Low Carbon Inertia Services (LCIS) – price cap and imbalance price proposals

A report to EirGrid plc

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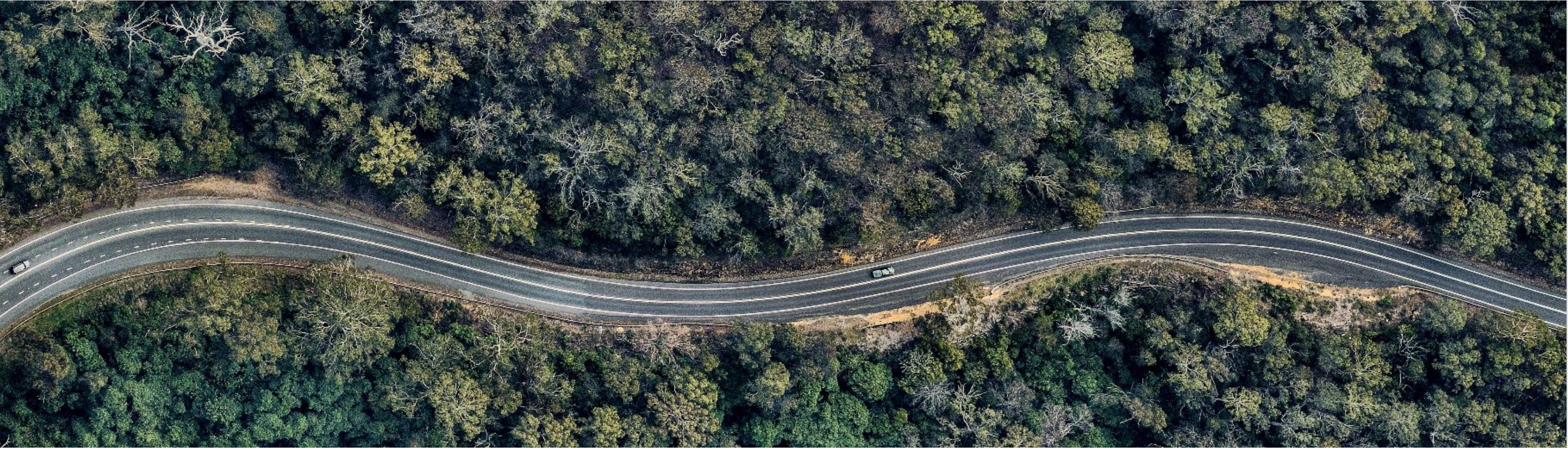

1 Executive summary

1.1 Low Carbon Inertia Service (LCIS) background and objectives

EirGrid and SONI will launch a procurement for Low Carbon Inertia Services (LCIS) in 2023, awarding Fixed Term Contracts to successful tenderers. The target for this procurement process is to deliver 10,000 MVA.s of synchronous inertia (6,000 MVA.s in Ireland and 4,000 MVA.s in Northern Ireland, total of 5 to 11 large devices) to meet the 2026 requirements. It is likely that synchronous condenser technology will be successful in the procurement. More details are provided in the SEMC Decision[1].

For the next consultation on the contractual arrangements, EirGrid and SONI need to propose bid caps for this procurement as set out in the SEMC Decision. Additionally, the cost of losses will be covered by the TSOs via the energy market but will be considered in the evaluation process as proposed in our recommendations paper. For this, an imbalance price will need to be defined.

The purpose of this report is to set out different options for:

- a potential price cap to control overall expenditure; and
- the imbalance price to be used for the purposes of the evaluation.

1.2 Price control and consumer protection

Price controls are typically used to ensure consumer protection. Any price control should, however, not interfere with the wider market functioning and allow competition to deliver the most efficient outcomes. For example, a price that is set at a very low level may risk delivering unsustainable investments or even volumes below the desired procurement level.

We have explored three options for setting the price for the LCIS auctions:

1. long run marginal cost (LRMC) of the 'best new entrant';
2. implied value of the corresponding System Services based on EirGrid analysis; and
3. a 'blended' approach (a blend of LRMC and the implied value).

