Integrated Single Electricity Market

(I-SEM)

Capacity Remuneration Mechanism (CRM)

T-4 Capacity Auction for 2022/23

Best New Entrant Net Cost of New Entrant

(BNE Net CONE)

Consultation Paper

SEM-18-025

2 May 2018

EXECUTIVE SUMMARY

The I-SEM CRM Detailed Design has been developed through an extensive series of consultation and decision papers. This involved substantial interaction between stakeholders, including both System Operators and Industry. This interaction took the form of numerous workshops and meetings in addition to the feedback from the consultations. Furthermore an I-SEM Rules Working Group was established aimed to ensure the process was robust and, through their involvement, utilised industry input and feedback. Industry input was provided through regular opportunities to provide feedback on the drafting of processes.

These subsequent design decisions were translated into auction market rules to form the Capacity Market Code (CMC) (SEM-17-033) [1] which was published in June 2017. The CMC sets out the arrangements whereby market participants can qualify for, and participate in, auctions for the award of capacity and participate in secondary trading of awarded capacity. The settlement arrangements for the Capacity Remuneration Mechanism (CRM) form part of the revised Trading and Settlement Code (TSC) (SEM-17-024) published in April 2017.

The introduction of the CRM involved formal notification to the European Commission (EC) of the proposed mechanism for purposes of State aid. The design had been developed to be consistent with guidelines published by the EC in this respect, however, the proposal was still subject to the outcome of the formal notification process. This process was led by Department of Communications, Climate Action & Environment (DCCAE) and Department for the Economy (DfE) who together with the Regulatory Authorities (CRU and UR) engaged with the EC in advance of the notification and during the notification process.

On 24th November 2017 the European Commission granted approval to implement a capacity mechanism within the I-SEM. This approval came with the endorsement of many elements of the CRM detailed design, together with their expectations for participation and implementation of enduring design features.

This consultation is focused purely on the Best New Entrant Net Cost of New Entrant (BNE Net CONE) to apply within the CRM commencing with the T-4 Capacity Year (CY) 2022/23 capacity auction. The SEM Committee will separately consult on the wider range of T-4 capacity auction parameters.

As part of the I-SEM CRM design the SEM Committee committed to reviewing the key assumptions in setting the Best New Entrant Net CONE before the first T-4 auction for Capacity Year 2022/23[2]. The rationale being that more significant new entry is expected to participate in the first T-4 auction due to the longer development lead time to deliver capacity from 1 October 2022. The first T-4 capacity auction is now scheduled for March 2019 to allow time to implement the State Aid requirements and make the necessary changes to the Capacity Market Code and also, where necessary, changes to the Trading and Settlement Code.

[1] https://www.semcommittee.com/publication/publication-i-sem-crm-capacity-market-code-decision
[2] CRM Auction Parameters Decision SEM-17-022

This paper and the appended Poyry report sets out the SEM Committee's proposals on the various components required to determine a value for a BNE Net CONE.

Previous SEM BNE assessments have focused on peaking plants in order to serve the final megawatt (MW) of demand, however given this BNE assessment will apply to the new capacity market arrangements with a focus on procuring capacity via a competitive auction process, it is the SEM Committee's view that this BNE assessment should more generally reflect the technology and cost decisions a rational investor would take within the new all-island market.

To assist respondents with the change in purpose for this BNE assessment the SEM Committee has sought an estimate of the Net CONE for a peaking plant that meets a set of criteria similar to those previously used to determine the BNE peaking plant under the SEM Capacity Payment Mechanism and also a Combined Cycle Gas Turbine (CCGT) given the evidence of recent investment in the SEM..

This consultation sets out the cost estimates and Net CONE values for both the above mentioned reference technologies.

The Net CONE for the **reference peaking plant** assessed for the first CRM T-4 Capacity Auction for Capacity Year 2022/23 is an **OCGT Siemens SGT5-2000E** fired on **distillate fuel**, sited in **Northern Ireland**. The estimated annualised fixed costs, net of estimated infra-marginal rent and ancillary service revenue, applicable for Capacity Year 2022/23 is proposed as **€88.4/kW/year based on de-rated capacity** and in nominal terms.

The Net CONE for the **reference CCGT plant** proposed for the first CRM T-4 Capacity Auction for Capacity Year 2022/23 is a **GE 9F.05**, sited in **Northern Ireland**. The estimated annualised fixed costs, net of estimated infra-marginal rent and ancillary service revenue, applicable for Capacity Year 2022/23 is proposed as **€86.0/kW/year based on de-rated capacity** and in nominal terms.

The proposed real pre-tax Weighted Average Cost of Capital (WACC) applied is **5.0% for Ireland** and **5.2% for Northern Ireland.**

The SEM Committee is of the view that the lowest Net CONE value should represent the Best New Entrant as it provides an appropriate expectation of a rational investor within a competitive capacity auction process whilst also being mindful of the need to protect consumers. Therefore, based upon the analysis carried out for this consultation the SEM Committee propose that a CCGT located in Northern Ireland should represent the Best New Entrant based upon the lowest Net CONE value of €86.0/de-rated kW/per year.

The detail supporting the above proposal is contained within the Poyry report which is attached as Appendix A to this paper. Respondents are strongly recommended to consider this paper together with the Poyry report appended, when constructing their consultation response.

