



RESS 2 Solar Project - Sensitivity Analysis

Commissioned by the
Irish Solar Energy Association

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The findings in this report relate to financial modelling analysis that KPMG has conducted on behalf of ISEA.

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Executive summary

- The recent Renewable Electricity Support Scheme (“RESS”) 2 auction was widely recognised by the renewable energy industry as being a success for solar energy deployment in Ireland and ultimately has the potential to be transformational for the role the technology plays in the Irish energy mix.
- The MW quantity of solar projects offered into the auction totalled 2,505 MW with a result of 1,534 MW being successfully cleared and granted a RESS offer.
- The weighted average strike price of successful offers (all eligible technology types) in the auction was €97.87 / MWh which represented a c.32% increase relative to the previous RESS 1 auction results in 2020 (€74.08 / MWh).
- Some of the main factors for the increase in the RESS 2 weighted average strike price relative to RESS 1 include:
 - Increased capex prices (in real terms) as a result of global supply chain challenges caused by COVID-19 and the conflict in Ukraine, coupled with higher demand for solar panels and associated components;
 - Higher inflation expectations at the time of the RESS 2 auction relative to the RESS 1 auction;
 - Higher constraint and curtailment expectations at the time of the RESS 2 auction relative to the RESS 1 auction; and
 - Increased levels of project risk associated with cost estimate uncertainty e.g. business rates and grid connection cost estimates have also likely contributed to the higher strike price level.

Following the auction, KPMG was commissioned by the Irish Solar Energy Association (“ISEA”) to model a Reference Case solar project and identify the impact that single assumption changes can have on the strike price required to maintain a given level of return (a 5% post-tax unlevered IRR target was assumed).

Whilst no two solar projects are the same, meaning any generically applied assumption should be used with caution, the sensitivities set out in this report should hopefully serve as an aid to solar energy developers and other interested stakeholders in understanding the key value drivers in their projects.

It should also be noted that a significant number of projects (and MW quantity) that were successful in the RESS 1 auction will not be constructed. In many cases, projects are not economically viable to deliver at the relevant RESS 1 strike prices awarded.

The industry has observed that the economics for solar development projects in Ireland in the vast majority of cases leave limited headroom for contingency costs and unexpected rises in capital or operational expenditure lines. Fluctuating capex costs and uncertainty on grid costs during the development process means significant investment needs to be made by solar energy developers in an uncertain environment. If a project is subsequently bid into a RESS auction applying incorrect estimates or indeed if costs change significantly without significant contingency applied in a bid, it can result in a project being uneconomic and ultimately not being constructed.

The sensitivities set out in this report should hopefully serve as aid to solar energy developers in understanding the key value drivers in their projects, as well as policymakers in how their decisions on various policy matters (e.g. inflation, rates, etc.) directly impact on the RESS strike price required by projects.



Introduction

In order to carry out our analysis, a Reference Case project was agreed with ISEA. The assumptions for the Reference Case project were compiled by KPMG in conjunction with ISEA, and represent what is considered to be a typical size project with input assumptions that have been observed in the market by KPMG, ISEA and a number of its members.

Whilst no two projects are the same, the assumptions are considered to be broadly representative of a typical solar project in Ireland. For the purpose of this analysis, a strike price of €97.87 / MWh (the published RESS 2 weighted average strike price) and a target 5% post-tax unlevered internal rate of return (IRR) have been assumed. Development, asset life and operating cost assumptions are summarised on the following page.

Please note, RESS auction bid strategies are project specific and should consider projected cash flows associated with the project, together with the bidder's own returns expectations (as regards a target post-tax unlevered (or levered) IRR).

The following sensitivities have been considered:



Reference Case project

Set out below is a listing of the assumption set used for the Reference Case project. A few notable assumptions are as follows:

Capacity: The capacity of the project is 70MW DC. Whilst there are a range of projects being developed in the country including a large number of <10MW projects and a number of larger projects (up to 100MW+), it is recognised that solar projects benefit from economies of scale, with larger solar projects benefiting from lower average asset management costs and lower average capex costs. A 70MW DC project has been selected as being broadly representative of a typical project under development in Ireland at present.

