to be small since this policy only requires installation of one chargepoint per car park as well as underground ducting for 20% of spaces).

45. Work was done to test these assumptions during consultation. No evidence was found to support that chargepoint infrastructure would be installed during construction without the policy or at a faster or slower rate. We therefore consider our approach reasonable to estimate installations in the absence of the intervention. Accurate forecasts of installations are difficult to predict both with and without the policy, this uncertainty is tested through sensitivity analysis.

Forecasting policy-driven installations in new/majorly renovated car parks

46. 'Non-residential car parks' for the purpose of this IA are those attached to a building and can mean both publicly accessible car parks such as those attached to supermarkets, hospitals and retail parks, and non-publicly accessible car parks such as those attached to workplaces.

47. To forecast the number of new non-residential installations the annual number of car parks, with over 10 spaces, attached to 'new' or 'majorly renovated' building attached have been estimated. The previous 2019 consultation IA did this by relying on a number of unevidenced assumptions in conjunction with available data on public and private car parks.

48. During consultation limited additional data and supporting evidence was provided, additionally no substantive challenge to assumptions used was made. Nevertheless, further data has been gathered through research and direct contact with stakeholders to strengthen the evidence base.

49. We estimate the number of annual installations in the following steps:

   a. Estimating the total number public and private (work place) car parks in the UK
   b. Determining the proportion of these which are in England
   c. Estimate the proportion of these which are attached to a building
   d. Assume a number equal to a % of the total number of eligible car parks will fall under this regulation each year.
   e. Estimating the number of chargepoint installations as the number of car parks impacted annually, and the number of units of ducting as 20% of the total number of spaces for the car parks impacted.

50. **Public Carparks:** Parkopedia[12] (the world's largest parking information service provider) was used at the consultation stage to identify that there are 20,370 car parks which are publicly accessible. This supports data collected by the British Parking Association (BPA) who state that there were around 20k publicly accessible car parks in in England, Wales and Scotland[13] in 2011.

51. **Workplace Carparks:** No data was available to estimate the non-publicly accessible car park stock. At the consultation stage; we estimated the number of workplace carparks as the difference between public car parks (from Parkopedia) and an estimate of the total population of car parks. In testing this approach with stakeholders and against other statistics, we determined that we had likely underestimated the number of private/workplace car parks in terms of volume of car parks and overestimated the average size of private car parks.

52. According to the Labour Force Survey (LFS), 18.7m people commute to work each day by car in England[14], and according to the National Travel Survey (NTS) around 70% report that they park in workplace car parks[15]. Assuming each car has one commuter (which will not always be the case), this could mean up to 13m parking spaces are required for car commuters to work. In the IPC[16] data seen by DfT, around 7% of all business/workplace car parks have less than 10 spaces.

53. Based on this, as the policy is only a requirement in car parks 10 spaces or above, it can be assumed that 7% of the 13m parking spaces required for commuters are in car parks which would fall out of scope for this IA, leaving ~12.1m spaces in car parks potentially in scope of this regulation. We assume all car parks have 50 spaces, so arrive at an estimated number of workplace car parks of 244k. Whilst this is an improvement on the previous approach taken, there is still uncertainty around this estimate which we explore further in sensitivities.

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[12] Parkopedia website, https://en.parkopedia.com/

[13] BPA data user guide, 2011 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/388123/Public_Car_Park_Data.pdf

[14] LFS, 2020, TSGB0109, https://www.gov.uk/government/statistical-data-sets/tsgb01-modal-comparisons

[15] NTS, 2018, Unpublished Ad-Hoc analysis gathered by the National Travel Survey for DfT

[16] The International Parking Community, is an independent body which have shared data on a sample of around 5,000 car parks in England with DfT. This data has been shared in confidence and used in developing assumptions for this IA with their agreement.

54. **Number of Carparks attached to a building:** Based on data received from the IPC, 11% of car parks[17] in a sample of 5,000 were 'public' (or not attached to a service such as retail, hospitals, etc.). We infer from this that 89% of the non-residential, public car park stock do have an attached building, arriving at ~18k public car parks when applied to 20,370. Again, this is an improvement on the previous approach which was to assume that all car parks had a building attached, however this is still uncertain.

55. **Number of Carparks in England:** The scope of this IA is for England only. Workplace car park calculations already use England data so do not need to be adjusted. However, the number of public car parks is estimated based on UK-related statistics, we use latest regional car ownership statistics[18] to determine the split of car ownership between England and other regions to estimate how many of these car parks are in England. According to this approach, ~ we estimate that 83% of car parks in the UK are in England. Applying this to our aggregate figure for public car parks we arrive at an estimate of approximately 259k (15k public and 244k workplace) car parks in England.

56. Finally, new or majorly renovated car parks are estimated. In the previous consultation stage IA it was assumed that 1% of the stock would be new/majorly renovated. Work has been performed to seek further evidence and methodologies to determine this number, for example we have attempted to use the methodology employed by MHCLG consultation IA for the Future Buildings Standard which uses a forecast based on floor space[19].

57. We therefore maintain our assumption from the consultation IA but note that it has been specifically tested with stakeholders as well as sense checked against potential corollary statistics, for example against car fleet growth (which averaged 1% a year for the last 10 years)[20]. To address the impact of existing uncertainty in this assumption, variations have been tested in the sensitivities section.

58. As a result, the 259k carparks in England (rounded to the nearest 100) estimated above is multiplied by 1% to arrive at the chargepoint volumes. For ducting volumes, the number of new/majorly renovated public and private car parks is multiplied by 171 (the assumed number of spaces per public car park based on Parkopedia data) and 50 spaces (the assumed number of spaces per workplace/private car park based on data received from the IPC) respectively. This figure is multiplied by 20% since the policy will only apply to 20% of spaces. This results in 2,585 chargepoints installed each year and 29,454 units of ducting.

59. The exemptions section below sets out the number of installations that are removed from this figure to account for an exemption for enclosed car parks for 5 years between 2022-2026.

Forecasting Baseline Non-Residential Installations

60. The baseline against which the policy option is compared is a scenario where there is no intervention and cark park owners face higher per-unit retrofit costs when they require chargepoint/ducting installation in the future. For this scenario, it is assumed that chargepoints will be installed in the same volumes over the appraisal period as the case in which their installation is mandated in new builds. The volume of installations in the early years is, however significantly lower, with the rate of installation increasing over time, in line with the percentage of EVs as a share of total car stock. Implicit to this is that, due to EVs being the dominant mode of charging, there will be no stranded assets. That is, car park owners will install at least the amount of infrastructure required by the EPBD, though this will happen later in the period. This is a reasonable assumption, as it is currently expected that EVs will be the dominant mode of road transport and EPBD requirements relate to a relatively

[17] International Parking Community, 2021, based on the proportion (%) of public carparks not built in support of a service other than parking

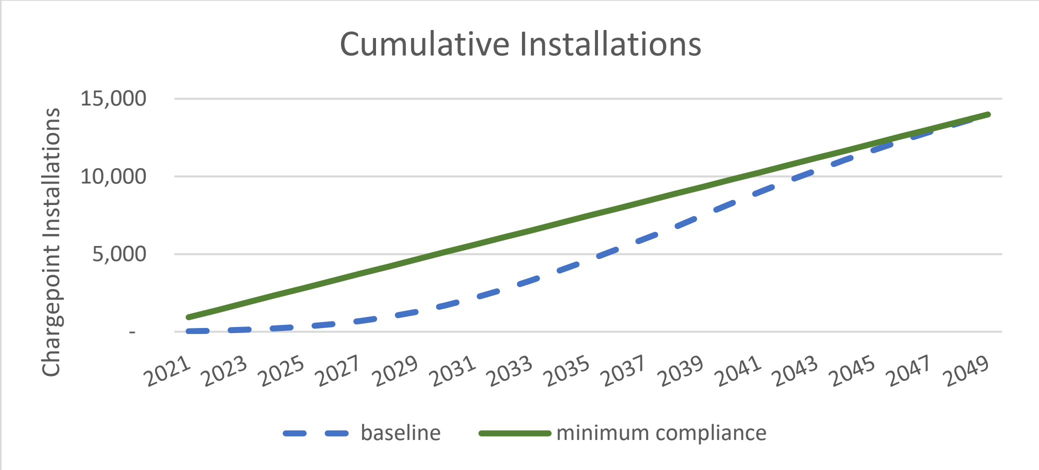
[18] Vehicle licensing statistics, 2019, DfT https://www.gov.uk/government/statistical-data-sets/veh02-licensed-cars

[19] MHCLG, Future Building Standards Consultation IA, 2021

[20] Vehicle licensing statistics

low proportion of total car park spaces. However, because there is uncertainty around this, further sensitivity testing has been conducted.

Figure 1: Cumulative new car park charge point installations



61. In the baseline it is assumed that car park owners retrofit infrastructure in line with EV uptake as a proportion of the total fleet. This rate is based on a DfT trajectory for uptake developed to align with the government's 10 point plan announcement which states the government's intention to end the sale of ICEVs by 2030. The precise rate of infrastructure roll out is uncertain however, and the rate of installation may occur above or below this rate in the baseline, and possibly in higher volumes. This is explored in sensitivity analysis.

62. There is evidence to show the market is looking to install charging infrastructure. Examples of the companies that have pledged to increase the provision of chargepoints include Tesco[21], the pub chain Marstons[22] and AA hotels and B&Bs[23]. Given these pledges, it seems likely that over the course of the appraisal period, there will be appetite for car park operators to retrofit chargepoints into some of the car parks that come under the scope of this policy. It is however very difficult to identify a reliable and accurate forecast for the rate at which these chargepoints will be installed.

63. It has also been observed that in car parks where charging infrastructure is installed, multiple installations are the average. Data from a Parkmark sample[24] identifies that of the car parks that currently have chargepoint provision, the average number of chargepoints is 4.8[25]. Crucially however, the scope of this IA only covers one chargepoint installed in each car park.

64. The annual number of chargepoint installations in the baseline is estimated using the total number of car parks renovated/added to the stock and the % of the fleet which is EV, taking into account the number of previously existing chargepoints. To estimate the amount of ducting it is assumed that each car park has ~171 spaces for public car parks and 50 spaces for workplace , and ducting is installed for 20% of these (meaning around 34 units of ducting per car park for public and 10 for workplace). We expect that over time installers will install ducting as well as other components for chargepoint infrastructure at a higher cost as the demand for charging increases and incentives for non-residential site owners to provide the necessary infrastructure increase. As mentioned above this approach and its uncertainties are explored in sensitivities.

[21] BPA UK parking sector report (p.2) https://www.britishparking.co.uk/write/documents/library/reports%20and%20research/bpa_uk_parking_sector_report_awweb.pdf

[22] Marstons News: Marstons partners with Engenie http://www.marstons.co.uk/news/marstons-rolls-out-rapid-EV-chargers.aspx

[23] ZapMap news: Chargemaster chargepoint offer for AA venues https://www.zap-map.com/chargemaster-charge-point-offer-for-aa-venues/

[24] ParkMark data request – accessed 20/02/2019 http://www.parkmark.co.uk/,

[25] This is based on a sample of 4,601 car parks, with 3.5% having some volume of chargepoints.

65. In the baseline all chargepoint infrastructure is retrofitted. This is a simplifying assumption, and it can be noted that there are some Local Authorities (LAs) with requirements for chargepoint installation during construction, but this is not widespread and it varies significantly between LAs.