[1] SEM-23-002 Procurement of Low Carbon Inertia Services Decision Paper

Our recommendation is to use a **blended approach**. This appears to be a reasonable compromise between value for consumers and underlying cost of provision. The estimated bid cap is €2.02/MVA.s/h (in nominal money terms). This approach does allow the overall price to rise above the LRMC estimate of a LCIS provider, but, at the same time, ensures that even if that is the case, consumers can benefit from a relative reduction in other parts of the electricity supply chain (for example reduction in fuel use).

Exhibit 1.1 – Overall qualitative score for price control

We have assessed the potential efficiency of the LCIS auction outcomes and the resulting cost to consumers under the different option. The level of competition is, however, eventually the key driver for delivering efficient outcomes and lowering cost to consumers. Using the LRMC of the best new entrant can still result in outcomes that are as efficient as those with the other two options. Similarly, the cost to consumers can be as low with the implied value approach as it would be with the LRMC of the best new entrant.

Options	Efficiency	Cost to consumers	Overall score
Best new entrant	◐	●	◕
Implied value	●	◔	◐
Blended approach	◕	◕	◕

Notes: The shaded area of the Harvey indicates performance – a higher quantity of filled segments indicates a higher performance.

1.3 Variable electricity cost evaluation

The cost of consumed energy will be covered under the SEM market arrangements and not as part of the LCIS contractual arrangements. This means providers are not exposed to this cost, provided they are able to meet their delivery obligations within their stated energy consumption. However, the 'losses' and the associated cost from potential solutions will be considered in the evaluation process to avoid favouring solutions with lower fixed costs, but with a significantly higher electricity consumption over low-consumption and higher fixed cost solutions.

We have explored three potential options as part of this analysis:

1. Historical average imbalance prices;
2. Price projections from a 'reputable independent consultant' or another third party; and
3. Blended average price based on forward prices and technology marginality assumptions.

Our preferred option is to use average **historical prices**. The imbalance price proposed is therefore €97/MWh (in nominal money terms). Future electricity prices are uncertain, and, in this case, the choice of an imbalance price estimate for the purposed of the LCIS provider evaluation is of 'low materiality' as long as the assumed price level is with a reasonable range. We, therefore, believe practicality and transparency should be the key considerations for choosing the approach towards the imbalance price.

Exhibit 1.2 – Overall qualitative score for treatment of electricity costs

We have qualitatively weighed the efficiency of the solution in the context of market and consumer outcomes, as well as the simplicity of the solution.

Options	Efficiency	Simplicity	Overall score
Historical prices	◐	●	◕
Third party forecast	◕	◐	◐
Adjusted forwards	◕	◔	◐

Notes: The shaded area of the Harvey indicates performance – a higher quantity of filled segments indicates a higher performance.

2 Introduction

2.1 Structure of this report

This report is organised into separate sections addressing each of the key design issues posed by EirGrid plc (EirGrid) and assessed by AFRY:

- Section 1 includes a summary of our preferred options for each of the design issues assessed.
- Section 2 summarises the structure of the report.
- Section 3 describes and evaluates options for price controls.
- Section 4 presents and evaluates options for the treatment of the variable electricity cost of potential providers in the evaluation process.

2.1.1 Sources

Unless otherwise attributed the source for all tables, figures and charts is AFRY Management Consulting.

3 Price control and consumer protection

Price controls are typically used to ensure consumer protection. Any price control should, however, not interfere with the wider market functioning and allow competition to deliver the most efficient outcomes. If a price control measure inhibits competition unduly, then inefficient outcomes can emerge – at worst this can result in market failure.

Price control measures can take many forms including:

- the inclusion of outside options (e.g. where a regulated entity provides a backstop solution acting as a ‘soft’ or ‘implicit’ price cap);
- obfuscation or withholding of target procurement volumes/price sensitivity (imbalance of information between buyer & seller); or
- explicit measures such as price caps.

In the context of LCIS, the SEMC Decision[2] required Eirgrid and SONI to explore the latter of these options. The objective of the price cap is not to reduce the bidding range of participants to within an unreasonable degree, but to prevent the manifestation of market power should it be that there are only a limited number of bidders able to meet the requirements.