Asset life: A 40 year asset life has been assumed for the Reference Case. Whilst planning life in Ireland is typically granted for 25 years, it is common for developers and

investors to value projects for a period beyond the expiration of planning permission. The following page considers planning in further detail.

Constraints & Curtailment: The Reference Case assumes combined constraints and curtailment to range from 2.5%-12.0% with an average dispatch down of 7.2% per annum and that no compensation is received.

Capacity factor: A capacity factor of 11.75% has been applied in order to solve for a post tax unlevered IRR of 5.0%. It is acknowledged that the RESS 2 terms and conditions reference an 11% capacity factor for solar projects and that such a capacity factor would be fairly typical for projects in Ireland. However, given the other base case assumptions selected for the Reference Case, it was necessary to assume a higher capacity factor in order to achieve the targeted level of return.

Project Assumptions:	
Capacity	70MWp (DC)
Maximum Export Capacity	50MW
Asset life	40 years
Yield	11.75% (based on MWp)
Capex (including EPC, Grid costs and devex)	€750k / MWp
Constraints and curtailment	2.5% -12.0% (7.2% average)
Revenue/Opex Assumptions:	
RESS strike price (MWh) and Merchant price curve	€97.87 for 15 years (unindexed); Central merchant price curve (solar weighted) thereafter
Land lease	€262.5k per annum
O&M	€5.5k per MW (DC) per annum
Asset management	€1.0k per MW (DC) per annum
Insurance	€1.25k per MW (DC) per annum
Utilities & Other	€250 per MW (DC) per annum
Balancing cost	€2.00 per MWh
Grid O&M cost	€25k per annum
Community benefit fund	€2.00 per MWh
Local business rates	€7.5k per MW (AC) per annum
Substation own consumption	10,000 kWh per annum
Transformer own consumption	5,000 kWh per annum
TUoS cost	€8.75k per MW (AC) per annum

Please note, the above assumptions have been prepared for use in a Reference Case in conjunction with ISEA members and should not be used as a foundation for bidding projects into a future RESS auction. Assumptions are project specific.



Asset life

Planning permission for solar projects in Ireland is typically granted on a 25 year basis. Notwithstanding this, many market participants are now valuing projects on the basis of 35-40 year project life assumptions. Implicit in this assumption is that planning permission will be extended in the future, otherwise the project would need to be decommissioned at the end of its planning life.

It is acknowledged that some market stakeholders may not attribute value to projects beyond their planning life (for example, this would be the observed position of some commercial lenders).

For the purpose of the Reference Case, a 40 year asset life has been assumed.

Two sensitivities have been considered for analysis purposes:

- **Sensitivity 1:** 35 year asset life; and
- **Sensitivity 2:** 30 year asset life

The sensitivity results are shown in the table below.

€ / MWh	Strike price required to maintain 5% post tax unlevered IRR	Strike price variance from Reference Case
Reference Case: 40 years	€97.87	-
Sensitivity 1: 35 years	€99.80	€1.93
Sensitivity 2: 30 years	€103.06	€5.19

Note: All other Reference Case assumptions were held constant as set out on page 5.



RESS strike price indexation

The Reference Case assumes no indexation is applied to the RESS strike price, in line with the current parameters of the RESS scheme.

Two sensitivities have been considered for analysis purposes:

- **Sensitivity 1:** The impact of applying indexation from provisional auction award date to the end of the RESS period.
- **Sensitivity 2:** The impact of applying partial indexation from provisional auction award date to the end of year 8 during the RESS period.

The sensitivity results are shown in the table below.

For the purpose of this analysis, inflation rates of 7.8% in 2022, 4.2% in 2023, 2.1% in 2024, and 2% per annum thereafter have been assumed. These inflation rates were sourced from the Central Bank of Ireland’s Q3 2022 Bulletin.

Application of indexation to RESS strike prices would likely result in greater project finance options as inflation risk would be mitigated. Lower costs of finance associated with lower risk could reduce the required strike price further.