66. No substantive evidence was provided at consultation to improve upon this assumption. It may well be the case that where non-residential building occupiers pay for development of their own premises, they will be incentivised to avoid retrofit costs as they will anticipate a future need to install chargepoints, however this is a key area of uncertainty explored through sensitivity testing, in the absence of evidence.

(i.iv). Application of charging infrastructure costs to forecast volumes and assumptions:

67. For both ducting and chargepoints, installation costs are taken from a report produced by consultants, Steer, who gathered cost quotes from a number of stakeholders, and sense checked these against findings from a literature review. The costs used in each option and further assumptions are set out in this section for each option; providing additional detail on what the costs contain, and how/why they vary between 'high' and 'low' as well as 'New Build' vs. 'Retrofit'.

68. Steer provided costs for different types of carpark installation; private residential, multi occupancy surface, multi occupancy (multi story) and multi occupancy (underground). The highest unit cost of installation in these is for surface level installations due to the likelihood of higher cost components and activity such as trenching required for these. No evidence was provided at consultation to understand what proportion of car parks would be of each type. Consequently, it is assumed that all car parks are multi-occupancy surface car parks, which have the highest unit cost. This is a reasonable assumption to make, since according to the latest publicly available study on non-residential parking '92% of public car parks are surface level'[26] (since this study doesn't account for work place car parks, we assume that 100% of all car parks are surface level for the purpose of this IA, so we do not underestimate costs).

Table 1: per-unit costs charging infrastructure costs (Steer, multioccupancy, surface)

	New build		Retrofit	
Component	**Low**	**High**	**Low**	**High**
Ducting cost per space	£67	£600	£167	£2,500
Chargepoint cost per car park	£1,182	£6,463	£1,640	£8,210

69. Each charge point installed will require some cabling, as well as a potential grid connection. However, each unit of ducting installed would not require these as there is no electrical hardware installed in ducting given ducting is conduit for routing cables from the power supply to the chargepoint.

70. The largest driver of variability in cost between the new build and retrofit scenario comes from the costs of civil works[27] in surface level car parks, where trenching is required. In retrofit installations, the cost of having to dig up roads is high.

71. The difference between the low and high cost scenarios is driven by the volume of ducting/trenching required, which depends on the assumed distances from the power supply to the charging infrastructure. Below details assumptions related to particular cost components such as cabling, connections and chargepoint hardware as well as wider cost assumptions.

[26] Spaced Out: Perspectives on Parking Policy; Bates & Leibling, RAC Foundation, July 2012, p 13.

[27] Considered to be work involving amendments to physical structures.

Cabling

72. Cabling is considered to capture any electrical cables that are required for connection between the power supply and the chargepoint.

73. As with ducting, the cost differences for cabling between categories are driven by the length of cabling required. For retrofit options, it is assumed that an entirely new cable from the distribution board to the chargepoint is required in all situations, which drives the higher cost.

74. At surface level, chargepoints will be supplied from a feeder pillar, which can serve multiple charge points.

Grid connection

75. Grid connection costs capture any costs involved in upgrading the grid capacity of a site to allow for chargepoint installation.

76. Grid connection costs associated with chargepoint connections vary significantly depending on location, and hence it is difficult to establish a representative cost for installations. There is a great deal of uncertainty surrounding these figures, and it has not been possible to fully capture the distribution of costs in the cost summaries, annex B sets out the assumptions chosen to arrive at these cost profiles.

77. The low range costs reflect a scenario where no additional capacity is required, so there is no grid connection cost, whilst in the high range scenario a larger transformer[28] is required (relative to the situation where no chargepoint is installed). For retrofit installations this would require the existing transformer to be replaced, whilst for new build installations, the cost would reflect the difference between the smaller and larger transformers.

78. No new evidence of alternative assumptions on grid connection costs were provided in the consultation. We engaged with key stakeholders directly who agreed with the estimated costs provided by Steer. Subsequently we have tested estimated connection costs per chargepoint against data gathered from commercially sensitive connection cost data provided to DfT by participants in the On-street Residential Charging Scheme (ORCs). This provides some confidence that the range of grid connection costs per chargepoint adequately captures the variability in connection costs per unit. Therefore, the costs used in the consultation stage IA are used in the final assessment, unchanged.

Chargepoint hardware

79. Hardware costs cover the physical chargepoint unit/outlet that connects an EV to the power source. These costs reflect those of a 7 kW ‘smart’ chargepoint. The installation of 7 kW chargepoints reflects minimum compliance, but in some cases higher speed chargers may be installed. Given these are costs for multi-occupancy surface car parks, we assume they are ground mounted.

Other key assumptions related to costs.

80. **All chargepoint installations are costed according to the single unit cost.** Whilst it is possible (likely) that when car park owners would install multiple chargepoints (and so benefit from economies of scale cost savings) the scope of this assessment only considers the first chargepoint installed in each car park, and so the single unit installation cost is applied.

81. **The ducting requirement for new build car parks are costed using the 100-installation unit cost**. This is because the assumed volume of ducting required in the average car park is for 34 spaces. The 100 x unit costs provided by Steer were broken down to a per unit basis and multiplied by the volume of car park spaces required. This does not perfectly capture the degree to which economies of scale reduce cost per unit based on different car park sizes,

[28] A static device which transfers electrical energy from one circuit to another through the process of electromagnetic induction.

but, given the limited breakdown of fixed and variable costs, it was not possible to identify this. Using the single unit cost would not allow us to capture any economies of scale, subsequently we use the figure for 100 units.

82. **Technological learning rates have not been modelled due to a lack of data to inform this**. Whilst most respondents to the consultation agreed that there will be technological improvements over the appraisal period, there was no indication as to how much this could impact hardware costs, if at all. Over time existing models will become cheaper whilst new technology enters the market at a higher price. If overall hardware costs were to decrease overtime, this would have a negative effect on the NPV, as a greater proportion of retrofit installations happen later in the appraisal period. this is explored further through sensitivity analysis.

83. **For every aspect of installation, there is a reduced cost when installations take place at the point of construction,** compared to retrofitted chargepoints for existing buildings/car parks. It is assumed that components of the installation at the point of construction bring a benefit to society in terms of the cost reduction relative to the retrofit cost.

84. Table 2 shows the present value net benefit for this impact, separated out by component. The first part of the table shows what the cost of a particular component would be under a retrofit installation, with the second part showing what the new build cost would be, and finally the net benefit section showing the difference between these figures. There is an overall net benefit for all aspects.

Table 2: New build Installation costs vs baseline £m (2019)	**Low**	**Central**	**High**
Retrofit installation costs (Baseline)			
Ducting	64	510	956
Chargepoint	63	188	314
Total	**126**	**698**	**1,270**
New build installation costs			
Ducting	37	183	330
Chargepoint	56	181	307
Total	**93**	**365**	**637**
Net impact			
Total	**34**	**334**	**633**

5.2.2 Monetised Impact (ii) Familiarisation costs

85. In addition to the installation costs, there will be time costs to car park owners and construction firms as they familiarise themselves with the new regulations. These costs include the time taken to read the regulations and to formulate a plan to respond to them. Whilst there is uncertainty around exactly how long it would take, it has been assumed that the impact will be greatest for contracting construction firms as they will have to accommodate the new requirements in their construction processes and advise clients of compliance costs.

86. Familiarisation costs analysis was developed for the consultation stage based on assumptions around the time taken for staff to familiarise and disseminate information on these regulations. We asked for feedback on these costs and there was no further comment on how they might be improved, subsequently we conclude that the approach is fit for

purpose, however we will look to continue monitoring activity to improve the evidence base around this.

87. For car park owners it has been assumed that one member of staff for each car park will spend around two hours reading and implementing the regulations. It is assumed that 10% of the non-construction staff in construction firms will also spend around 3 hours reading and implementing the regulations. These time and staff requirement estimates are unevidenced. ASHE 2019 hourly wage data for 'Property, housing and estate managers' and 'Production manager and directors in construction' gives rates of £19.79 and £24.17 respectively[29]. Including a non-wage labour uplift of 26.5%[30] increases this to £25.03 and £30.58 respectively.

88. Familiarisation costs are provided in table 3. The low and high scenarios represent a situation where familiarisation takes +/- 1 hour of the time identified in the central scenario.

Table 3: Familiarisation costs (2019 prices)			
	Low	**Central**	**High**
Familiarisation cost	£96k	£191k	£287k

5.2.3 Monetised Impact (iii) Material replacement costs

89. With the implementation of this policy, it is expected that infrastructure will be installed earlier than it would be without the policy. This means that over the appraisal period, there will be a higher amount of replacements for infrastructure than without the policy, due to wear. However, the regulation doesn't specify replacements, so chargepoint replacements are entirely optional and this is considered an indirect cost to business.

90. The Chartered Institute of Building Services Engineers (CIBSE) guidance ('Guide M – Maintenance engineering and management'[31]) provides a credible source for assumptions around economic lives, which can be used to determine the maximum time a component is used for.

91. The economic life estimates in the CIBSE guidance are based on assumptions around maintenance, installation and hours of operation.

92. Indicative economic life expectancy is given in Appendix 12.A1 of CIBSE Guide M. There are no specific guidelines for electric vehicle charging infrastructure although there is clear guidance on elements of chargepoint infrastructure, such as cables, feeder pillars, ducting and distribution boards. During the consultation, stakeholders were asked for input on component lifespan assumptions which has led to the adjustment of Electric Vehicle Supply Equipment ('EVSE', or chargepoint hardware) to 10 years. Lifespan assumptions used in the analysis are presented in Table 4.

Table 4: Indicative economic lifespan of equipment		
Equipment type	**Multi-occupancy car park**	**Private off-street parking**
Cables	30 years[1]	25 years[6]
Feeder pillars, base units etc	30 years[2]	N/A
Ducting	30 years[3]	30 years[3]

[29] https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/occupation4digitsoc2010ashetable14 ASHE table 14.6a, 2019

[30] TAG unit A4.1 social impact appraisal, para. 2.2.4, https://www.gov.uk/government/publications/tag-unit-a4-1-social-impact-appraisal

[31] CIBSE guide M https://www.breeam.nl/sites/breeam.nl/files/hulp/CIBSE%20Guide%20M.pdf

<table>
<tr><td>Distribution boards</td><td>20 years[4]</td><td>20 years[4]</td></tr>
<tr><td>EVSE outlet</td><td>10 years[5]</td><td>10 years[5]</td></tr>
<tr><td colspan="3">References from CIBSE Guide M, Appendix 13. A1
Distribution of LV electricity from main switchgear to area distribution boards:
1. HV and LV cables and wiring etc (thermoplastic) – 30 years
2. Fuse pillars, base units, poles and accessories etc – 30 years
3. Conduits and cable trunking plus supports etc – 30 to 35 years
4. LV switch gear and distribution boards – 20 years
Power installations:
5. Socket outlets, fuse connection units, etc – 10 years
6. General LV power installations – 25 years</td></tr>
</table>

93. Based on the equipment lifespans presented in the table above, and assuming baseline and policy option volumes of installations as presented above, the costs in table 5 have been generated for the appraisal period. The baseline total replacement costs are lower than for the policy on scenario, and so fewer components require replacement during the appraisal period. It is assumed that any aspect of the installation not installed at the point of construction, would later be retrofitted at the same time as it would have been in the baseline. Total replacement costs for each option are presented as well as the costs relative to the baseline.