The SEM Committee intends to make a decision by September 2018 on the new BNE Net Cone which will reflect updated assumptions or decisions based on the latest available information. The final BNE Gross Investment Cost and BNE Net CONE will first be applied to setting the following parameters (which will be consulted upon separately) for the first T-4 CY2022/23 capacity auction:

- **Auction Price Cap (APC):** The maximum price qualified bidders may bid their qualified volume at, and is therefore the maximum price that the auction can clear at. This is set as a multiple of Net CONE.
- **Existing Capacity Price Cap (ECPC):** A uniform price cap to apply to all existing capacity providers (except DSUs), with the exception of those who apply and receive a Unit Specific Price Cap. This is set as a multiple of Net CONE.
- **New Capacity Investment Rate Threshold (NCIRT):** The amount that a new investor must invest per de-rated MW of capacity to qualify for a multi-year Reliability Option. This parameter is based upon a percentage of the gross BNE investment cost.

Responses to the consultation paper should be sent to Karen Shiels (Karen.Shiels@uregni.gov.uk) and Kevin Lenaghan (Kevin.Lenaghan@uregni.gov.uk) by 17.00 on Friday, 15 June 2018. Please note that we intend publishing all responses unless marked confidential.

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1. OVERVIEW

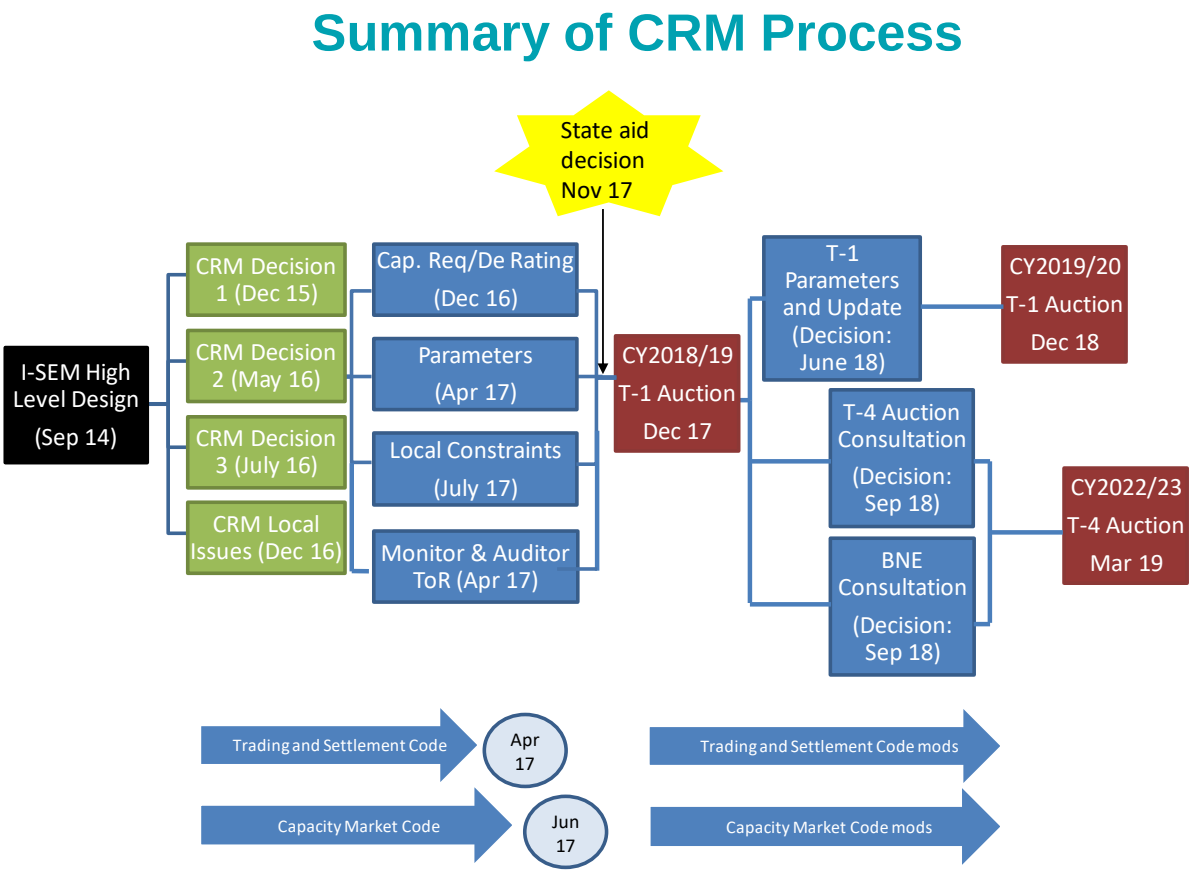
1.1 BACKGROUND

1.1.1 The I-SEM CRM Detailed Design has been developed through an extensive series of consultation and decision papers. This involved substantial interaction between stakeholders, including both System Operators and Industry. This interaction took the form of numerous workshops and meetings in addition to the feedback from the consultations.

1.1.2 Throughout the design and implementation process of the I-SEM (including CRM) the intention was to avoid any unintended consequences. In order to manage the risk of unintended consequences occurring an I-SEM Rules Working Group was established. The aim of this group was to ensure the processes were robust and, through their involvement, utilised industry input and feedback. Industry input was provided through regular opportunities to provide feedback on the drafting of processes.