€ / MWh	Strike price required to maintain 5% post tax unlevered IRR	Strike price variance from Reference Case
Reference Case: No indexation	€97.87	-
Sensitivity 1: Apply indexation from provisional auction award date to the end of the assumed RESS period (15 years)	€80.23	€(17.64)
Sensitivity 2: Apply partial indexation from provisional auction award date to the end of year 8 of the assumed RESS period	€82.49	€(15.38)

Note: All other Reference Case assumptions were held constant as set out on page 5.



Indexation

Given the high levels of inflation currently being experienced in Ireland and across the world, it is prudent to analyse how changes in inflation assumptions impact the returns of RESS 2 solar assets. While inflation is usually associated with capex costs, for the purposes of this report, the sensitivity analysis also applies to merchant revenue and opex costs.

For the purpose of this analysis, inflation rates of 7.8% in 2022, 4.2% in 2023, 2.1% in 2024, and 2% per annum thereafter were assumed for the Reference Case. These inflation rates were sourced from the Central Bank of Ireland’s Q3 2022 Bulletin.

Three sensitivities have been considered for analysis purposes:

- **Sensitivity 1:** Increase Reference Case inflation rates by 1%;
- **Sensitivity 2:** Increase Reference Case inflation rates by 2%; and
- **Sensitivity 3:** Decrease Reference Case inflation rates by 1%.

The sensitivity results are shown in the table below.

The results illustrate that a higher inflationary outlook reduces the RESS strike price requirement. As the RESS strike price itself is unindexed, this highlights the impact of indexation on energy price forecasts following the end of the 15 year RESS tenor.

€ / MWh	Strike price required to maintain 5% post tax unlevered IRR	Strike price variance from Reference Case
Reference Case: No indexation	€97.87	-
Sensitivity 1: Increase indexation by 1% per annum	€93.28	€(4.59)
Sensitivity 2: Increase indexation by 2% per annum	€87.07	€(10.80)
Sensitivity 3: Decrease indexation by 1% per annum	€100.47	€2.60

Note: All other Reference Case assumptions were held constant as set out on page 5.



Tenor of support

The Reference Case assumes a 15 year RESS support tenor.

Two sensitivities have been considered for analysis purposes:

- **Sensitivity 1:** The impact of extending the RESS support to 20 years on an unindexed basis; and
- **Sensitivity 2:** The impact of extending the RESS support to 20 years on an indexed basis.

The results of the sensitivity analysis are shown in the table below.

For sensitivity 1, where the RESS support was applied for a 20 year period (unindexed), the project required