3.1 Description of potential options

There are three potential options that we have explored for setting the price cap:

1. long run marginal cost (LRMC) of the best new entrant;
2. implied value of system services based on EirGrid analysis; or
3. a blended approach (between LRMC and implied value).

3.1.1 Long run marginal cost of the best new entrant

The long run marginal cost approach sets a price cap at the expected cost of the best new entrant (typically with some headroom to account for variation in project costs between assumed and real project costs, and cost

[2] SEM-23-002 LCIS Procurement - SEMC Decision Paper.pdf (semcommittee.com)

uncertainty between price cap calculation and actual project delivery). The intention of this approach is to limit any perceived abuse of market power from participants who might otherwise be able to bid high prices should there be limited competition in the process.

The wider consensus is that the best new entrant for LCIS provision is a synchronous condenser (with a flywheel). We do, however, recognise that there may be alternative solutions available. Should that be the case, there is nothing blocking different technologies to participate in the LCIS auction assuming they can meet the technical specifications of the service, and if they are more cost effective than the reference technology (synchronous condenser), they could also bid below the price cap and be awarded a contract.

Project sizing may have an impact on the 'cost per unit' of the service, in particular the size of the flywheel relative to the size of the synchronous condenser. We have carefully selected a set of conservative assumptions, exploring smaller solutions so as not to penalise providers that wish to offer small to medium-sized solutions in the LCIS procurement process.

We have used a range of costs for our assessment to better reflect the variance in costs as a result of the overall system size, and size of the flywheel relative to the size of the synchronous condenser. This is presented in the table below. We are considering units from 900 to 2,000MVA.s, and with a MVA rating ranging from 50 to 400MVA. For the purposes of the below, we have not included scalars in our baseline solution.

Exhibit 3.1 – Cost assumptions for potential inertia providers

Cost assumptions to estimate long run marginal cost of the best new entrant, for units from 900 to 2000MVA.s, and with a MVA rating ranging from 50 to 400MVA.

	CAPEX €/kVA.s, real 2021	**OPEX** €/kVA.s/yr, real 2021	**Cost of capital, pre-tax, real**
Low	20.0	0.8	6.9%
Mid	29.3	2	8.3%
High	38.7	2.4	9.6%

Notes: Costs data based on interviews with potential providers and on National Grid ESO Stability Phase 1 Tender Results. Given the lack of deployment of these units in the SEM, obtaining reliable cost estimates for total CAPEX is challenging. The figures quoted above reflect turnkey EPC costs for a new-build unit.

The long run marginal costs for potential inertia providers is then estimated based on these costs, and assuming that:

- the totality of the CAPEX is recovered during the 6 year contract;
- after the 6 years of fixed contract, OPEX and variable costs are assumed to be recovered by a separate market mechanism (i.e. no net cost or revenue is assumed after the contract in this assessment); and
- there is no residual value upon contract expiry and no other net revenues outside the LCIS during the contract period.

The table below presents the resulting long run marginal costs based on these assumptions.

Exhibit 3.2 – Long run marginal costs for potential inertia providers

Estimated long run marginal costs for potential inertia providers assuming a range of costs.

	Estimated LRMC €/MVA.s/h, nominal
Low	**0.69**
Mid	**1.12**
High	**1.56**

Notes: Costs expressed in real 2021 were inflated over the 2026-2032 period in order to obtain LRMC in nominal terms.

The preferred choice would be to use the upper end of the range of costs for the bid cap calculations (€1.56/MVA.s/h) to also cater for smaller sized solutions.

3.1.2 Implied value of System Services

In November 2022, following a request from the Regulatory Authorities, EirGrid and SONI undertook an internal study to estimate the benefits of LCIS. This analysis focused on the cost and carbon savings from reducing the minimum number of conventional units that must run from 8 to 5 for the year 2026. The study explored the outcome of four scenarios, testing a range of fuel and carbon prices, and different renewable capacity.