1.1.3 Decisions made during the aforementioned consultation periods were translated into auction market rules to form the Capacity Market Code (CMC) (SEM-17-033) which was published in June 2017. The CMC sets out the arrangements whereby market participants can qualify for, and participate in, auctions for the award of capacity and participate in secondary trading of awarded capacity. The settlement arrangements for the Capacity Remuneration Mechanism (CRM) form part of the revised Trading and Settlement Code (TSC) (SEM-17-024) published in April 2017. A summary of this extensive process is shown in Figure 1 below, along with key CRM development milestones over the next 12 months.

Figure 1: Key CRM milestones



1.1.4 The introduction of the CRM involved formal notification to the European Commission (EC) of the proposed mechanism for purposes of State aid. The design had been developed to be consistent with guidelines published by the EC in this respect, however, the proposal was still subject to the outcome of the formal notification process. This process was led by Department of Communications, Climate Action & Environment (DCCAE) and Department for the Economy (DfE) who together with the Regulatory Authorities (CRU and UR) engaged with the EC in advance of the notification and during the notification process.

1.1.5 The EC approved the CRM on 24 November 2017[3], based upon some further commitments given by the Departments to the EC during the State aid approval process. The State Aid commitments had/have limited impact on the Capacity Year (CY) 2018/19 and CY2019/20 T-1 auctions, but have a material impact on the first T-4 auction (for CY2022/23) and the remaining two transitional auctions for CY2020/21 and CY2021/22.

1.1.6 The first Capacity Auction took place in December 2017 to cover the period from I-SEM go-live to 30 September 2019, and is referred to as CY 2018/19. The second transitional T-1 capacity

[3] http://ec.europa.eu/competition/state_aid/cases/267880/267880_1948214_166_2.pdf

auction is due to take place on 13 December 2018 for capacity year CY 2019/20[4]. Furthermore, the first T-4 Capacity Auction for capacity year 2022/23 is now planned to take place in March 2019, for which this consultation is particularly related.

1.2 PURPOSE OF THIS CONSULTATION PAPER

1.2.1 Following consultation on the first Capacity Auction parameters the SEM Committee decided to review the key assumptions (including the Weighted Average Cost of Capital (WACC)) in setting the Net Cost of New Entry (Net CONE) before the first T-4 auction for Capacity Year 2022/23[5]. The rationale being that more significant new entry is expected to participate in the first T-4 auction due to the longer development lead time to deliver capacity from 1 October 2022.

1.2.2 Within CRM the BNE Gross Investment Cost and Net CONE calculation are key drivers in setting the following auction parameters:

- **Auction Price Cap (APC):** The maximum price qualified bidders may bid their qualified volume at, and is therefore the maximum price that the auction can clear at. This is set as a multiple of Net CONE.
- **Existing Capacity Price Cap (ECPC):** A uniform price cap to apply to all existing capacity providers (except DSUs), with the exception of those who apply and receive a Unit Specific Price Cap. This is set as a multiple of Net CONE.
- **New Capacity Investment Rate Threshold (NCIRT):** The amount that a new investor must invest per de-rated MW of capacity to qualify for a multi-year Reliability Option. This parameter is based upon a percentage of the gross BNE investment cost.

1.2.3 It is important to note the references to BNE Net CONE has the same meaning as Best New Entrant price (BNE price). In capacity terms, both Net CONE and BNE price are presented as a monetary figure per unit of de-rated capacity per year. In this consultation these values are on a €/de-rated kilowatt/year basis.

1.2.4 The SEM Committee previously carried out a detailed bottom-up review of the BNE Net CONE to apply to the 2016 Annual Capacity Payment Sum under the Capacity Payment Mechanism. This BNE Net CONE has since been uplifted to apply to subsequent years and was used as the basis of the Net CONE calculation for the first CRM T-1 transitional auction.

1.2.5 It is the SEM Committee's view that the primary focus for the BNE assessment going forward is that it should more generally reflect the technology and cost decisions a rational investor would take within the new all-island market. The BNE Net CONE will then form the basis for

[4] http://www.sem-o.com/ISEM/General/CAT1920T-1%20-%202019%202020%20T-1%20Capacity%20Auction%20Timetable.pdf

[5] CRM Auction Parameters Decision SEM-17-022

the above mentioned auction parameters which apply to the new capacity market arrangements within the I-SEM.

1.2.6 The SEM Committee have engaged Poyry Management Consulting to assist the RAs in a bottom up assessment of the fixed costs and Net CONE of a BNE peaking plant that meets a set of criteria similar to those previously used to determine the BNE peaking plant under the SEM Capacity Payments Mechanism and a BNE Combined Cycle Gas Turbine (CCGT) as evidenced by recent investment in the SEM.

1.2.7 Where possible, the methodology applied is consistent with that used for previous BNE calculations, however adjustments are necessary to make the BNE applicable to the capacity market design. These adjustments are set out in this consultation.

1.2.8 This consultation paper summarises the key recommendations made by Poyry and provides the SEM Committee's proposed Best New Entrant based on the analysis provided. The detail accompanying the recommendations is contained with the Poyry report which is attached as Appendix A to this paper. Respondents are strongly recommended to consider this paper together with the Poyry report appended, when constructing their consultation response.

2. REFERENCE TECHNOLOGIES

2.1 INTRODUCTION

2.1.1 The first step in this BNE Net CONE assessment is to propose suitable technology options, applicable for use in the Capacity Market for auctioning capacity for the Capacity Year 2022/23.