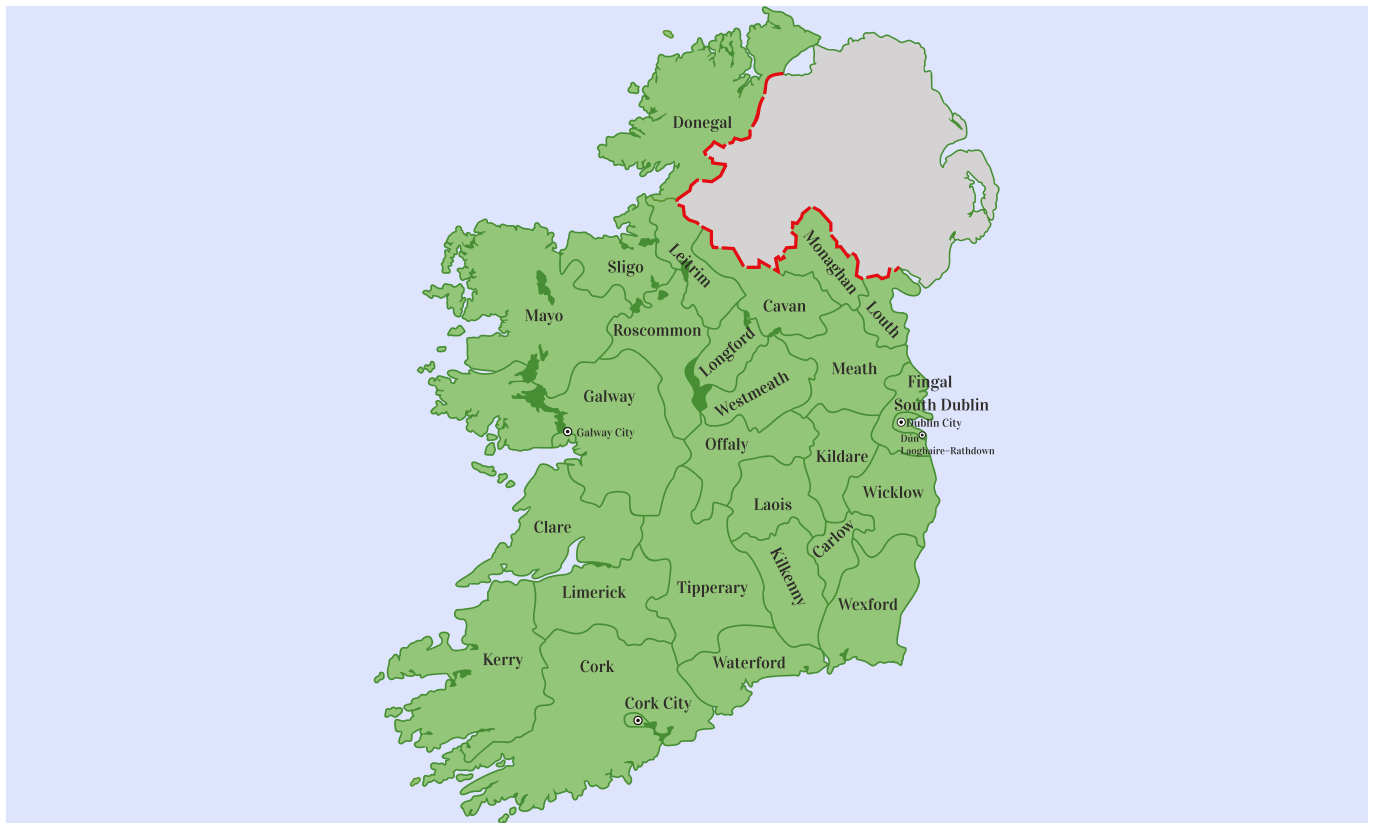
a slightly lower strike price of €97.03 / MWh. This is reflective of the assumed merchant price curve (indexed) having a lower nominal price than the Reference Case strike price for several years after the end of the 15 year RESS tenor.

For sensitivity 2, when indexation is applied for a 20 year period, the project required a substantially lower strike price of €76.90 / MWh.

For the purpose of this analysis, inflation rates of 7.8% in 2022, 4.2% in 2023, 2.1% in 2024, and 2% per annum thereafter have been assumed. These inflation rates were sourced from the Central Bank of Ireland’s Q3 2022 Bulletin.

€ / MWh	Strike price required to maintain 5% post tax unlevered IRR	Strike price variance from Reference Case
Reference Case: 15 years	€97.87	-
Sensitivity 1: Apply RESS support for 20 years (unindexed)	€97.03	€(0.84)
Sensitivity 2: Apply RESS support for 20 years with indexation	€76.90	€(20.97)

Note: All other Reference Case assumptions were held constant as set out on page 5.



Business Rates

The Reference Case assumes business rates of €7.5k / MW (AC).

Two sensitivities have been considered for analysis purposes:

- **Sensitivity 1:** The impact of reducing the €7.5k / MW (AC) business rates assumption by 50% to €3.75k / MW (AC); and
- **Sensitivity 2:** The impact of completely removing business rates for solar projects.

The results of the sensitivity analysis are shown in the table below.

From a commercial risk perspective, it is noted that uncertainty in relation to business rates results in additional risk. Business rates vary significantly across Local Authorities leading to large differences in project costs incurred by developers in different parts of the country. Greater certainty on the business rates position over the longer term would help mitigate this risk and could result in lower strike prices.

€ / MWh	Strike price required to maintain 5% post tax unlevered IRR	Strike price variance from Reference Case
Reference Case: €7.5k / MW (AC)	€97.87	-
Sensitivity 1: €3.75k / MW (AC) (50% of Reference Case)	€90.57	€(7.30)
Sensitivity 2: No rates	€83.55	€(14.32)

Note: All other Reference Case assumptions were held constant as set out on page 5.