This highlighted, as expected, generation and carbon costs savings in all four scenarios. We have used the savings determined by this study as a proxy for the implied value of the LCIS provision. However, not all of the benefit can be allocated to the LCIS as a broader range of low-carbon capability provision is needed to unlock the entirety of the benefits, some of which is outside the scope of the LCIS (for example ramping capability or new dispatchable generation to satisfy security of supply constraints).

In addition, when using this implied value for determining a price cap, we need to be mindful that:

- solutions can earn additional revenue for their technical characteristics through scalars, and the price cap should be sufficient to allow for bids after accounting for the impact of scalars~~and the price cap would then need to be adjusted accordingly~~; and
- the bid price is not intended to capture all costs associated with the operation of the service providers (e.g. energy costs).

We have therefore chosen to assume that only half of the benefits can be assigned to LCIS providers, as a conservative estimate.

The table below shows the total production cost savings identified by the study, and the corresponding implied value of the service, assuming half of savings are a result of the LCIS provision.

Exhibit 3.3 –LCIS Benefits Analysis results and implied value

LCIS benefits results and implied value assuming half of the savings are attributable to LCIS providers for the bid cap calculation

EirGrid and SONI study results				Implied value analysis	
Scenario	**RES capa.**	**Fuel/ carbon prices**	**Annual total production cost savings in 2026** m€/y, nominal (2026)	**Assuming half of the savings are attributable to LCIS providers over the period** m€/y, nominal	**Implied value** €/MVA.s/h, nominal
A	8.5 GW	Low	116	61.0	**0.70**
B	8.5 GW	High	365	191.9	**2.19**
C	10 GW	Low	139	73.1	**0.83**
D	10 GW	High	413	217.1	**2.48**

Source: EirGrid and SONI internal study.
Notes: In order to obtain the savings attributable to LCIS providers over the period in nominal money, the total production cost savings in 2026 from EirGrid and SONI study were divided by two and inflated over the 2026-2032 period.

The intention of the bid cap is to protect consumers, rather than stifle innovation. In order to ensure a range of potential solutions are viable (not restricted by the bid cap), the highest implied value from the study - from scenario D - is used in the bid cap calculation. The adopted implied value is €2.48/MVA.s/h.

3.1.3 A blended approach

A blended approach between the implied value of System Services and the long run marginal cost of the best new entrant represents a compromise for sharing the economic surplus created between producers and consumers. Inherently all forecasts contain uncertainty, and the future value/cost of system services are no exception. The approach is aimed at ensuring consumers are better off than the status quo, whilst recognising the value that providers offer and allowing for them to be rewarded appropriately.

Note that providers are still subject to competitive forces. They are, however, less constrained if competition turns out to be weaker than expected – either due to low interest from market participants (e.g. due to perceived low returns), or due to real world constraints (e.g. project costs are much higher than expected because of limited sites/connections etc.).

The proposed bid cap under this option is the 50:50 split – i.e. arithmetic average between previous two approaches. It results in a proposed cap of €2.02/MVA.s/h.

3.2 Option evaluation

The exhibit below presents the bid caps under each option in € and £/MVA.s per hour (nominal money terms).

Exhibit 3.4 – Potential price caps for LCIS procurement

Potential price caps under different price cap methodologies explored in € and £/MVA.s per hour

Options	Potential price caps €/MVA.s/h, nominal	Potential price caps £/MVA.s/h, nominal
Best new entrant	1.56	1.39
Implied value	2.48	2.20
Blended approach	2.02	1.79

Notes: Assuming a real GBP/EUR exchange rate of 1.13.

The table below details the benefits and drawbacks of each option. In general, the risk with the cost based approach is to underestimate to cost and set the cap too low, which could lead to under-procurement. On the other hand, the cap based on the implied value approach should ensure sufficient volume procurement, but there is more potential for higher cost to consumers.

Exhibit 3.5 – Key benefits and drawbacks of options for price control measures

Appraisal of the potential benefits and drawbacks of each of the proposed approaches, limited to key considerations and differentiators between options.