2.1.2 Previous SEM BNE assessments were carried out periodically as part of the Capacity Payments Mechanism, a fixed revenue mechanism which collected a pre-determined amount of money, the Annual Capacity Payment Sum from supplier and paid these funds to available generation capacity in accordance with rules set out in the Trading and Settlement Code. The value of the Annual Capacity Payment Sum was determined as the product of two number:

- A Quantity (the Capacity Requirement) – determined as the amount of capacity required to exactly meet an all-island generation security standard; and
- A Price – determined as the annualised fixed costs of a Best New Entrant peaking plant net of Infra-marginal rent and ancillary services revenue, expressed in €/kW per year.

2.1.3 The previous SEM BNE calculations were designed to determine the costs that a rational investor in a peaking plant, which served the final megawatt (MW) of demand, would incur at the point when the market was in equilibrium. The characteristics of the BNE plant for which costs were derived was that the notional plant could be located in either Ireland or Northern Ireland and use the plant and fuel type which proved most cost efficient. The plant serving the final megawatt of demand was expected to only operate for a very small proportion of the time.

2.1.4 With the introduction of the new I-SEM Capacity Remuneration Mechanism (CRM) a BNE Net CONE assessment is still relevant however its purpose within the CRM is very different. The CRM moves to procuring a pre-defined capacity requirement as part of a competitive process and therefore sends both exit and investment signals.

2.1.5 Within the CRM new capacity can apply for a multi-year Reliability Option of up to 10 years. To qualify for participation in the capacity auction for a multi-year Reliability Option, *inter alia*, a New Capacity Investment Rate Threshold (NCIRT) must be met. This threshold is based upon a percentage of the Gross Best New Entrant Investment Cost and expressed in terms of €(or £)/de-rated MW)[6]. Ultimately, to be awarded a multi-year Reliability Option the new capacity must be successful in the competitive auction process. Furthermore, within the new CRM the BNE Net CONE assessment is used as the basis for setting separate values for the Auction Price Cap and the Existing Capacity Price Cap expressed as €(or £)/kW per year. The multiple of BNE

[6] This is the gross investment spend, not an annualised value which is the case for Gross CONE and Net CONE

Net CONE for each of these price caps will be consulted upon separately in advance of the first T-4 capacity auction.

2.1.6 The above outlines the change in purpose of the BNE assessment within the CRM and how the BNE assessment should more generally reflect the technology and cost decisions a rational investor would take within the new all-island market as a whole. In recent years within the SEM investors technology choice has been the CCGT ranging from 343 MW to 464 MW. Other capacity markets such as GB and PJM have also considered the Net CONE of CCGTs. It is for these reasons the Regulatory Authorities have requested that Poyry carryout an estimate of the Gross Investment Cost and Net CONE for both:

- A peaking plant that meets a set of criteria similar to those previously used to determine the BNE peaking plant under the SEM CPM; and
- A Combined Cycle Gas Turbine (CCGT) of a size that would not exceed the size of the current largest infeed in the all-island system[7].

2.1.7 Once the reference technologies are selected, the next step is to estimate the capital investment and annual fixed costs associated with that technology. Taken together with a Weighted Cost of Capital (WACC) a Gross BNE price/Gross CONE value can be derived.

2.2 PROPOSED REFERENCE TECHNOLOGIES

2.2.1 As in previous years, the methodology employed to arrive at a proposed technology for a reference peaking plant begins with a wide range of options across all available technologies.

2.2.2 In looking at this afresh, Poyry remain of the view taken in previous BNE assessments that interconnectors, Aggregated Generating Units (AGUs) and pumped storage should not be considered further as feasible options for the BNE reference peaking plant. Technology options such as battery storage, compressed air energy storage and flywheel, and open cycle gas fired reciprocating engines, which could potentially be considered as a 'peaking plant', have for various feasibility reasons not been considered appropriate as the BNE reference peaking plant. Chapter 3 of the Poyry report detail the reasons for not considering these technologies further which broadly include a lack of commercial experience, difficulty in determining costs and environmental reasons.

2.2.3 Poyry therefore conclude that the only technology to be considered further as a potential BNE peaking plant is an Open Cycle Gas Turbine (OCGT).

2.2.4 A selection criteria is then applied to initially filter a wide range of gas turbines. The criteria applied for short listing technologies is summarised in Table 1 below.

[7] Currently East West Interconnector at 500 MW

Table 1: Reference Peaking Plant Selection Criteria

Criteria
Is the gas turbine model commercially proven, with over 8,000 hours of commercial operation at three different sites?
Can the gas turbine model operate on distillate fuel oil as back up fuel in order to comply with secondary fuel obligations in both Ireland and Northern Ireland?
Can the gas turbine model comply with the environmental requirements?
Can the gas turbine model reach full load from a cold start in under 20 minutes?

2.2.5 Having applied this criteria and given consideration to the lowest specific capital cost, a shortlist of four gas turbine models was identified. In order to make the final selection a more detailed assessment of their net electrical output and EPC[8] contract price was modelled using Thermoflow GTPRO and its associated cost estimating program PEACE[9].

2.2.6 Based on Poyry's detailed assessment the **proposed BNE reference peaking plant is a Siemens SGT5-2000E** and this is considered appropriate for use as the BNE peaking plant for capacity year 2022/23. The average lifetime output is 190 MW on distillate and 198 MW on dual fuel.