Constraints and curtailment

Constraints and curtailment assumptions vary from project to project. The Reference Case assumes combined constraints and curtailment to range from 2.5% - 12.0% with an average dispatch down of 7.2% per annum and that no compensation is received.

Two sensitivities have been considered for analysis purposes:

- **Sensitivity 1:** The impact of increasing the Reference Case constraints and curtailment assumption by 1% throughout the life of the asset; and

- **Sensitivity 2:** The impact of reducing the Reference Case constraints and curtailment assumption by 1% throughout the life of the asset.

The results of the sensitivity analysis are shown in the table below. The sensitivities illustrate that even minor changes in the rate of dispatch down can have a sizeable impact on the RESS strike price. Greater certainty on the dispatch down position over the longer term would reduce risk and therefore strike prices.

€ / MWh	Strike price required to maintain 5% post tax unlevered IRR	Strike price variance from Reference Case
Reference Case: 2.5%-12.0%	€97.87	-
Sensitivity 1: 3.5%-13.0%	€99.36	€1.49
Sensitivity 2: 1.5%-11.0%	€95.89	€(1.98)

Note: All other Reference Case assumptions were held constant as set out on page 5.



TUoS costs

The Reference Case assumes TUoS costs of €8,750 / MW (AC)

■ **Sensitivity 1:** The sensitivity analysis considers the impact of TUoS costs being charged on a MWh basis as opposed to a MW basis. The rationale for this is that TUoS costs are disproportionately high for solar projects relative to onshore wind projects under the current charging regime, due to solar projects having lower capacity factors relative to onshore wind.

■ Based on a sample of locations considered for this report (and following the approach outlined above as a means of better aligning TUoS costs applied to solar projects), the sensitivity assumes a reduction in TUoS cost of €4,375 / MW (AC).

€ / MWh	Strike price required to maintain 5% post tax unlevered IRR	Strike price variance from Reference Case
Reference Case: €8,750 / MW (AC) p.a.	€97.87	-
Sensitivity 1: Reduction in TUoS cost to €4,375 / MW (AC), based on applying MWh approach to TUoS derivation.	€89.39	€(8.48)

Note: All other Reference Case assumptions were held constant as set out on page 5.



Project capex – grid cost sensitivity

Capital expenditure varies from project to project and is project specific. For example, larger projects benefit from economies of scale and grid connection costs vary by project.

For the Reference Case, a capex requirement of €750k / MW has been assumed.

83.33% of this capex is assumed to be attributable to development expenditure and EPC costs.

16.67% of the total capex is assumed to be attributable to grid costs, with grid assumed to cost €125k / MW.

Grid costs for the Reference Case project roughly correspond with connection to an existing 110kV transmission station via approximately 5km of new 110kV underground cable to a new tail-fed 110kV single bay station. Cost estimates for the reference project

are based on 2022 standard transmission charges (CER/09/077). More complex projects and/or out turn unit rates higher than the standard charges will result in grid capex costs in excess of the Reference Case project costs.

■ Sensitivities: Four sensitivities have been considered for grid capex.

Sensitivity 1: assumed grid capex increased by 20%,

Sensitivity 2: assumed grid capex increased by 50%,

Sensitivity 3: assumed grid capex decreased by 20%, and

Sensitivity 4: assumed grid capex decreased by 50%.

The results of the sensitivity analysis are shown in the table below.

€ / MWh	Strike price required to maintain 5% post tax unlevered IRR	Strike price variance from Reference Case
Sensitivity 1: 20% increase in grid capex to €150k / MW	€100.47	€2.60
Sensitivity 2: 50% increase in grid capex to €187.5k / MW	€104.76	€6.89
Sensitivity 3: 20% reduction in grid capex to €100k / MW	€94.76	€(3.11)
Sensitivity 4: 50% reduction in grid capex to €62k / MW	€90.69	€(7.18)

Note: All other Reference Case assumptions were held constant as set out on page 5.