Table 5: Material/hardware replacement costs (£m, 2019)

Component	Net Replacement Costs
EVSE outlet	16
Distribution boards	0.3
Cables	3.4
Ducting and feeder pillars	0
Total Costs	**20**

94. These costs represent an upper bound for replacement costs, as throughout earlier years of EV adoption, charging infrastructure installed in the policy option is likely to be underutilised. As level of use/hours of operation negatively impacts the economic life of charging equipment, it is possible that hardware installed in the early years would last longer than the estimates provided. This would result in lower replacement costs for the options relative to the baseline. However, it is also possible that because this policy requires the installation of 7 kW chargers at a minimum, these might be replaced sooner with higher specification chargers.

5.2.4 Monetised Impact (iv) Operational/Maintenance Cost

95. As a result of this policy, we expect that single chargepoints will be installed in sites earlier than they would have been without the policy. Carpark owner/operators may incur maintenance costs which can require payment to maintenance service providers either on an adhoc or contractual basis. However, the regulation doesn't specify any kind of maintenance regime, so chargepoint maintenance is entirely optional and this is considered an indirect cost to business. The commercial arrangements around chargepoint services are complex and vary greatly from provider to provider, and costs of maintenance can be driven by any number of variables including by chargepoint type and location.

96. Stakeholders have fed back to DfT that a full spectrum of arrangements may exist between chargepoint operators and site owners, from free chargepoints and maintenance costs by chargepoint operators in return for revenues received from chargepoint use[32], to highly bespoke contracts tailored to each site owners requirements – that can include anything from back office data and electricity management services, to standard maintenance checks.

97. Sources reviewed for this IA indicate that where standard maintenance packages are offered, service providers offer varied packages at different costs which include items such as guaranteed quick response times at higher prices, covering more chargepoints at the higher cost end.

98. As this policy only requires installation of one chargepoint per site, and utilisation may be low (thus requiring less maintenance), assuming that site owners opt for more expensive packages would likely overestimate costs. Similarly, assuming that no costs are incurred because suitable commercial arrangements are arrived at with chargepoint operators to avoid maintenance costs, would likely underestimate the costs to business.

99. Therefore, for the purpose of this IA, we use publicly available data on maintenance contract costs from service providers for their minimum support packages[33]. These sources show that that site owner/operators can pay between £237 and £360 a year for maintenance contracts. Applying these to the number of chargepoints installed annually in the counterfactual ('policy-off') and policy scenario we arrive at an additional cost of between £67m and £102m over the appraisal period.

Table 6: Maintenance costs for sites

	Low	**Central**	**High**
Annual maintenance Cost Per Site (£)	**237**	**324**	**360**
Policy Maintenance Costs (£m)	141	193	214
Baseline (£m)	84	115	128
Net Costs (£m)	57	78	86

5.3 Non-monetised Impacts

5.3.1 Non-monetised Impact (v) EV uptake

100. As perceived lack of access to charging is a key barrier to EV adoption, with increased non-residential chargepoint installation comes the potential for the rate of EV adoption to increase. Whilst the number of chargepoints installed over the appraisal period in the policy on/off scenarios, the installation rate is much higher in the early years in option 1. This increased early roll out of chargepoints could impact public perception positively and increase sales of EVs in the policy on scenario relative to the baseline.

101. As EVs displace ICE vehicles, there are monetisable benefits to society through emissions savings. Increased EV demand may also create more of an incentive for businesses to invest in public charging infrastructure, which can in turn lead to further increases in EV uptake. These multiplier effects can therefore lead to a cycle of induced EV demand and chargepoint roll out.

[32] BP-Chargemaster Brochure, 2018, https://bpchargemaster.com/wp-content/uploads/2018/02/Network-offer-brochure-final.pdf

[33] Several sources used; EV Camel, 2021 https://www.evcamel.com/; API Electrical, 2021, https://www.apielectrical.co.uk/ and 'Aftercare', 2021, https://www.evchargepoints.com/

102. Access to chargepoints is correlated with EV uptake (according to sources discussed below), and it is acknowledged that low availability is an inhibitor to adoption. By providing charging infrastructure, the necessity to bear the financial, logistical and time cost of installation is taken away from the consumer.

103. For public charging infrastructure, the European Parliament's TRAN committee report[34] has reviewed the available literature and assesses that, whilst there is a positive correlation between public chargepoint provision and EV uptake and that charging infrastructure roll-out is critical in the early stages of market development, it is unclear exactly the impact that the provision of infrastructure has, and how it interacts with other factors affecting uptake such as model availability, financial incentives etc.

104. It is expected that the deployment of chargepoints will impact consumer confidence in EV purchase and use, due to increased visibility of chargepoints alleviating range anxiety. According to some studies, range anxiety and the availability of chargepoints affects up to 20% of consumers when considering purchasing an EV[35]. However, given we estimate this policy will result in an additional 2,585 chargepoints installed a year, it would not be proportionate to directly estimate the impact on uptake and subsequent emissions savings. Instead we provide a sense of the cost saving through a hypothetical scenario. It is assumed that average emissions of 123g/km of CO2 and 0.095g/km of NOX for cars and an average annual mileage of 12,553km/year. WebTAG valuations of emissions damage costs are used, with £70.55/tonne[36] for CO2 and £33,705/tonne[37] for NOX.

105. Using these figures gives an estimate for the value of emissions savings from the displacement of an ICE vehicle, at around £150 per car displaced each year (though we would expect over time this value will increase as the price of carbon increases).

5.3.2 Non-monetised Impact (vi). Avoidance of disruption costs

106. An additional non-monetised benefit may be generated through avoiding any disruption costs that could arise as a result of construction work taking place during a retrofit installation. When installation takes place at the point of construction, it is assumed that there are no occupants/customers in the car park who can be inconvenienced by the work taking place. During a retrofit installation, where customers are likely to be present at the property, disruption costs could include disruption to the electricity supply; property access issues; and parking disruption. This will be most acute when an installation involves car park resurfacing, such as those taking place in surface car parks. These disruption costs are likely to be determined by individual car park circumstances e.g. size and type and are not likely to be significant, therefore they have not been quantified (and consequently the benefit from avoiding them has not been defined).

6. Results

107. This section outlines the results, explores a number of the sensitivities and risks to the results, and finally looks at the distributional impacts of this policy, in particular the potential impacts on Small and Micro Businesses (SMBs).

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[34] European Parliament, 2018, http://www.europarl.europa.eu/RegData/etudes/STUD/2018/617470/IPOL_STU(2018)617470_EN.pdf Sections 3.1 & 3.2

[36] DfT, WebTag, 2020, https://www.gov.uk/government/publications/tag-data-book, Data table A3.4 non-traded values 2020, price year 2019

[37] DfT, WebTag, 2020, https://www.gov.uk/government/publications/tag-data-book, Data table A3.2 marginal abatement costs 2020, price year 2019

6.1. Evidence and results summary

108. The table below summarises the impacts of this policy. It is estimated the policy results in a net cost saving (central) of £235m over a 29 year appraisal period, driven primarily by the cost saving of installing ducting during construction as opposed to retrofitting it.

Table 7: Summary of costs (2019 prices, millions)			
£m	Low	Central	High
Installation costs (No Intervention)	**126**	**698**	**1,270**
Installation Costs	93	365	637
Net Replacement Costs	10	20	31
Net Operating Costs	57	78	86
Familiarisation Costs	0.1	0.2	0.3
NPV of Policy	**-33**	**235**	**516**

109. The wide range in impacts stems from the variability in unit costs for this policy and is necessary to capture the uncertainty inherent in this policy. Due to the uncertainty in a number of these assumptions and variables which cannot be mitigated with further work at this time, we will aim to conduct a full post implementation review, preceded by monitoring which is detailed in the monitoring and evaluation section. In order to set out these uncertainties, we have conducted extensive sensitivity testing on key variables, which are set out below.

6.2. Sensitivity Analysis:

110. The above estimates are most sensitive to the assumption that without this regulation, at least the same amount of infrastructure will be retrofit in non-residential car parks (which are in scope), albeit at a slower rate. There are a number of uncertainties around this, related to implicit assumptions on (but not limited to) consumer preference of where to charge, car ownership, and the likelihood that all cars and vans are electrified.

111. Should demand to retrofit chargepoints and ducting be below a level proportionate to the volume of the car/van fleet which is EV, the NPV will be negatively impacted. Additionally, should this regulation fail to substantively impact installer decisions because they already intend to install chargepoints during construction, the policy would be unnecessary. We explore here, the reasons why there may be lower than expected retrofitting in the baseline and the potential impact this might have on the NPV.

<u>Reasons for lower than anticipated retrofitting of chargepoint infrastructure in the baseline</u>

112. **Lower than expected car ownership:** at the moment we expect that cars and vans still remain the primary mode of road transport and that demand for cars and vans will continue to grow in line with national income and population. Whilst we expect this to be the case, there is some evidence to show that car ownership growth may diminish/reach a plateau with any number of factors contributing; from increased urbanisation leading to reduced perceived need for cars to changing demographics[38], with lower than expected car ownership growth we might expect less demand for non-residential chargepoints in car parks targeted by this policy.

[38] http://sro.sussex.ac.uk/id/eprint/69143/1/1-s2.0-S1361920917300536-main%20%284%29.pdf

113. **BEV uptake is below the trajectory set out in the baseline due to shift in technology/preference/modes:** the baseline BEV uptake trajectory is based on scenarios created by DfT and which are aligned with a 2030 phase out of ICE vehicle. The scenario assumes consumers shift primarily to BEVs over alternatives. If this were not the case, then BEV uptake could be below the assumed trajectory, leading to fewer than expected lower non-residential charging. Given the relative technology readiness of BEVs relative to, for example, hydrogen as an alternative, the proximity of the phase out date, a rapidly expanding EV market, and reducing EV costs, a substantial alternative technology to BEVs is highly unlikely in the absence of supply constraints.

114. **Cars primarily charge at home and do not typically use non-residential sites:** It is currently the case that EV drivers prefer to charge at home and overnight[39], however it is expected that EV drivers with home charging will still need to use public chargepoints in order to top up and have confidence in EV range. Additionally, up to 35% of car-owning households do not have access to off-street parking[40] and so these households will require access to public charging options in order to charge their vehicles. Nevertheless, options such as on-street residential charging, or rapid charging hubs may be viable alternatives to non-residential charging in car parks. If it is the case that consumers overwhelmingly choose alternatives to car park charging, then this policy may result in stranded assets.

115. There are other reasons beside the above which we explore in risks and uncertainties, along with measures we will take to address these issues through monitoring and evaluation.

116. However, there are a number of factors which support our expectation that chargepoint demand will be increased due to high EV uptake, and demand would proportionately increase in non-residential sites.