2.2.7 To select the technology for a reference CCGT consideration was given to the technology choices made by investors for the most recent gas fired CCGT in Ireland and Northern Ireland. All of the eight projects identified used F class gas turbine technology and therefore the **proposed BNE reference CCGT plant is the GE 9F.05** gas turbine, with a capacity of 447 MW.

2.2.8 The detailed approach taken to select the above reference plants is set out in Chapter 3 of the attached Poyry report (Appendix A).

2.2.9 The technical assumptions for both selected reference plants have been built into the performance and cost models. These reference plants are then assessed based on the costs associated with locating in either Northern Ireland or Ireland, and the reference peaking plant is also assessed by fuel type i.e. distillate or dual fuel.

[8] Engineering Procurement Construction

[9] Thermoflow GTPRO is a well-established automated system design software which automates the process of designing a combined cycle or gas turbine plant. PEACE (Plant Engineering and Cost Estimator) is a separately licensed module which can be run in conjunction with GTPRO and provides additional inputs to automate the preliminary engineering and cost estimation of each plant, as designed in GTPRO.

2.3 SUMMARY INVESTMENT COSTS

2.3.1 The key cost areas that make up the **capital costs** of the reference plants are:

- Engineering, Procurement & Construction (EPC) costs;
- Site procurement costs;
- Electrical connection costs;
- Gas and water connection costs;
- Owner's contingency;
- Financing costs;
- Interest During Construction (IDC);
- Construction insurance;
- Up-front costs for initial filling of fuel oil tanks;
- Project development and O&M mobilisation costs;
- Commissioning utilities cost;
- Operating spares; and
- Market accession and participation fees.

2.3.2 In addition to identifying investment costs, it is necessary to consider the **recurring annual fixed operational costs** the reference plants will face. These have been categorised as follows:

- Trading and administrative costs;
- Personnel costs;
- Insurance;
- Fixed maintenance costs;
- Fixed costs payable under LTSA[10];
- Business rates;
- Market operator fees;
- Electricity transmission charges; and
- Gas transportation charges.

2.3.3 Chapter 4 of the Poyry report attached considered each of these areas in turn. This includes the assumptions made and reflects the costs associated with locating the reference plants in either Northern Ireland or Ireland.

2.3.4 The tables below summarise the investment costs and separately the annual fixed costs (in €m) for the **OCGT (Siemens SGT5-2000E)** for both distillate and dual fuel and the **CCGT (GE 9F.05)**. Both are shown for each jurisdiction in Euros[11].

[10] Long Term Service Agreement

[11] The Poyry Report contains an Annex with the Northern Ireland costs converted into pounds Sterling.

Table 2: Capital cost estimates (€ million 2017 prices)

Jurisdiction	Ireland			Northern Ireland		
Technology	**OCGT distillate**	**OCGT dual**	**CCGT**	**OCGT distillate**	**OCGT dual**	**CCGT**
EPC costs	93.0	92.5	266.6	91.6	92.0	264.6
Site procurement cost	0.7	0.7	3.0	0.9	0.9	3.7
Electrical connection costs	5.7	5.7	5.7	5.7	5.7	5.7
Water connection costs	0.5	0.5	0.6	0.5	0.5	0.6
Gas connection costs	0.0	3.7	4.6	0.0	3.7	4.6
Owners contingency	4.7	4.6	13.3	4.6	4.6	13.2
Financing costs	1.9	1.9	5.3	1.8	1.8	5.3
Interest during construction	1.3	1.4	5.7	1.2	1.2	5.2
Construction insurance	0.8	0.8	2.4	0.8	0.8	2.4
Initial fill of fuel oil tanks	1.8	1.6	4.3	2.4	2.1	5.7
Project development	5.6	5.6	16.0	5.5	5.5	15.9
Commissioning utilities costs	2.3	2.3	6.7	2.3	2.3	6.6
Operating spares	1.4	1.4	4.0	1.4	1.4	4.0
Accession fees	0.0	0.0	0.0	0.0	0.0	0.0
Participation fees	0.0	0.0	0.0	0.0	0.0	0.0
Total	**119.8**	**122.7**	**338.3**	**118.7**	**122.6**	**337.5**

Table 3: Annual fixed cost estimates (€ million 2017 prices)

Jurisdiction	Ireland			Northern Ireland		
Technology	**OCGT distillate**	**OCGT dual**	**CCGT**	**OCGT distillate**	**OCGT dual**	**CCGT**
Trading and admin	0.7	0.7	2.1	0.7	0.7	2.1
Personnel	0.8	0.8	3.2	0.8	0.8	3.2
Insurance	0.6	0.6	1.6	0.5	0.6	1.6
Fixed maintenance	0.5	0.5	1.3	0.5	0.5	1.3
Fixed fee under LTSA	0.6	0.6	1.7	0.6	0.6	1.7
Business rates	1.5	1.5	3.5	0.6	0.7	2.3
Market operator rates	0.0	0.0	0.0	0.0	0.0	0.0
Electricity transportation charges	1.2	1.2	2.8	1.1	1.1	2.5
Gas transportation charges	0.0	0.0	12.6	0.0	2.4	10.8
Total	**5.8**	**5.9**	**28.8**	**4.8**	**7.3**	**25.4**

3. ECONOMIC & FINANCIAL PARAMETERS

3.1 INTRODUCTION

3.1.1 A key component of the calculation of the BNE Net CONE is the determination of the Weighted Average Cost of Capital (WACC). The WACC is combined with the capital expenditure and economic life to arrive at an annualised capital expenditure used in the BNE Net CONE calculation.