Options	Benefits	Drawbacks
Best new entrant	— Cap should be sufficiently low to protect consumers from potential excess costs	— Costs are uncertain and project specific — Can risk under-procurement if costs underestimated and cap set too low
Implied value	— Limits risk of under-procurement	— Current approach to modelling means that implied value is representative of wider benefits, not just benefits from LCIS provision — Future scenarios demonstrate a wide range of potential outcomes for consumers
Blended approach	— Represents a compromise between value for consumers and cost of solution — Cap should be sufficiently high to allow for competitive market outcomes and low enough to protect consumers from excess costs	— Wide range of potential costs and benefits in both approaches that are used to form the blended approach

3.3 Preferred option

Our preferred option is the **blended approach** as it is deemed to represent the best compromise between value for consumers and cost of solution. The proposed bid cap is €2.02/MVA.s per h. We believe this approach offers a fair compromise between protecting consumers and rewarding providers for their contribution to system security.

Exhibit 3.6 – Overall qualitative score for price control

We have assessed the potential efficiency of the LCIS auction outcomes and the resulting cost to consumers under the different option. The level of competition is, however, eventually the key driver for delivering efficient outcomes and lowering cost to consumers. Using the LRMC of the best new entrant can still result in outcomes that are as efficient as those with the other two options. Similarly, the cost to consumers can be as low with the implied value approach as it would be with the LRMC of the best new entrant.

Options	Efficiency	Cost to consumers	Overall score
Best new entrant	◐	●	◕
Implied value	●	◔	◐
Blended approach	◕	◕	◕

Notes: The shaded area of the Harvey indicates performance – a higher quantity of filled segments indicates a higher performance.

4 Electricity consumption costs evaluation

As part of the LCIS service, EirGrid will be responsible and pay for the electricity consumption of LCIS providers. Providers will therefore face no exposure for these costs in principle, provided they are able to meet their delivery obligations within their stated energy consumption. However, the cost of the electricity 'losses' (the term 'losses' is used here to describe the electricity consumption of LCIS providers) will be considered in the evaluation process to avoid favouring solutions with lower fixed costs, but with a significantly higher electricity consumption over low-consumption, high fixed cost solutions.

Whilst the value ascribed to these losses (electricity price multiplied by expected losses) is broadly irrelevant to providers commercially, they may impact the assessment of successful bidders. Choice of a benchmark that precipitates relatively higher electricity prices will penalise high energy consumption (per MVA.s) solutions. The choice of a benchmark that results in relatively lower price expectations will skew the evaluation of bids in favour of energy intensive solutions.

The objective of the exercise is to select a benchmark which offers a reasonable reflection of costs that might be incurred by the TSOs on behalf of consumers for the purposes of evaluation, noting that the impact on providers is expected to be limited.

4.1 Description of potential options

We are exploring three potential options as part of this analysis:

1. Historical average imbalance prices;
2. Price projections from 'reputable consultant' or other third party; or
3. Blended average price based on forward prices and marginality assumptions.

4.1.1 Historical average imbalance prices

For this assessment, historical imbalance prices since the launch of I-SEM are considered. The imbalance prices we are proposing to use is the average of historical imbalance prices over the years 2019 to 2021, adjusted to account for the expected inflation over the contract period. 2022 is excluded from the historical average as it was marked by the energy crisis following the Ukraine war, and is not deemed representative. This results in an average price of €97/MWh (in nominal money terms).

4.1.2 Price projections from 'reputable consultant' or other third party

The proposal is to use electricity price projections from a 'reputable consultant' over the contract period as the estimate for the imbalance price during the period.

The arithmetic average of wholesale electricity price projections[3] over the years 2026 to 2031 (reflecting the expected 6 year term of the LCIS contract) are in the range of 72-129 (in nominal money), based on the latest AFRY wholesale electricity price projections.

4.1.3 Blended average prices based on forward prices and marginality assumptions

Another view is that forward prices reflect the current expectation of the future market. Future electricity prices can be estimated using forward prices for the underlying commodities and making assumptions the percentage of time the price will be set by a given technology.

In this option, several assumptions are made for simplicity:

- by 2026, gas is assumed to be the marginal technology ~80% of the time, and low/zero price technologies set the price for the remainder of the time;
- we have used NPB and EU ETS forward prices, traded on 01/02/2023, for delivery in 2026 (noting, however, that forward markets are highly illiquid that far out into the future) ; and
- technical parameters from a representative Combined Cycle Gas Turbine are assumed, as presented in the table below.