- **Manufacturer CO2 regulations:** The EU introduced mandatory passenger car emissions reduction targets that require the average emissions of new cars in a manufacturer's fleet to be below 95g of CO2/km by 2021[41]. Failure to meet this requirement results in substantial penalties to manufacturers. This legislation is driving supply-side change, encouraging manufactures to develop and produce EV models, such that they are able to reduce their average fleet emissions to within these limits. This investment from manufacturers in developing and producing new models helps contribute to the declining EV capital costs. This is evidenced by VW pledging to invest $50bn in developing EVs by 2023[42], and Ford pledging to invest £11bn by 2022[43]**.** These regulations have been retained in UK law and now apply separately to vehicles registered in GB (soon to be UK). The Government committed to publishing a Green Paper on the post-EU CO_2 regulatory framework as part of the PM's 10 Point Plan in November 2020
- **Total cost of ownership parity:** Whilst the up-front cost of EVs is currently higher than for ICE vehicles, the cost of operating an EV is lower than an ICE vehicle for some drivers – and in a few cases EVs can be cheaper to own. As manufacturers produce more EVs at scale and continue to invest in R&D, the purchase cost of EVs is continuing to decline. Many forecasts identify that the point at which widespread price parity will be reached on a TCO basis is very close. Bloomberg NEF analysis suggests that unsubsidised purchase price parity will start from 2024, and UBS suggest that

[39] 'A review of consumer preferences of and with electric charging infrastructure', 2018, https://www.sciencedirect.com/science/article/abs/pii/S1361920918301330

[40] English Housing Survey, 2018, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/817757/EHS_2017-18_Energy_Report.pdf

[41] EU: Reducing CO2 emissions from passenger cars https://ec.europa.eu/clima/policies/transport/vehicles/cars_en

[42] CNN: VW to spend $50bn on electric cars 'offensive' https://edition.cnn.com/2018/11/16/business/volkswagen-electric-cars/index.html

[43] Reuters: Ford plans $11bn investment, 40 electrified vehicles by 2022 https://uk.reuters.com/article/us-autoshow-detroit-ford-motor/ford-plans-11-billion-investment-40-electrified-vehicles-by-2022-idUKKBN1F30YZ

widespread TCO parity will happen in Europe from 2023[44]. This further supports the view that the transition to a dominant EV market is underway.

- **Commitment to end the sale of ICE vehicles in 2040 moved forward to 2030 in a recent government announcement:** A strong signal to manufacturers to invest in EV production has come from the Government, following the announcement to consult on bringing forward the end of the sale of ICE vehicles in the UK from 2040 to 2030. This announcement adds further pressure on vehicle manufacturers to ensure that they are equipped to operate in an automotive market that is dominated by EVs.
- **Non-residential incentives for chargepoints:** We expect that the vast majority of non-residential car parks are retail or work place related (as well as private car parks which charge for parking). All of these have incentives to provide chargepoints for car park users – for example supermarkets may provide chargepoints for customers in order to improve consumer experience and compete for EV driving customers from supermarkets without chargepoints.

Testing the sensitivity of the NPV to reductions in baseline levels of retrofit

117. We rely on scenarios which illustrate how the NPV would change if the risks outlined above were realised. These scenarios focus on variations in BEV uptake and how that would impact on the demand for retrofit chargepoint installations (and subsequently the utility of this regulation). The scenarios are described as follows.

(1) **No further policies enacted to further EV transition:** This scenario is modelled using internal car choice modelling, assumes that there is no ending of new petrol/diesel car sales and that the transition to zero emission vehicles does not fully occur because ICE vehicles do not become a cost effective alternative. This scenario results in 50% of installations occurring in the baseline, which leads to the negative NPV set out in table 8.

(2) **Scenarios where baseline installations are constrained to 35%:** Constraining baseline retrofit installations to 35% of the stock of new builds illustrates a scenario where a smaller number of consumers charge at non-residential sites or at home because EV ranges are high enough that people do not need to charge elsewhere, and only those without off-street parking (i.e. 35% of car owning households[45]) charge at non-residential car parks due to a lack of alternative options.

(3) **Scenario where all additional ducting is not required and so savings are not realised:** A significant assumption in this IA is that the cost of installing ducting for 1 in 5 spaces is incurred in the baseline at higher cost. We include a sensitivity to demonstrate the impact on the NPV in a scenario where this ducting is not retrofit to demonstrate the impact of this specific assumption.

Table 8: Summary of baseline sensitivities (2019 prices, millions)

£m	NPV
NPV of Policy	**235**
(1) No further policies enacted to further EV transition	-23
(2) Baseline installations are constrained by 35%	-528
(3) All additional ducting is not required so savings are not realised	-275

[44] EVfleetworld: cost of ownership for EVs to hit parity from 2018 https://evfleetworld.co.uk/cost-of-ownership-for-EVs-to-hit-parity-from-2018/

118. The sensitivity analysis show there are scenarios where the NPV could change to being a net cost if the policy is unchanged and, for instance, demand for destination charging does not materialise. All of the factors which might drive these scenarios can be monitored and will be reviewed at the point of post implementation review (PIR) five years after the policy is implemented.

119. The above sensitivities look specifically at the risk of stranded assets. However, a key uncertainty that we have not been able to substantively address through consultation is the number of car parks impacted annually. There is a clear lack of data on car parks and the rate at which they are developed. Discussions with parking bodies revealed that this is a significant evidence gap and they were unable to provide an estimate. Other stakeholders recommended taking a similar approach to the one we have taken. We expect that there being an equivalent of 1% of the stock annually requiring compliance with this policy is appropriate given stakeholder feedback. However, we recognise that this is a key uncertainty so we test the impact on the NPV of variations in this assumption by looking at two scenarios; one where only 0.5% equivalent of the stock of car parks is impacted and one where 2% of the stock is impacted. The impact on the NPV is provided in table 9.

Table 9: Summary of car park sensitivities (2019 prices, millions)	
£m	NPV
NPV of Policy	**235**
(1) 0.5% stock of car parks impacted	118
(2) 2% stock of car parks impacted	470

Testing the sensitivity of the NPV to technology learning rates

120. Finally, we assume in this IA that there are no cost reductions over time due to technology and production maturity. This is because cabling and ducting are well developed and established activities with clear resource costs and an extensive history of manufacture and installation. Chargepoint hardware is an evolving technology which will have both downward and upward cost pressures. This could be through improvements in the efficiency of production and demand for higher specifications.

121. Chargepoint costs are more uncertain going forward and so we test the impact of reducing chargepoint costs over time. Typically learning rates are applied to technologies such that costs reduce by a percentage for every ‘doubling of demand’. Without access to global forecasts of chargepoint demand, sensitivity testing is conducted through cost reductions for chargepoint hardware by 10%, 20%, and 50% every 10 years. The results of this analysis are presented below. Reduction in chargepoint costs improve the NPV of this policy.

Table 10: Summary of costed impacts	
Cost reduction scenario	**NPV (£m, 2019)**
NPV of Policy	235
10% Cost reduction every 10 years	225
20% Cost reduction every 10 years	216
50% Cost reduction every 10 years	200

122. As the learning rate increases, retrofitting becomes more attractive as installation costs are incurred later than in the policy option, benefitting more from the learning rate-induced lower costs. The decrease in baseline installation costs (benefits) is larger in magnitude than the

decrease in policy installation costs (costs), meaning the NPV reduces as the learning rate increases.

6.3. Risks and uncertainties

123. The sensitivities section outlines a number of factors which may result in the policy causing ‘overprovision’ of chargepoint infrastructure, as well as uncertainties in the impact of the policy. This section looks further at the risks (such as unintended consequences) and uncertainties inherent in this policy that cannot be mitigated, and so will guide our monitoring process. We also discuss policy interactions, i.e. where this regulation may interact with others to cause wider impacts.

124. **Chargepoints utilisation:** There is a risk that the benefits of chargepoint provision are not realised if the transition to EVs does not happen in the expected manner. In such a case, the chargepoint may go through the duration of its expected lifecycle being under-utilised. This has been discussed to some degree in the above sections. This is a core reason we are not considering any measures additional to the requirements set out in the EPBD with regard to non-residential buildings, nevertheless we expect to undertake substantial monitoring of factors which may impact the need for destination chargepoints, detailed in the monitoring and evaluation section.

125. **Cost uncertainty**: The VfM of this policy is highly dependent on the difference in cost between installation during and post-construction. If this cost difference is overestimated, this could have significant impacts on the VfM of the policy. We have taken care to ensure that the current costs are accurate through extensive stakeholder engagement and a consultant-led study/survey of costs sourced direct from providers. We have also ensured that the uncertainty is represented in a wide range. Therefore, we believe this uncertainty is adequately accounted for. Nevertheless, we might expect that such cost differences would drive innovation to bring down the cost of retrofit. As this will remain an uncertainty, we will seek to monitor chargepoint infrastructure costs and review how the difference between retrofit and in-construction installation evolves through gathering evidence from ongoing government infrastructure policies and continued stakeholder engagement. It should also be noted that we have opted not to include optimism bias in our cost estimates given the wide range used and the fact that costs are based on direct quotes for items with a clear track record of being installed. In addition, we do not include learning rates in the assumption that technology improvements will lead to improved chargepoint specifications but not necessarily cost reductions. Additionally, costly aspects of installation such as trenching are unlikely to be improved, and if they are, we have included a wide range of costs which we expect will reflect where the cost of ducting comes down across the board.

126. **Technology change and obsolescence:** Given the long time-horizon considered in this appraisal, there is a chance that changes in the vehicle or chargepoint market results in chargepoint infrastructure that are installed under these regulations becoming obsolete. The reasons for this are discussed in sensitivities, however there may be unintended consequences such as ‘locking in’ installation of technologies which are redundant. For example, if EVs are no longer the dominant zero emission alternative to ICE vehicles, chargepoints may become redundant/unused but still be required under regulation; similarly changes to charging technology may mean that, unchanged, the policy drives the installation of dated chargepoint types. There is no evidence to indicate that either of these are substantive risks at this stage, however we will undertake monitoring activity to gather data on the latest technology, which will allow us to address these risks and any need to amend the regulation at the point we conduct a post implementation review (likely to be five years after the policy comes into force). *Specific details of how we will monitor this are set out in monitoring and evaluation.*

127. **Reduction in car spaces:** As a result of this policy, developers of developing parking spaces increases as ducting is required for one in five spaces. Consequently developers/building owners may be incentivised to build less/reduce the number of parking spaces meaning less parking for customers. More practically, feedback from the consultation indicated that free standing chargepoints take up space and impact the layout of parking bays, requiring lines to be redrawn such that the number of parking spaces might be reduced – however, there is no clear indication of the size of this impact. As no data is available and substantive feedback received, *we expect to monitor the construction and development decisions with regard to the number of parking spaces developed in construction.*

How this policy fits in with wider policies (Policy Interactions)

128. The other charging infrastructure provisions in the EPBD set out requirements for residential developments. At the moment, there is no evidence to indicate that regulation for residential and non-residential building developments would interact to mean that costs are either more or less than the sum total of the costs outlined in the impact assessments for both parts of these regulations.

129. The proposal for residential regulation is to require the installation of at least one chargepoint as well as the necessary cabling and ducting for every dwelling with an associated parking space and in new residential properties and those undergoing major renovation. This does increase the risk that less people will be less reliant on destination charging and subsequently increase the risk of stranded assets (particularly unused ducting) arising from this policy.

130. The current working hypothesis of most studies on charging EVs such as that from the CCC46 on chargepoint requirements is that charging at non-residential sites is for the purpose of 'Topping-Up' as opposed to fully charging Electric Vehicles (which is what we would expect from residential chargepoints). This is based on the premise that at most non-residential sites, individuals will not be parked long enough to fully charge up their vehicles (for example at commercial sites where people stop to shop).

131. Should consumers park long enough at non-residential sites to fully charge their vehicles, the cost would likely be higher given that (a) public chargepoints may charge higher rates, either because they are operated by commercial chargepoint companies, or because users would only be able to park during commercial/operating hours preventing access to off peak charging rates. Therefore, it is likely that there will be no or little competition between residential and non-residential chargepoint provision. Therefore, the driving of chargepoint installation at non-residential sites is unlikely to result in less value ascribed to residential charging and vice-versa.