3.1.2 Poyry have carried out an extensive assessment for each of the building blocks to arrive at a proposed WACC appropriate for the Capacity Year 2022/23. This comprehensive assessment, including assumptions made, is provided in Chapter 6 of the Poyry Report attached (Appendix A).

3.1.3 The different WACC parameters have been defined based on a wide range of market evidence and regulatory precedent. However, it should be noted that there is limited precedent of regulators setting a cost of capital for a merchant generating unit, as in this case, compared to regulators WACC determinations for infrastructure projects or other monopolies.

3.2 PROPOSED WEIGHTED AVERAGE COST OF CAPITAL (WACC)

3.2.1 As part of the Poyry analysis, the assumptions in Table 4 below have been applied.

Table 4: Summary of assumptions on the nature of investment

Description	Assumption
Type of Investment	The project is a green-field investment with no existing assets and associated financing costs.
Plant Life	Economic life of 20 years
Financing	The debt tenor is assumed to be 10 years

3.2.2 Chapter 6 of the Poyry Report appended provides a comprehensive assessment of the WACC building blocks which form their recommendation of the WACC to be used for the BNE Net CONE for Capacity Year 2022/23.

3.2.3 In summary, Poyry have recommended the appropriate range for the real pre-tax WACC for the BNE Net CONE to be 4.5% - 6.6% in Ireland and 4.7% - 6.6% in Northern Ireland.

3.2.4 Based upon Poyry's assessment and recommendations the SEM Committee are proposing setting the WACC for Ireland and Northern Ireland as set out in Table 5 below.

Table 5: Proposed real pre-tax WACC

Capacity Year 2022/23	Proposed WACC (real pre-tax)
Ireland	**5.0%**
Northern Ireland	**5.2%**

3.2.5 As this WACC is intended to apply to Capacity Year 2022/23 with a BNE Net CONE defined in nominal terms, the above real pre-tax WACC is converted using an assumed 2% (long term) annual inflation to give an equivalent nominal pre-tax WACC of 7.1% and 7.3% for Ireland and Northern Ireland respectively.

4. ENERGY MARKET AND SYSTEM SERVICES REVENUES

4.1.1 To arrive at the BNE Net CONE an adjustment is required to subtract non-capacity market revenue streams from the Gross BNE price/Gross CONE. In addition to income from the Capacity Market, a generator operating in I-SEM would be capturing:

- revenues from the energy market(s):
  - a generating unit is expected to capture a certain amount of operating margin, commonly referred to as inframarginal rent, from selling electricity into different ex-ante markets and the balancing market.
- Income for the provision of DS3 System Services:
  - DS3 System Services are procured by the TSOs and potential providers capture a relevant payment.

4.2 INFRAMARGINAL RENT

4.2.1 The inframarginal rent can be defined as the electricity market revenue net of the short-run cost of operation.

4.2.2 Consideration has to also be given to the expected operation of the new plant, for example, an OCGT would be assumed to be operating as a peaking unit with low number of running hours. Whereas a new entrant CCGT would be expected to run in a baseload/mid merit position in the short to medium term with high number of running hours and low number of starts.

4.2.3 In previous SEM BNE calculations, inframarginal rent was deducted using the following formula

IMR DEDUCTED IN €/KW = [(PCAP – BID)/1000] * OUTAGE TIME * (1 – FOP)

Where BID is the bid price of the BNE plant, PCAP is the SEM Price Cap (€1,000/MWh), FOP is Forced Outage Probability, and OUTAGE TIME is the duration of lost load under the generation security standard.

4.2.4 Due to the introduction of the CRM the above formula has had to be revised to reflect the impact of Reliability Option difference payments and Administered Scarcity Pricing (ASP).

4.2.5 If a capacity provider has a Reliability Option (RO) it is required to make difference payments, when the relevant energy price exceeds the RO Strike Price set at €500/MWh. The Reliability Option reduces the inframarginal rent that a generator can earn, so should be taken account of in a revised Net CONE calculation. The Reliability Option Strike Price, which will cap the inframarginal rent of a generator with a Reliability Option on the proportion of the capacity covered by the Reliability Option, will be a variable price. However, the DSU Floor Price is set

at €500/MWh unless there is a very significant change in fuel prices, therefore the Reliability Option Strike Price will be €500/MWh most of the time. The €500/MWh value is used in place of the existing €1,000/MWh Pool Price Cap in the revised BNE calculation, to calculate the inframarginal rent that the BNE plant can earn on the portion of the capacity covered by the Reliability Option. Furthermore, the following will also need to take into account, the fact that:

- The BNE reference plant will be exposed to difference payments on the full ASP when on forced outage; but
- Can earn inframarginal rent at the full ASP on the de-rated component of its capacity;
- The introduction of Partial ASP may mean that there are more hours when prices are lifted to €500/MWh or above.