Project capex: EPC sensitivity

As stated previously, a capex requirement of €750k / MW has been assumed for the Reference Case project.

83.33% of this capex is assumed to be attributable to development expenditure and EPC costs (€625k / MW).

■ **Sensitivities:** Four sensitivities have been considered for project capex (excluding associated grid connection costs).

Sensitivity 1: assumed capex increased by 10%,

Sensitivity 2: assumed capex increased by 20%,

Sensitivity 3: assumed capex decreased by 10%, and

Sensitivity 4: assumed capex decreased by 20%.

The results of the sensitivity analysis are shown in the table below.

€ / MWh	Strike price required to maintain 5% post tax unlevered IRR	Strike price variance from Reference Case
Reference Case: €625k / MW	€97.87	-
Sensitivity 1: 10% increase in EPC capex to €687.5k / MW	€104.76	€6.89
Sensitivity 2: 20% increase in EPC capex to €750k / MW	€111.92	€14.05
Sensitivity 3: 10% reduction in EPC capex to €562.5k / MW	€90.46	€(7.41)
Sensitivity 4: 20% reduction in EPC capex to €500k / MW	€83.63	€(14.24)

Note: All other Reference Case assumptions were held constant as set out on page 5.



Capacity factor

A recent study indicated that the capacity factor of solar energy sites in Ireland ranges from 9.9% to 13.2% with a mean capacity factor of 11.0%.

The Reference Case assumes a capacity factor of 11.75%.

It is also acknowledged that the RESS 2 Terms and Conditions reference an 11% capacity factor for solar and that such a capacity factor would be fairly typical for projects in Ireland.

However, given the other base case assumptions selected for the Reference Case, it was necessary to assume a higher capacity factor in order to achieve the targeted level of return.

■ **Sensitivities:** Two sensitivities have been considered for analysis purposes:

Sensitivity 1: The impact of increasing the Reference Case capacity factor by 1%; and

Sensitivity 2: The impact of decreasing the Reference Case capacity factor by 1%.

The results of the sensitivity analysis are shown in the table below.

€ / MWh	Strike price required to maintain 5% post tax unlevered IRR	Strike price variance from Reference Case
Reference Case: 11.75%	€97.87	-
Sensitivity 1: 12.75%	€85.94	€(11.93)
Sensitivity 2: 10.75%	€111.46	€13.59

Note: All other Reference Case assumptions were held constant as set out on page 5.



Merchant price curves

The Reference Case assumes a central price curve forecast (solar weighted) for the period following the end of the 15 year RESS tenor.

■ **Sensitivities:** Two sensitivities have been considered for analysis purposes:

Sensitivity 1: The impact of changing the Reference Case merchant price curve (solar weighted) from a central case forecast to a low case forecast; and

Sensitivity 2: The impact of changing the Reference Case merchant price curve (solar weighted) from a central case forecast to a high case forecast.

The results of the sensitivity analysis are shown in the table below.

€ / MWh	Strike price required to maintain 5% post tax unlevered IRR	Strike price variance from Reference Case
Reference Case: Mer-chant curve: central case (solar weighted)	€97.87	-
Sensitivity 1: Merchant curve: low case (solar weighted)	€113.43	€15.56
Sensitivity 2: Merchant curve: high case (solar weighted)	€74.52	€(23.35)

Note: All other Reference Case assumptions were held constant as set out on page 5.



Degradation

The reduction in solar panel output over time is known as degradation. Solar panel degradation is caused by external factors that are unavoidable such as UV exposure and adverse weather conditions. The Reference Case assumes a degradation rate of 0.35%.

Sensitivity 1 & 2: Two sensitivities were considered whereby the degradation rate was increased to 0.40% and 0.50% respectively.

The results of the sensitivity analysis are shown in the table below.

€ / MWh	Strike price required to maintain 5% post tax unlevered IRR	Strike price variance from Reference Case
Reference Case: 0.35% degradation rate	€97.87	-
Sensitivity 1: 0.4% degradation rate	€98.69	€0.82
Sensitivity 2: 0.5% degradation rate	€100.85	€2.98

Note: All other Reference Case assumptions were held constant as set out on page 5.