132. The Electric Vehicles Smart Charge Points ('smart charging') regulations are to come into force in 2021/22 and will ensure that new chargepoints installed meet minimum technical specifications on cyber/data security, interoperability and 'smart' charging (i.e. having the ability to manage/shift electricity demand to manage the impact of peak demand on the electricity grid).

133. This scheme will raise the cost of production for chargepoint manufacturers, which may be passed onto chargepoint installers/consumers; though it is expected that this will result in a significant net benefit to society from better managed peak demand. Our analysis already assumes chargepoints are 'smart' enabled and have a price uplift included in unit costs, however we do not include absorbed manufacturer costs which may result from other measures to be implemented through 'smart charging' regulations as it is unclear how much these will raise unit costs. This could mean increased costs to business/consumers which arise from the requirements of EPBD regulations interacting with smart charging regulations. In light of this, and uncertainty about the impact of wider measures from smart charging

[46]Committee on Climate Change (2018) - 'Plugging the Gap': An analysis of chargepoint requiremenst to 2030 https://d423d1558e1d71897434.b-cdn.net/wp-content/uploads/2018/01/Plugging-the-gap-Assessment-of-future-demand-for-Britains-EV-public-charging-network.pdf

regulations on chargepoint costs, we will undertake to monitor costs and how they evolve in light of these regulations.

COVID-19 Impacts

134. There are no immediate, obvious and direct impacts on the efficacy or necessity of this policy caused by the COVID-19 pandemic. At the time of assessing the impact of these regulations, there is insufficient evidence on how the pandemic may affect housebuilding and electric vehicle take-up in the long-run, however there is a comprehensive monitoring and evaluation in place that would capture these effects.

7. Distributional Impacts

135. Whilst infrastructure installation during construction presents an opportunity to avoid higher costs of retrofit, there is uncertainty as to who bears the cost, and who precisely gains from the cost avoidance. 'Who pays' and 'who benefits' will depend on the ability of those required to incur the cost, who we expect to be building purchasers/owners, to pass on the costs to landowners or building occupiers (if these are different to owners).

136. This section looks at the cost incidence through mechanisms by which costs will directly impact certain businesses, but ultimately be borne either property owners, renters or car park users; then we discuss on Small and Micro Businesses (SMBs) as well as wider costs and benefits to groups which cannot be monetised at this stage.

Groups impacted

137. We have consulted with industry as well as MHCLG to understand the incidence of costs from building regulations. Given the early stage of market development, there is limited indication of where the final cost burden would lie. We therefore discuss the groups that may bear the final cost of this intervention.

138. There are four major groups which may be impacted by costs relating to this regulation; developers contracted to build/renovate properties attached to car parks, owners of those properties (who may be public or private enterprises), landowners, or carpark/EV users.

Direct costs to business

139. Feedback received from those experienced in the industry indicated that developers of non-residential properties will typically buy land to develop and then sell on to investors or purchasers, consequently developers bear the initial cost of compliance with regulations (the direct cost falls to developers), which increases the cost of production of new non-residential developments.

140. To illustrate the impact of this regulation on business, as set out in the Regulatory Policy Committee guidance on cost pass-through[47], we assume that 100% of the cost of compliance is a direct cost to non-residential property developers, though expect in reality that the some of the costs can be passed on to public or private entities which own the properties and contract their services. This assumption has been tested with stakeholders, but note that there is a degree of uncertainty and subsequently monitoring should be carried out after implementation, in order that there be better data available at the time of post-implementation review.

141. For the purpose of this calculation, we assume 100% of policy installation costs and familiarisation costs will directly fall on businesses (developers). We assume 63.5%[48] of avoided retrofit installation costs (avoided cost to business) will be enjoyed directly by

[47] https://www.gov.uk/government/publications/rpc-case-histories-direct-and-indirect-impacts-march-2019

[48] We assume 36.5% of public car parks are publicly owned, which is the midpoint of 25% suggested by IPC data and 48% suggested by the British Parking Federation in 2013. This suggests 63.5% of public car parks are owned by businesses.

businesses, resulting in a net direct benefit/ negative cost to business. We do not, however, consider maintenance and replacement costs to be direct costs to business as these are potentially avoidable and are not a requirement of this regulation. Instead, these are considered indirect costs. The estimated Equivalent Annual Net Direct Cost to Business (EANDCB) and total cost to business is presented in table 11.

Table 11: Estimated annual net direct cost to business (EANDCB) (millions, 2019 prices, 2022 base year)	
	Option 1
Annual direct cost	20
Annual direct benefit	24
Estimated annual net direct cost to business (EANDCB)	-4 (net benefit)

142. Developers can pass on these costs to entities that have contracted them to carry out construction on their behalf or to investors. In either case, those buying a development or paying for the development will price in the additional cost of infrastructure.

143. Developers may also pass on costs to landowners through reduced prices offered on land and building occupiers may pass on costs to car park users. There was limited evidence presented at consultation to suggest the degree of cost pass through which is possible. Subsequently, we describe the mechanisms by which costs may be borne by different groups indirectly.

144. This is proportionate given that there is scope for amendment after post implementation review, pending the gathering of evidence through monitoring and evaluation of this policy (likely to occur five years post-implementation).

Cost pass through

145. Property owners may indirectly incur the cost through paying developers who charge them for compliance costs. These may be private businesses or public/local authority run organisations.

146. **Costs borne by public sector/Local Authorities:** Available evidence suggests that a significant proportion of parking is provided by public sector organisations, such as hospitals and educational facilities. The British Parking Federation in 2013 found that out of 4,700 parking facilities surveyed, around 48% were run by local authorities (though this research might have been biased through self-selection)[49]. Data received from the IPC suggested that hospitals and education facilities made up around 25% of public car parks (which are likely attached to a building). With the data available we can assume that between 25%-48% of indirect costs for compliance to this regulation would indirectly fall to public sector entities if all of these costs can be passed on.

147. **Costs borne by private business:** The remainder of indirect costs are likely to be borne by private businesses, which could be include renters/occupiers where their owner may pass on the cost to tenants via rents and charges. Limited evidence was presented at consultation to determine the degree to which this could be the case.

148. **Car park users:** This regulation may also pass on costs to car park users through increased car park charges, although no information was provided in consultation to support this.

Wider impacts on groups

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[49] BPF, 2013, 'The size and shape of the UK parking profession', https://www.britishparking.co.uk/write/documents/library/reports%20and%20research/bpa_uk_parking_sector_report_awweb.pdf

149. **Rural drivers, developers and car park owners:** As this policy does not specify any variations depending on location, there is a chance that car park owners in rural locations will be disproportionately impacted. In 2019, 29% of registered EVs were in rural areas, whilst urban areas had 71%[50]. Given the lower number of EVs, rural car park owners may be less able to generate revenue from providing charging services compared to their urban counterparts. However, this is not expected in the medium or long run with the end of new sales of ICE cars and vans, improvements in EV efficiency and lower prices potentially supporting the increase in EV uptake and willingness to pay for public charging.

150. **Drivers without off-street parking:** There tends to be more homes with off-street parking in rural areas. Therefore, consumers have the option to do most of their charging at home, which is the most common and preferred form of charging. There are also grant schemes in place to support home charging such as the Electric Vehicle Homecharge Scheme. This results in less dependency on public infrastructure. Therefore, this policy can help achieve an optimal level of public charging infrastructure by having only new car park owners install one chargepoint and additional infrastructure, they can then decide based on utilisation if more chargepoints are needed.

Exemptions

151. The Government will not extend the proposed requirements to properties with 'enclosed' car parks (e.g. basement and multistorey car parks) until a review of current fire safety regulations is complete. The review will establish if current fire safety regulations are sufficient to ensure enclosed car parks have the measures needed to withstand and mitigate EV fires and protect firefighters. Using Parkopedia data which suggests 7% of in-scope car parks are enclosed, we estimate approx. 170 of the 2,585 annual installations will be impacted by this exemption. This exemption is included in the above analysis and we assume it will be in place for 5 years (whilst the review is ongoing) between 2022-2026. Including this exemption in the analysis reduced the NPV by £3m, from £238m to £235m.

152. Non-residential buildings undergoing major renovation work for fire safety remediation purposes will also be exempted from these requirements. This will protect non-residential building owners who may have faced significant challenges in light of the Grenfell tragedy from further costs. Our analysis suggests that the number of properties affected by the overall exemption is likely to be limited; most properties that require cladding remediation will not fall under the definition of a 'major renovation' and so will not trigger these requirements. MHCLG further advised that the number of properties undergoing other fire safety remediation work that would constitute a 'major renovation' is likely to be small too. Given that we expect the relative impact to be negligible, this exemption has not been included in the analysis to avoid underestimating costs to business.

153. The Government will transpose article 8.6 of the EPBD, which permitted an exemption related to electric vehicle charging infrastructure exceeding 7% of the total cost of the major renovations. Non-residential properties undergoing major renovation will be exempt from installing chargepoints where the cost of chargepoints and cable routes exceed 7% of the total cost of the renovations. Cable requirements will still apply unless the cost of installing the cable routes alone exceeds 7% of the total cost of the renovation. The unit cost for the chargepoint is £3,823 per car park in the central scenario and the unit cost for ducting is £334 per space in the central scenario. Given that ducting is required every 5 spaces and assuming an average of 171 spaces per public car park and 50 spaces per workplace car park, the estimated cost for ducting is £11,423 per public car park and £3,340 per workplace car park. Taking the midpoint and including chargepoint costs provides an estimated average cost of

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[50] Vehicle Licensing Statistics tables, VEH0131, Licensed Plug-in Cars by Local Authority https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01:

approx. £11,200 per non-residential property for full chargepoint provision. This means a major renovation would have to be under approx. £160,100 for the exemption to apply.

154. A 'major renovation' is defined as more than 25% of the surface area of the building envelope going under renovation[51] and the average cost of a major renovation for a non-residential building is £2,500 per square metre.[52] Suppose the non-residential building is a two-storey office block with a surface area of 1,600 square metres[53], the estimated cost of the major renovation is £1m. Given the large difference between this estimated cost and £116,100, this suggests there is a low likelihood of charging infrastructure costs exceeding 7% of the total cost of the major renovation. The non-residential property would have to be under approx. 185 square metres to be exempt, which seems highly unlikely for a non-residential property with over 10 car parking spaces. Therefore, we expect the impact of this exemption to be negligible and so have not included this in the analysis to avoid underestimating costs to non-residential building owners.

7.1. Small and Micro Business Assessment

155. We expect that this legislation will directly impact firms constructing/managing construction of buildings and also impact non-residential property owners or entities which lease/rent those properties. We also expect car park owners will most likely bear the subsequent cost having been directly charged by builders for materials and labour.

SMB Construction/Developer Impacts

156. We expect the direct first-round impacts will fall on developers/builders, and so we look at the potential impact on these entities if it is not the case that they can pass on costs to building owners.

157. According to latest data from the ONS[54], up to 99% (12,625 out of 13,440) of all registered businesses in England involved with the construction of non-residential buildings have a headcount of under 50 and so could be classed as Small or Micro Businesses (SMBs). Due to the inclusion of sole proprietorships and subcontractors in these figures however, using this approach to identify the number of SMBs impacted by this regulation would likely lead to an overestimate of the impact to SMB developers as much of the regulatory burden is unlikely to be borne by subcontractors and sole proprietorships.