Inframarginal rent for a reference peaking plant (OCGT)

4.2.6 The reference peaking plant falls within the range 191 – 200 MW and based upon the T-1 2018/19 published Initial Auction Information Pack[12] the corresponding marginal de-rating factor is 90.9%. As set out in detail in chapter 5 of the attached Poyry report and consistent with recent SEM Committee CRM decisions the expected inframarginal rent for an OCGT is calculated by applying the following formula:

$$IMR_{GT} = [RO\ DIFFERENCE\ PAYMENT\ FOR\ RO\ CAPACITY] + [ASP\ PAYMENT\ FOR\ NON-RO\ CAPACITY] + [CAPTURED\ IMR\ FOR\ RO\ CAPACITY] =$$

$$DERATING_{GTi} \times 8 \times OUTAGE_{GT} \times (SP - FULL\ ASP) + (1 - DERATING_{GTi}) \times 8 \times (1 - OUTAGE_{GT}) \times (FULL\ ASP - INC_{GT}) + DERATING_{GTi} \times 8 \times (1 - OUTAGE_{GT}) \times (SP - INC_{GT}) + DERATING_{GTi} \times 4 \times OUTAGE_{GT} \times (SP - PARTIAL\ ASP) + (1 - DERATING_{GTi}) \times 4 \times (1 - OUTAGE_{GT}) \times (PARTIAL\ ASP - INC_{GT}) + DERATING_{GTi} \times 4 \times (1 - OUTAGE_{GT}) \times (SP - INC_{GT})$$

where

$DERATING_{GTi}$ is the de-rating factor as determined by the TSOs for the corresponding technology and nameplate capacity range.

$OUTAGE_{GT}$ is the forced outage rate, assumed to be equal to the capacity de-rating for the smallest capacity range [0-1MW] as provided by the TSOs.

INC_{GT} is the incremental operating cost of a GT, assumed to be equal to 212.58 €/MWh, in line with the assumption used for the 2018/19 BNE inframarginal rent.

SP is the Strike Price of the Reliability Option contract[13].

$FULL\ ASP$ is the full Administered Scarcity Price assumed to be equal to the current Euphemia price cap of 3000 €/MWh.

$PARTIAL\ ASP$ is assumed to be half the value of the full Administered Scarcity Price.

[12] http://www.sem-o.com/ISEM/General/Initial%20Auction%20Information%20Pack.pdf

[13] The value applied in the calculation is €500MWh being the most recent published value (CRM T-1 Parameters decision paper SEM-17-022)

SP is the Reliability Option Strike Price assumed to be equal to the DSU floor price of 500 €/MWh.

4.2.7 The resulting inframarginal rent for the **reference peaking plant (OCGT) is €3.602/kW – installed** in nominal money terms based upon the current assumption that Full ASP being equal to €3,000/MWh.

Inframarginal rent for a reference CCGT

4.2.8 A new entry CCGT is expected to have high running hours and therefore expected to be a baseload/mid-merit plant which will attract higher inframarginal rent when compared to a peaking plant. Inframarginal rent of a CCGT is driven by the operation pattern and the price formation and therefore the ASP-based calculation applied to the peaking plant is not appropriate for calculating the inframarginal rent for a CCGT.

4.2.9 A key assumption is a new entrant CCGT will have a relatively higher efficiency when compared to existing CCGT in the all-island market and therefore have a more advantageous position in the merit order ahead of all other existing CCGTs and also when operating it would capture the highest inframarginal rent compared to all other CCGTs on the system. Therefore an average load factor between 65%-75% has been assumed for the reference CCGT plant for the period 2022/23 to 2031/32, being the ten year Reliability Option period available to new capacity[14].

4.2.10 As detailed in Chapter 5 of the attached Poyry report, the average variable operating costs are calculated for the new CCGT and when compared with generic existing CCGT the difference would represent inframarginal rent. However an uplift is required to reflect the impact start-up and no-load costs have on the wholesale price formation. This uplift is applied to the variable operating costs of a generic existing CCGT to determine an average wholesale price at times when the reference new entry CCGT is operating. By combining the per MWh difference between the variable operating cost of the reference new entry CCGT and the average captured wholesale price with the assumed load factor the total implied inframarginal rent is derived. The results of this analysis is summarised in Table 6 below.

[14] Assumption is a 75% load factor in the first year of operation gradually declining (linearly) to 65% in the tenth year of operation.

Table 6: Implied inframarginal rent for a reference new entry CCGT (real 2017 money terms)

	2022/23	2031/32
CO2 (€/tonne)	7.9	48.1
Gas (€/MWh)	17.3	26.1
VOWC (€/MWh)	2.5	2.5
Variable operating cost of reference CCGT (52.1%)[15]	38.5	69.4
Variable operating cost of 'generic' existing CCGT (48%)	41.5	75.1
Uplift (€/MWh)	4.3	4.3
Captured wholesale price (€/MWh)	45.8	79.4
Assumed load factor	75%	65%
Implied inframarginal rent (€/kW - installed)	**48.4**	**57.0**

4.2.11 Having calculated the implied inframarginal rent, it is at this stage consideration is given to the impact of the ASP function on the inframarginal rent for the reference new entry CCGT. To calculate this 'additional' inframarginal rent the same formula used for the reference peaking plant above is used by replacing the values to those applicable for the reference CCGT.

4.2.12 The reference CCGT plant falls within the range 441 – 450 MW and based upon the T-1 2018/19 published Initial Auction Information Pack the corresponding marginal de-rating factor is 87.2%. However, the outage rate is assumed to be 7.4% (based upon the de-rating factor of the smallest unit within the gas turbine technology group). Based on this information the 'additional' inframarginal rent for a reference CCGT is calculated for 2022/23 and for 2031/32 assuming Full ASP of €3,000/MWh.