Exhibit 4.1 – Forward prices and technical parameters used for the blended price

Commodities forward prices and technical parameters for an indicative gas turbine used for defining future electricity prices

Forward prices, traded on 01/02/2023	
NBP forward for delivery in 2026, p/therm	99.50
EU ETS future for delivery in 2026, €/MWh	109.65
UK Pound Sterling/Euro cross rate	1.126

Combined Cycle Gas Turbine parameters	
Efficiency	54.4%
Other costs (e.g. variable work costs, fuel delivery…), €/MWh elec	3.0
Emission intensity, tCO2/MWh gas	0.182
% of time CCGT sets the electricity price	80%

Source: Refinitiv, AFRY analysis

[3] Based on AFRY High and Low Q4 2022 projections.

Calculating the overall marginal cost of the CCGT (including fuel, carbon and other variable costs) based on forward prices, and assuming this technology sets the electricity price 80% of the time, the resulting price is €92.43/MWh (in nominal money terms).

4.2 Option evaluation

The table below compares the estimated values under the proposed options. These can be used as proxy for the unit costs of electricity consumption that might be incurred by the TSOs on behalf of consumers for the purposes of evaluation of LCIS bids.

Exhibit 4.2 – Comparison of approaches

Potential imbalance prices for the evaluation of LCIS providers

Option	Estimated imbalance price €/MWh, nominal
Historical average imbalance prices	**97**
Third party projections	**72-129**
Adjusted forwards and marginality approach	**92**

The table below lists the benefits and drawbacks of options presented in Section 4.1.

Exhibit 4.3 – Key benefits and drawbacks of options for treatment of electricity costs

Appraisal of the potential benefits and drawbacks of each of the proposed approaches

Options	Benefits	Drawbacks
Historical average imbalance prices	— Simple and easy to verify, understand, and audit – highly transparent — Information well understood by market participants and easily available to all	— Historical prices are not always a good indicator of future prices — Subject to biases depending on range of selected prices for evaluation.
Third party projections	— Takes account of expected trends in market development in terms of both supply/demand dynamics as well as fuel prices	— Credible third party unlikely to allow release of forecasts, particularly since these are usually a proprietary product
Adjusted forwards and marginality approach	— Captures (in a very simplistic way though) the effects of fuel prices and structural shifts — Forward data relatively easy to access	— Determining proportion of year different technologies are marginal still requires market modelling — Forward products for calculation of costs either do not extend to the end of the procurement window or are illiquid.

4.3 Preferred option

Our preferred option is to use average **historical prices**. The imbalance price proposed is therefore €97/MWh (in nominal money terms). Future electricity prices are uncertain, and, in this case, the choice of an imbalance price estimate for the purposed of the LCIS provider evaluation is of 'low materiality' as long as the assumed price level is with a reasonable range. We, therefore, believe practicality and transparency should be the key considerations for choosing the approach towards the imbalance price.

Exhibit 4.4 – Overall qualitative score for treatment of electricity costs

We have qualitatively weighed the efficiency of the solution in the context of market and consumer outcomes, as well as the simplicity of the solution.

Options	Efficiency	Simplicity	Overall score
Historical prices	◐	●	◕
Third party forecast	◕	◐	◐
Adjusted forwards	◕	◔	◐

Notes: The shaded area of the Harvey indicates performance – a higher quantity of filled segments indicates a higher performance.

Annex A Inflation assumptions

For the purpose of this paper, all prices and cost data are presented in nominal money terms nominal money. The table below presents the inflation assumptions used in this report.

Exhibit 4.5 – Annual euro-zone inflation rate assumptions

	2023	2024	2025	2026	2027-2031
Euro-zone inflation rate	5.6%	2.4%	2.3%	2.1%	2%

Source: Bloomberg, AFRY.

The annual inflation projections are derived from a Bloomberg poll of financial institutions' inflation forecasts.

ÅF and Pöyry have come together as AFRY. We don’t care much about making history.

We care about making future.