158. If we were to look only at businesses with 10-49 employees, which would exclude sole traders, 5% of all the construction sector falls into this category. If we were to apply this to the population of registered businesses in England in construction of non-residential buildings, this would mean 672 out of 13,440 enterprises which could be directly impacted (5%*13,440).

159. Another way of estimating the proportion of SMBs is through construction stats from the ONS. According to ONS construction stats, around 40% of the value of construction of non-domestic buildings was performed by SMBs[55].

160. Based on our analysis which estimated around 2,585 carparks annually being impacted by the regulation, with 5%-40% of these carparks being completed by SMBs, this translates to between 129 and 1034 developments being completed by SMBs annually and incurring the direct cost of this regulation. Assuming workplace car parks have on average 50 spaces

[51] https://www.tameside.gov.uk/buildingcontrol/guidancenotes/note24guide1.pdf

[52] Spon's Architects' and Builders Price Book, 2021, page 73-74

[53] Spon's Architects' and Builders Price Book 2021, page 80

[54] Data taken directly from NOMIS for SIC code 41201 – construction of commercial buildings, https://www.nomisweb.co.uk/

[55] ONS construction statistics tables, 2019: https://www.ons.gov.uk/businessindustryandtrade/constructionindustry/datasets/constructionstatisticsannualtables

(based on IPC data) and commercial/public car parks have 171 spaces, this equates to a cost to SMB developers of between £19m and £150m. This is set out in table 12.

Table 12: Annual Cost to Construction/Developer SMBs 2019 prices (£)	Low	Central	High
Proportion with 10-49 employees	5%	23%	40%
Total annual installations	2,585	2,585	2,585
SMB annual installations	129	582	1,034
Annual Cost for SMBs (£m)	**19**	**84**	**150**
Annual Cost Per SMB (£)	**0.1**	**0.1**	**0.1**

161. Our understanding from speaking with trade bodies is that familiarisation costs would not disproportionately prevent small developers/contractors operating in the market due the typical flexibility shown by SMB builders in familiarising themselves with new regulations outside of work hours. Whilst this is a new burden that will be in place over and above the baseline costs, SMB builders are well equipped to familiarise themselves with new building regulations.

162. As discussed above, we expect that these costs can and will likely be passed on to building owners, or those leasing/renting a building and so we explore sectors with SMBs which might be impacted indirectly; particularly building owners. We note again, however, that the policy is a minimum requirement under an international obligation; and so we maintain a proportionate approach to our assessment of the cost.

SMB Car Park Owner Impacts

163. The consultation was used to develop the evidence base around SMB car park owners. We engaged a number of bodies to develop an insight into the types of SMB which would be impacted and whether there might be any costs which fall abnormally on SMBs relative to larger businesses. No responses were received which indicated that this would be the case, and furthermore no responses were received to indicate the proportion and type of SMBs which would be impacted. Consequently, we build an assessment around the potential impacts to SMBs around the best available evidence we have at the time of writing.

164. We estimate that there are approximately 244k workplace car parks with over 10 spaces and attached to a building in England for the purpose of this IA. Assuming workplace car parks are private, these could be car parks attached to offices, factories or any number of workplace type. There is not a ‘sector’ by which we can define workplaces and so we use public statistics on the total number of SMB businesses in the UK to derive a percentage assumption to apply to the number of SMB workplaces in scope of this IA.

165. According to government business population statistics,[56] there are around 1.36m businesses in the UK which have an employee headcount of under 50. The vast majority of these (1.16m) are businesses with below 10 employees, and of these the majority are sole proprietorships. It can reasonably be expected that micro businesses (with 0-9 employees) would not be impacted by this policy since only car parks with over 10 spaces fall within its scope. Excluding these, we can estimate that around 4% of all small business[57] workplaces with car parks would be impacted (assuming the same proportions apply). Applying this 4% to the estimated number of workplace car parks with over 10 spaces, we arrive at a figure of around 8,800 SMB workplaces with in-scope car parks. To include workplaces with under 10

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[56] Governent business population statistics, 2019, https://www.gov.uk/government/statistics/business-population-estimates-2019/business-population-estimates-for-the-uk-and-regions-2019-statistical-release-html

[57] Businesses with below 50 headcount

staff, would increase this assumption to 23% meaning around 56,800 SMB workplaces with over 10 parking spaces.

166. In terms of non-workplace, non-residential data - Parkpoedia data suggests there are 20,370 carparks, of which we estimated 14,900 were in scope of this regulation (this estimate has been broadly confirmed though further correspondence with Parkopedia seen by DfT analysts). The composition of these car parks in terms of what sectors they fall into is uncertain. A number of approaches and evidence sources have been reviewed to determine the numbers of SMBs which might be impacted from these groups, however there is little public information available to determine this figure, and none was forthcoming in consultation.

167. Commercially sensitive data reviewed by DfT shows current chargepoint deployment in non-residential car parks is most prevalent in workplaces, the retail sector and hotel sector.[58] We attempt to use these as archetypal non-residential car park types to estimate the proportion of car parks which belong to SMBs. However, these sectors are dominated (in terms of number of organisations) by micro businesses with staff below 10 people, and it is not possible with current data to accurately determine the extent to which small businesses would have over 10 parking spaces.

168. According to industry data from the ONS[59], around 85% of all hotel/temporary accommodation businesses have below 50 employees, and the retail sector is up to 99% comprised of businesses with below 50 employees. To assume that up to 99% of the car park stock which have over 10 spaces belong to SMBs would likely lead to an overestimate of impacts on SMBs.

169. According to data received from the IPC, around 30% of retail car parks in their sample have 10-50 spaces and 40% of other businesses have car parks with 10-50 spaces. In the absence of better information, our best assumption is that between 30%-40% of annual developments of non-workplace buildings attached to car parks which require compliance with this regulation are SMBs.

170. This would mean that between 4,465 and 5,953 of public car parks are attached to SMBs, coupled with our estimate of workplace chargepoints we arrive at a range of between 13,239 and 62,705 SMBs in total with car parks that have over 10 parking spaces.

171. In our analysis, as described above we assume that a number equivalent to 1% of the stock of in-scope car parks fall under this regulation, which equates to between 132-627 SMBs impacted by this regulation. If all developer costs are passed on to non-residential building owners, we estimate the annual cost to SMB occupants of these buildings below.

Table 13: Annual Cost to SMBs 2019 prices (£)	**Low**	**Central**	**High**
Total SMB Car Parks	13,239	38,103	62,705
Annual Installations	132	381	627
Number of Spaces	10	25	50
Cost per carpark (£)	1,315	6,889	12,463
Annual Cost for SMBs (£)	**174,132**	**2,624,917**	**7,814,676**
Annual Cost Per SMB (£)	**1,315**	**6,889**	**12,463**

172. In summary, we expect the cost burden to fall on construction/ developer SMBs initially but expect this to be passed on to non-residential building owners. In addition, given that there

58 Data from Zapmap 2021, not publishable due to licensing agreement

59 ONS, 2021 - Standard Industrial Classification (SIC Code) 5510, Hotels/short term accomodation

is a net benefit to businesses over the appraisal period, we still expect SMBs to be better off over the appraisal period.

Mitigating costs

173. There are a range of mitigations against cost which we expect SMBs could use, including government support and passing on costs to carpark users through parking charges or other means.

174. The Workplace Charging Scheme (WCS) provides Government support of up to £350 towards the cost of installing a charge point socket for staff and fleet use, with a maximum of 40 sockets available per business.[60] To date over 5,000 businesses have used this scheme to install over 14,500 charge point sockets. For non-residential developments which are workplaces, it is possible that they would be able to gain access to these funds.

175. Most local authorities provide financial support for start-ups and SMEs whether it is in the form of grants or loans, some of which can cover capital project expansion related to business development. For example, the Business Growth Grant in Leicestershire provides grants from £2,000 to £25,000 towards capital projects for SMEs looking to scale up. However, the businesses must be trading for a minimum of 24 months[61]. In East Midlands they offer Enterprise Loans (ELEM) of £3,000 to £50,000 for start-ups that have been trading for less than 24 months and existing businesses looking to grow in the most deprived areas of the East Midlands to support improvements to premises and aid competitiveness[62]. Whilst not all SMBs would be able to use these funds, there may be other similar investment options.

176. There is also the possibility that smaller developers and car park owners can pass on additional costs to consumers, through parking charges, or recoup costs through deals with chargepoint operators in return for using their services. Finally, it is also to be noted that car parks with less than 10 spaces will be exempt from this regulation, providing a potential further mitigation for SMBs).

177. It is unlikely that SMBs with car parks will be disproportionately impacted by this policy. Much of the cost of this regulation arise from the amount of ducting which will scale according to the number of spaces attached to a building. Assuming that costs scale with size, to a significant degree we can expect that costs will fall equitably on different sizes of business. This assertion is unevidenced however and we will look to develop our evidence around this through monitoring activity once this regulation has come into force.

178. There will be no full exemption for SMBs given this regulation is being brought in as an international obligation, without gold plating. However, work will be undertaken to determine whether negative impacts to SMBs would need to be mitigated in the future in the post-implementation review to be conducted 5 years after the regulation has come into force.

7.2. Electricity network

179. Where electricity peak demand exceeds a local electricity distribution networks' capacity to deliver electricity, costs of upgrading the network may be triggered. These costs can include the laying of new cables, new electricity capital such as transformers and the upgrade of systems. Typically, these upgrades and reinforcements are paid for in part by the entity requesting a new connection and in part recovered through electricity bills from consumers. Whilst it is true that cars charging in car parks could add to peak demand, based on research and consultation with networks modellers we believe that this policy alone will not trigger

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60 https://www.gov.uk/government/publications/workplace-charging-scheme-guidance-for-applicants-installers-and-manufacturers

61 Business Growth Grant – Leicestershire: https://bizgateway.org.uk/business-growth-grant/

62 Enterprise East Midlands: http://www.first-enterprise.co.uk/business-loans/

connection costs to the degree that it is proportionate to examine the impacts on the Electricity Network in close detail.

180. The UK is moving away from the use of fossil fuels as a primary source of energy across transport and heat, with electrification expected to be the primary method for achieving decarbonisation targets in these sectors. This is likely to require significant investment in the transmission and distribution of electricity. For context, an example study performed by Imperial University for the CCC estimated that up to £50bn extra investment in grid capacity could be required up to 2035[63] for the electrification of EVs and heat pumps which provides a measure of the scale of investment required for overall electrification.

181. If it is the case that the existing stock of car parks will ultimately be retrofitted with charging infrastructure, as well as have necessary upgrades to accommodate heat electrification, then the relative contribution of this policy to connection costs is likely to be small.

182. During consultation we reviewed evidence related to electricity networks as well as modelling approaches. The modelling of potential network costs and impacts is complex; with drivers of network costs being highly localised. These costs can be mitigated to a significant degree by ‘demand shifting’ behaviour and technology which moves electricity demand from EVs away from peak times so that consumers can benefit from cheaper rates when they charge overnight. Based on this, the wider context of the Net Zero transition and the fact that this legislation only applies for new and majorly renovated non-residential car parks, bespoke electricity network analysis for this IA would be disproportionate.

7.3. Monitoring and Evaluation:

183. Risks and uncertainties are identified in this IA which we propose to address through a monitoring framework. Many of these risks hold true for policies across government interventions to transition the UK to a ‘Net-Zero’ emitter as they require high levels of technology investment under conditions of uncertainty. There is also a requirement to act before these uncertainties can be mitigated.