Conclusion

As set out, this Report seeks to identify the impact single assumption changes to a Reference Case project can have on the strike price required to maintain a given level of return.

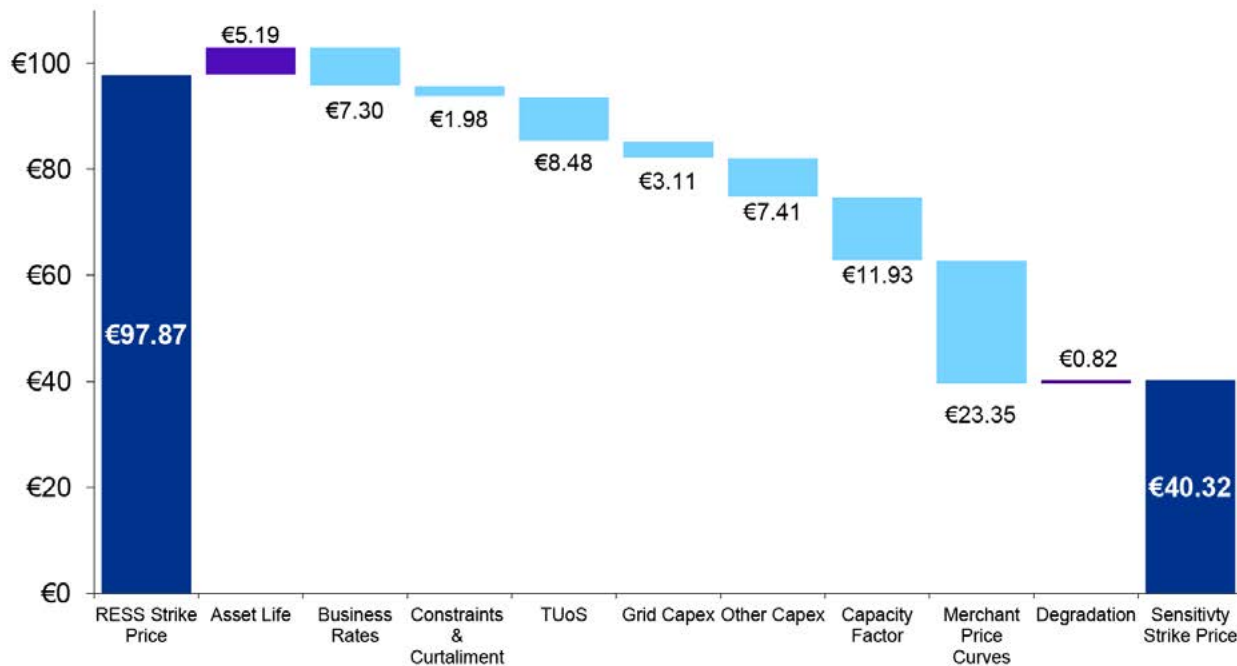
The chart below illustrates the impact that a selection of sensitivities considered in this Report have on the RESS strike price, relative to the Reference Case strike price, in order to maintain the targeted level of return (5% post-tax unlevered IRR).

For the purposes of the Sensitivity Case strike price, adjusted scenarios around indexation and tenor of

support have not been included in order to compare the RESS strike price with the Sensitivity Case strike price on a like for like basis.

It is acknowledged that this analysis is somewhat simplistic in its application of a sum of the parts approach. Notwithstanding this, it provides an indication of the level of impact that each specific assumption has on the RESS strike price required to maintain a targeted level of return.

Average RESS strike price to Sensitivity Case strike price waterfall



Sensitivity Case	
Asset Life	30 year asset life
Business rates	€3.75k / MW (AC) (50% of Reference Case)
Constraints & Curtailment	Combined constraints & curtailment range from 1.5% - 11.0%
TUoS	€4,375 / MW (AC) (50% of Reference Case)
Grid Capex	20% reduction in grid capex to (€100k/ MW)
Other Capex	10% reduction in EPC capex to (€562.5k/MW)
Capacity Factor	12.75%
Merchant price curves	High case (solar weighted)
Degradation	0.4% degradation rate



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