184. The uncertainty inherent in low carbon transition policies stem from the unpredictability of consumer preferences for technologies, technology costs and innovation in new technologies; a framework for monitoring is therefore needed to monitor how these evolve and to support ex-post evaluation.

185. There is likely to be a broad set of interventions aimed at addressing the need for charging infrastructure for EVs; for destination and workplace charging as well as other types, such as residential etc. consequently, a monitoring and evaluation programme is in development to understand the effectiveness across these potential schemes, although this has yet to be formalised.

186. Here we outline current considerations for developing the monitoring framework, data we expect to gather, potential approaches to gathering that data and analysis that will go into evaluation in a Post Implementation Review (PIR) five years after regulations come into force.

187. Given this policy is likely to continue passed the five-year mark; we would expect a further framework for monitoring and evaluation to be proposed during a detailed PIR, based on what is known at that time and the most important uncertainties to be addressed. At that time we would also expect a timeline for a further PIR to be presented.

188. We anticipate requiring a combination of qualitative and quantitative data and methods to evaluate the effectiveness of this policy,

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[63] CCC, Vivid Economics & Imperial University, 2019 p.28, https://www.theccc.org.uk/wp-content/uploads/2019/05/CCC-Accelerated-Electrification-Vivid-Economics-Imperial.pdf note: this is one scenario of many set out in this paper; there is significant uncertainty around such estimates, consequently we provide this figure for context around the potential scale of cost but note the cost could be lower.

189. Key uncertainties are listed below, alongside how we will attempt to mitigate them through specific monitoring activity as well as how we will use data gathered for further analysis. We then outline key research questions we will look at in evaluation, and the data monitoring that will occur, where possible relating specific data sources that we can use or expand upon.

Uncertainties and monitoring

190. **Cost:** Chargepoint infrastructure costs are central to determining VfM across EV infrastructure policy; consequently, data gathering on costs is ongoing through existing government schemes which make the provision of relevant data a condition to the receipt of government support, as well as through studies which are likely to be implemented. We currently gather cost data from schemes which have been used to validate our current cost assumptions; we anticipate receiving more data from further schemes to be implemented. During evaluation, we will be able to use this to understand the difference in cost between retrofit and up-front installation to test whether the cost difference is significant enough to warrant continuation of this policy.

191. **Consumer and Business Impacts/Preferences:** We expect to use a combination of direct interview and survey based social research to gain insight into consumer/business impacts and preferences. For example, through direct engagement we can test destination and workplace consumer preferences for charging their vehicles, car park owner preferences for installing chargepoints during construction and potentially the capacity for car park owners to pass on costs to consumers. An example of where we have done this recently is with an informal evidence/consultation exercise on the EVHS where we have, among other things, requested information from landlords on the cost of chargepoint installation[64].

192. **Stranded Assets:** We currently collect utilisation data through some of our schemes and anticipate this to be the case with future schemes where feasible. This will enable us to test whether utilisation at sites where these regulations apply is high enough to warrant infrastructure installation.

193. **Technology Changes Leading to Obsolescence:** Technology changes could mean that chargepoints become obsolete, either because of the way people own and use cars evolves meaning charging at home is increasingly a redundant approach (due to car sharing, for instance) or because another technology such as hydrogen fuel cells becomes a primary mode of road transport. These are risks across the net zero programme of policies; consequently, they will be monitored as they pose a significant wide (though low probability) risk to our policies. We regularly gather market intelligence and data on vehicle technology costs for input into internal vehicle consumer choice modelling.

194. **Provision of Parking:** Provision of parking may drop due to this policy. DfT will look to monitor this through the English Housing Survey, which will include looking at how the proportions of different types of dwelling are changing. This would be a difficult thing to attribute solely to the policy in question - so we anticipate using data on net additions to the housing stock, parking provision and social research to determine whether or not this is a key driver. Where parking provision is evidenced as being impacted by this policy, we will look to understand the costs of this to society; currently we do not expect this to be the case since parking spaces raise the value of property as explained earlier in this IA.

195. **Policy Interactions:** DfT will work with MHCLG to determine the extent to which this policy in concert with other cost inducing regulations are impacting building development choices. We will also continue to work alongside BEIS to understand the impact of smart charging regulations and the degree to which cost increases in chargepoints impact the wider market.

196. **International Comparisons:** This IA presents a large number of comparative international government interventions and it is expected this is a policy which will be implemented across

[64] Announcement of DfT consultation in trade press, 2021: https://www.fleetnews.co.uk/news/latest-fleet-news/electric-fleet-news/2021/02/15/government-reveals-electric-vehicle-charge-point-plans

Europe to varying degrees, providing we are engaged with a number of countries implementing these and other policies and expect to be able to share data and analysis to test the efficacy and need of this policy.

197. **Business impacts:** We will look to understand the level of cost pass through building regulations, and the impacts on business through continuing to review the literature and engaging with stakeholders. The PIR will consider the impacts on SMBs, including the extent to which this policy has been difficult to implement/altered behaviour. Where it is clear that cost mitigations are not sufficient to protect SMBs from adverse consequences, exemptions may be considered in the future. This monitoring can be done through direct informal consultation, as well as through partnering with the evaluation of other schemes designed to support small and micro builders. We are currently well linked with trade bodies representing the sector and expect to be able to use direct industry insight on the impact of regulation as a whole; however, it was not available at the time of this IA.

198. **Unintended consequences:** We expect that stakeholder engagement over the life of this policy, related infrastructure policies that read across, and data monitoring will alert us to any unintended consequences. There has been an extensive consultation, with post consultation engagement to test the policy with stakeholders; we therefore expect that we have covered off the key impacts of this policy.

Proportionality Approach

199. It is expected that the UK will decarbonise road transport through electrification of the car and van fleet and to this end the government has announced an end to sales of ICE cars and vans by 2030[65]. There is a wide programme of interventions underway in order to aid this transition so that it occurs at a pace which maximises the likelihood that decarbonisation targets will be met in accord with Carbon Budgets[66] and the aim to have the UK become a Net Zero economy by 2050.

200. As has been discussed in this IA, there is a significant degree of uncertainty in this transition given it will often be driven by shifting to new low carbon technologies for which an unprecedented level of infrastructure investment will be needed. With new technologies and the need for early action, there is significant uncertainty around how those technologies will evolve, whether new solutions will emerge and how they will suit different groups. This is the case across interventions in the Net Zero space. With this uncertainty, it can be expected that analysis of impacts may be limited, and the emphasis of interventions must fall to identifying risks, potential impacts and establishment of appropriate plans for monitoring and evaluation to ensure that interventions can change course where necessary.

201. In the case of this policy we have identified and monetised key impacts and have improved the evidence base from the consultation stage where possible. A lack of evidence presented at consultation stage can be taken as a good indicator that much of the evidence required to make a fully robust appraisal is difficult to obtain.

202. The size of this intervention relative to the overall transition expected and the level of evidence available at the time of writing mean that we expect the approach taken to this appraisal is proportionate. We do, however undertake to conduct monitoring and evidence gathering so that the design of this policy can be amended if a post implementation review, to be conducted 5 years after the regulations come into force, finds that it is appropriate to do so.

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[65] Announced in the Governments '10 point plan', Nov 2020; https://www.gov.uk/government/news/pm-outlines-his-ten-point-plan-for-a-green-industrial-revolution-for-250000-jobs

[66] 6th Carbon Budget announced December 2020, CCC https://www.theccc.org.uk/publication/sixth-carbon-budget/

8. Summary & Conclusion

203. This impact assessment has considered one option for increasing the level of EV charging infrastructure provision in new non-residential car parks. This option is summarised in the table below.

Table 14: Option summaries (£m, 2019 prices, 2022 base year)		
Option	**NPV**	**EANDCB**
Option 1 (new car parks only)	235	-4

204. In summary, the preferred option requires that new and majorly renovated non-residential car parks attached to a building must have at least one chargepoint and ducting for 1 in 5 spaces installed during construction. This is matches the EPDB minimum requirement. The most significant risk to the NPV of this policy is that chargepoint installations absent this intervention would have been less than those installed due to the policy; we expect to monitor this.

205. We have taken the step of assuming the costs of compliance fall directly on developers and car park owners without a possibility of pass-through to consumers to ensure that there is no underestimation of the cost to business as there was no conclusive evidence to suggest that businesses (in this case developers and car park owners) would be able to pass on costs of compliance. We will monitor this and conduct further analysis to test cost pass-through in a post implementation review.

206. The proposed policy carries with it a number of uncertainties which are characteristic of interventions in technology transitions. We will aim to address these uncertainties through a monitoring programme which will be succeeded by a post implementation review; at which amendments to proposed regulations may be made in accord with the latest evidence available at that point.

Annexes

Annex A: Steer cost tables

207. The following cost summary tables are taken from costs reported by Steer to DfT and were used for the derivation of costs for the relevant options.

208. These costs were compiled by Steer from direct quotes from a number of sources and cannot be presented in a more disaggregated or non-anonymised format due to commercial sensitivity.

209. The costs were developed in a 3-stage process. First, costs were gathered and scrutinised from the UK and internationally through desk research. Secondly, the relevant questions to stakeholders were tested with an initial list of respondents which comprised of builders, network and transmission network operators and chargepoint installers. Finally, a full consultation was held with stakeholders across these groups with costs quotes being compiled and sent to DfT. In total 9 in depth interviews were held and 5 data sets received.

210. Throughout, interviewees were required to present information and rationales which underpinned cost quotes. After this process, DfT analysts directly engaged with a number of relevant stakeholders to further validate these costs. Finally, costs were tested against commercially sensitive cost data gathered by DfTC through the Onstreet Residential Charging Scheme (ORCS) which allowed us to confirm that the range of costs captured a significant portion of the variability, allowing us to deem these costs adequate for the purpose of this IA.

Annex A1: Steer - Wiring and Installation costs for single charge point

Wiring and Installation costs					
Building type	**Cost group**	**New Build**		**Retrofit**	
		Low	**High**	**Low**	**High**
Off-Street Private	Cabling + Ducting	£100	£500	£500	£500
	Electrical Equipment	£0	£100	£0	£100
	Civils	£0	£0	£0	£0
	Total	£100	£600	£500	£600
Multioccupancy surface	Cabling + Ducting	£500	£1,500	£500	£1,500
	Electrical Equipment	£80	£360	£80	£360
	Civils	£300	£1,000	£300	£2,000
	Total	£880	£2,860	£880	£3,860
Multioccupancy underground	Cabling + Ducting	£500	£1,500	£500	£1,500
	Electrical Equipment	£150	£800	£150	£800
	Civils	£0	£0	£0	£0
	Total	£650	£2,300	£650	£2,300
Multioccupancy multi-storey	Cabling + Ducting	£500	£1,500	£500	£1,500
	Electrical Equipment	£150	£800	£150	£800
	Civils	£0	£0	£0	£0
	Total	£650	£2,300	£650	£2,300

Annex A2: Steer – Wiring and Installation costs for 100 charge points

Wiring and Installation costs					
Building type	**Cost group**	**New Build**		**Retrofit**	
		Low	**High**	**Low**	**High**
Off-Street Private	Cabling + Ducting	£8,000	£40,000	£8,000	£40,000
	Electrical Equipment	£0	£8,000	£0	£8,000
	Civils	£0	£0	£0	£0
	Total	£8,000	£48,000	£8,000	£48,000
Multioccupancy surface	Cabling + Ducting	£20,000	£60,000	£20,000	£60,000
	Electrical Equipment	£3,200	£14,400	£3,200	£14,400
	Civils	£12,000	£40,000	£12,000	£80,000
	Total	£35,200	£114,400	£35,200	£154,400
Multioccupancy underground	Cabling + Ducting	£20,000	£60,000	£20,000	£60,000
	Electrical Equipment	£6,000	£32,000	£6,000	£32,000
	Civils	£0	£0	£0	£0
	Total	£26,000	£92,000	£26,000	£92,000
Multioccupancy multi-storey	Cabling + Ducting	£20,000	£60,000	£20,000	£60,000
	Electrical Equipment	£6,000	£32,000	£6,000	£32,000
	Civils	£0	£0	£0	£0
	Total	£26,000	£92,000	£26,000	£92,000

Annex A3: Steer – Grid Connection costs for single charge point

Grid connection 1 x point				
Building Type	**New Build**		**Retrofit**	
	Low	**High**	**Low**	**High**
Off-street private	£0	£0	£0	£1,300
Multioccupancy surface	£0	£3,000	£0	£3,000
Multioccupancy underground	£0	£3,000	£0	£3,000
Multioccupancy multi-storey	£0	£3,000	£0	£3,000

Annex A4: Steer – Grid Connection costs for 100 charge points

Grid connection 100 x point				
Building Type	New Build		Retrofit	
	Low	High	Low	High
Off-street private	£5,000	£40,000	£5,000	£80,000
Multioccupancy surface	£2,000	£120,000	£5,000	£120,000
Multioccupancy underground	£2,000	£120,000	£5,000	£120,000
Multioccupancy multi-storey	£2,000	£120,000	£5,000	£120,000

Annex A5: Steer and Chargepoint Installer – Hardware costs

Charge point Hardware Costs		
Building Type		
	x1	x100
Off-street private	£515	£46,003
Multioccupancy surface	£1,350	£120,536
Multioccupancy underground	£580	£51,786
Multioccupancy multi-storey	£580	£51,786

Annex A6: Steer – Data connectivity costs

Cost item	Cost	Additional Information
Charge point modem	£410	Single modem can be used for multiple chargepoints
Data Cabling (inc. labo	£1,000	Cost for 100 chargepoints

Annex B: Option Cost summaries

211. This section presents in greater detail some of the underlying assumptions and drivers that inform the component costs used in this assessment.

Annex B1 - Ducting

212. Itemised costs were used to disaggregate the costs of cabling and ducting which were combined in the wiring and installation cost summaries provided by Steer. The relevant cost drivers for the low cost and high cost scenarios are identified in table B1 below.

213. The primary driver of cost differences between categories for this option is whether cabling can be routed using ducting (as with multi-occupancy underground and multi-storey) or whether underground trenching is required (as with multi-occupancy surface car parks). This is primarily due to the significant labour costs involved which typically represent around 70% to 80% of the total costs of trenching. Furthermore, undertaking trenching to replace or lay new cable in a retrofit environment can cause disruption to the building users until the surface is reinstated. This disruption cost has not been estimated as part of this assessment.

214. For single installation there is little variability in the costs between retrofit and new build. The only variability comes from the costs of civils works for and surface level multi-occupancy car parks. The difference between the low and high cost scenarios is driven by the volumes of ducting/trenching required, depending on the distances from the power supply to the charge point.

Annex B2 - Cabling + Grid connection

Cabling

215. As with the ducting option, the cost differences for cabling between categories are driven by the length of cabling required. These costs are also shown in the tables above. For retrofit options, it is assumed that an entirely new cable from the distribution board to the chargepoint is required in all situations, which drives the higher cost.

216. Another significant cost sensitivity is the electrical equipment required. For a single installation in multi-occupancy basement or multi-storey parking, the chargepoint will only require a single miniature circuit breaker (MCB) in an existing distribution board which can be easily retrofitted. However, when 100 connections are installed together, multiple moulded case circuit breakers of different current ratings will be required to supply electricity to the charge points. At surface level charge points will be supplied from a feeder pillar, which can serve multiple charge points.

217. The cost for 100 connections would be inclusive of new transformers and distribution network cabling. This cost will be absorbed by either the developer or socialised depending on the development type and whether it is new build or retrofit. The factors influencing the costs of wiring and installation are highlighted below; unless the parking provision is stated, the costs are applicable to all parking types.

Table B1: wiring and installation cost drivers

Factor	Low Scenario	High Scenario
Electrical Equipment Distribution board Array controller Single installation Multi-installation	 N/A N/A N/A N/A	 Required Required MCB, RCD, PME MCCB, 400A, RCD, PME
Cabling and Ducting Cabling Ducting Connection Traffic management	 6mm/3 core (1 Phase) N/A Single Outlet, 7kw N/A	 25mm/5 core (3 Phase) 300mm cable tray Twin Outlet, 22kw Permitting fees (one off) Design fees (m²) Labour costs
Civils Labour	 Electrician Day rate	 Electrician and Civils day rate
Trenching and Reinstatement (Multi-occupancy surface) Excavation Materials e.g. tarmac Waste removal	 N/A N/A N/A	 Cost per m Cost per m Cost per m
Fire prevention (multi-occupancy)		
General Project management Commissioning (NICEIC)	 N/A Per charge point	 Fee for managed installations Per charge point

Grid Connection

218. The costs associated with chargepoint connections vary significantly depending on location, and hence it is difficult to establish general figures for installations. The reason for this is because the costs associated with providing a connection are based on a number of factors

including: the type of network in that area (rural, suburban, urban); the type of property and hence the type of connection (including whether it is retrofit or new build; whether the connection is flexible or not; the age of the connection point and associated network; the voltage of the connection point). Whilst there is a great deal of uncertainty surrounding these figures, and it has not been possible to capture the full extent of this variability in the cost summaries, the following section identifies the assumptions that have been built into these cost profiles.

219. For both retrofit and new build, the cost of grid connection will be affected by the peak power required to meet the maximum charging demand of vehicles in the development. This is influenced by the diversity of demand (e.g. the amount of energy the vehicles require whilst parked and the dwell time of the vehicles at that location). The amount of energy required will vary based on the usage patterns of the vehicle (e.g. vehicles in rural areas may be driven further therefore may require more charging) and the charging behaviours of the vehicle owner/ user (e.g. does the user have a charge point at home therefore require less charging in other locations). The dwell time will be influenced by what the parking is provided for (e.g. residential/ workplace/ shopping).

220. Additionally, for retrofit installations, the cost associated with the grid connection will be influenced by; the capacity of the existing connection, and the after diversity maximum demand (ADMD) of existing loads on the connection (after diversity maximum demand – i.e. the typical maximum power demand based on the amount of power required from each load and when each load is used over a typical day).

221. The connection and cabling costs can also be mitigated by the use of smart charging although will still be influenced by the above factors. The costs provided do not currently account for this reduced peak power demand requirement with smart chargers or any associated load management system. For multi-occupancy, the high range costs assume that the connection can accommodate 22 kW charge points. As the proposed regulations only require 7 kW chargepoints this is not applicable There is however uncertainty surrounding this managed load scenario and what the actual power demand for charging may be when wide-scale EV adoption occurs.

222. A further factor influencing the connection cost is the type of electrical earthing the building's power supply (grid connection) has. Often in the UK, buildings use a protective multiple earth (PME) power supply which may no longer be suitable if a charge point is installed. The use of PME supplies is dependent on the type of structure the parking is located in. This primarily concerns if the parking location for charging vehicles, the chargepoint, and the supply (grid connection point) are contained within the same structure (e.g. multi-story or basement carpark); or the parking and supply are located separately (e.g. in an open-air surface level carpark). Additionally, parking located within a steel framed building (or buildings attached to a steel framed building), may not use a PME supply. For individual residential buildings certain relaxations to the wiring standards may apply.

223. The impact will be biggest for retrofit, where a PME supply is no longer appropriate, alteration to the supply, additional electrical works, or a separate supply will be required. For new builds, there may be an increase in cost associated with not being able to use a PME supply. However, this is assumed to be marginal compared to retrofit.

224. For a single installation, either new build or retrofit, it is assumed that there would be sufficient spare power capacity to supply the chargepoint. Therefore, there are no additional grid connection costs, unless a dedicated supply was installed.

225. For multi-occupancy car parks, the need for grid upgrades upstream of the dedicated building transformer is assumed to be minimal. However, for both the upstream (HV) distribution network and the national grid transition network, the aggregate effects of multiple developments installing multiple charge points certainly would have an impact and incur significant cost, although these have not been considered within this assessment.

Table B2: Grid connection cost drivers

Factor	Low Scenario	High Scenario
Residential off-street (retrofit)		
Alteration of connection of individual house to LV distribution grid. 1. Service alteration to increase supply power capacity 2. Alteration to PME supply for vehicles used on driveway.	 N/A N/A	 Required (assumed 10m able) - Highest cost for overhead supply alteration. Required.
Upstream grid reinforcement (Where multiple charge points installed on the same distribution network) 1. Cabling (4x200m) 2. Transformer	 N/A Required	 Cost per m Cost dependent on capacity (kWs)
Residential off-street (new build)		
Single Installation	N/A	N/A
Multi-occupancy Car Park – Basement/ Multi-storey (Retrofit) *Assumed no cost for 1 x installation*		
1. Cabling (100m) 2. Transformer 3. Alteration of PME supply	Cost per m Cost dependent on capacity (kWs) N/A	Cost per m Cost dependent on capacity (kWs) Required
Multi-occupancy Car Park – Basement/ Multi-storey (New build) *Assumed no cost for 1 x installation.*		
1. Service connection 2. Cabling (100m) 3. Transformer	Required (fixed cost) Cost per m Cost dependent on capacity (kWs)	Required (fixed cost) Cost per m Cost dependent on capacity (kWs)

Annex B3 - Chargepoint

226. These costs include the hardware costs of a 7kW 'smart' chargepoint and the data connectivity costs that are relevant for the multi-occupancy underground and multi-storey categories where it is assumed that data connectivity may not be available. These costs are identified in annex table A6. Multi-occupancy surface car parks are assumed to require a ground mounted chargepoint which carries an additional cost, whilst the other parking categories are assumed to require a wall mounted charge point.

227. Chargepoint power is the biggest single factor in influencing the cost of a charger. Given that it will be a functional requirement for chargepoints to have power of at least 7kW, we have assumed that a 7kW chargepoint is appropriate for all parking categories. The costs used were derived from a combination of the cost summaries provided by Steer as well as direct engagement with a range of chargepoint operators. A range has not been provided as we understand that many high range costs reflect the inclusion of a number of optional extras that are not essential to the functionality of the chargepoint. The bulk-buy unit costs for 100 chargepoints was found using the same ratios as identified by Steer for the wall mounted unit, meaning that for a 100 chargepoints, the unit cost is 89% of the cost of a single unit.

228. There are many additional factors that affect the cost of chargepoint hardware, such as the number of sockets, the type of mount and payment/authorisation. We have assumed the

relevant costs for a base model chargepoint. The costs are applicable whether the installation is within a retrofit or new build environment, but bulk costs means that multi-occupancy new build developments are able to take advantage of lower unit costs.

229. Although we expect the cost of hardware to fall over time, we have not included this in the analysis, as we do not have sufficient data to inform the rate of reduction.