4.2.13 Based on Poyry's analysis, we propose to use an expected **inframarginal rent of €54.5/kW in 2022/23 rising linearly up to €62.7/kW in 2031/32 in real 2017 money terms** for a reference new entry CCGT. Post 2031/32 we propose to assume that the inframarginal rent decreases by 5% every year to reflect the entry of newer, more efficient units on the system and decreasing load factor for the reference CCGT.

Treatment of ASP in calculating Inframarginal rent for the reference plants

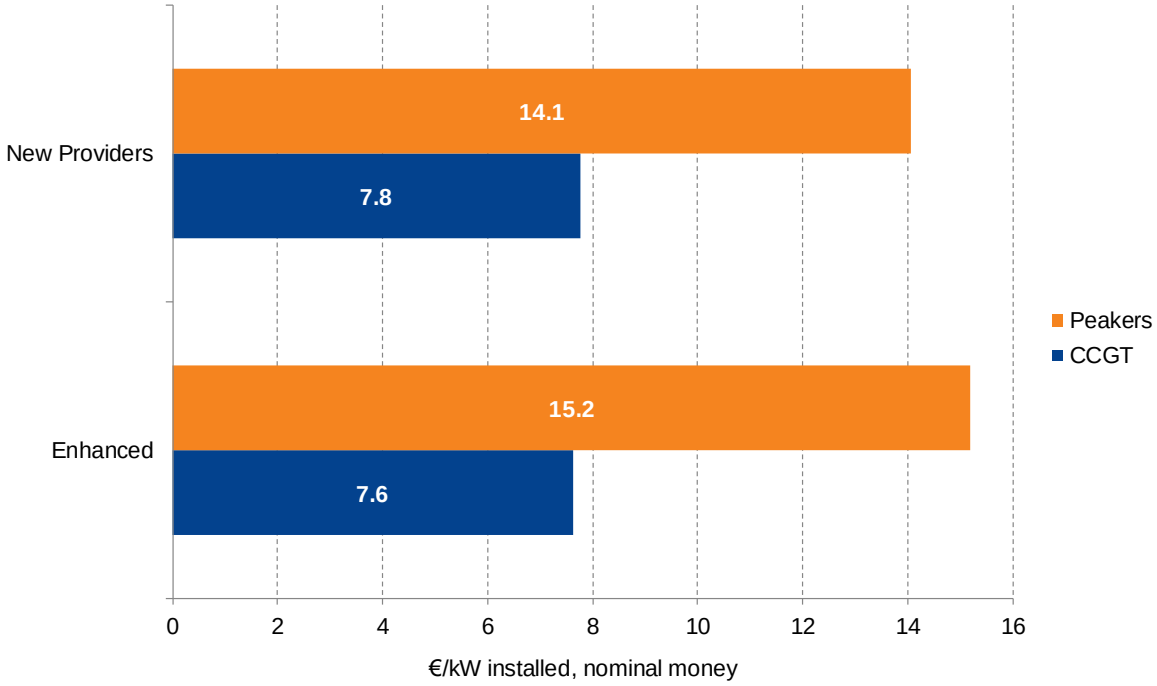
4.2.14 An important aspect to note is that the inframarginal rent calculations have assumed the value of Full ASP continues to equal €3,000/MWh. This value may be subject to change and the Full ASP may in future be set at the level of, or percentage of, Value of Lost Load (VoLL) which is circa €11,000/MWh, however given uncertainty on when this change may take place the assumption for this consultation has been to keep with the €3,000/MWh. The assumptions relating to ASP are those currently applied, however should these change, the BNE Net CONE decision will be updated to reflect such changes linked to ASP.

4.1 SYSTEM SERVICES REVENUES

4.1.1 The provision of system services is through the DS3 System Services arrangements. For the purposes of proposing a BNE Net CONE appropriate for the Capacity Year 2022/23 the expected DS3 System Services income captured by the chosen reference technologies will be based upon the latest published information.

4.1.2 During October 2017, the SEM Committee approved the base tariffs and scalars recommended by the TSOs[15]. The TSO recommendation paper provided the implied average annual revenue from regulated tariffs per technology type under two scenarios ('Enhanced' and 'New Providers') with the use of the 'stepped' temporal scalar design. These annual revenues are expressed in €/kW of installed capacity and reflect the average captured income of the entire technology portfolio for Capacity Year 2019/20. The average values across all scenarios for a 'generic' CCGT and peaking plants are presented in Figure 2 below.

Figure 2: Peaking plant and CCGT DS3 System Services revenue 2019/20



4.1.3 With the DS3 System Services arrangements an expenditure cap of €235 million has been set for 2019/20. For this BNE Net CONE calculation the assumption has been made that this expenditure cap of €235 million will remain at the same level in nominal terms post 2019/20 for future capacity years and therefore has been assumed for the Capacity Year 2022/23.

[15] DS3 System Services Tariffs for Regulated Arrangements, Recommendation Paper. 23 October 2017 published by Eirgrid and SONI; and
SEM-17-080 DS3 System Services Tariffs and Scalars Decision paper, 24 October 2017.

4.1.4 While a new entrant may have the potential to have more advanced System Service capabilities and is expected to capture System Services revenue greater than similar existing plant on the system, for the purposes of this calculation a more conservative approach has been taken. The assumption has been to use the average across all cases for each technology type due to uncertainty in calculating future System Services revenues.

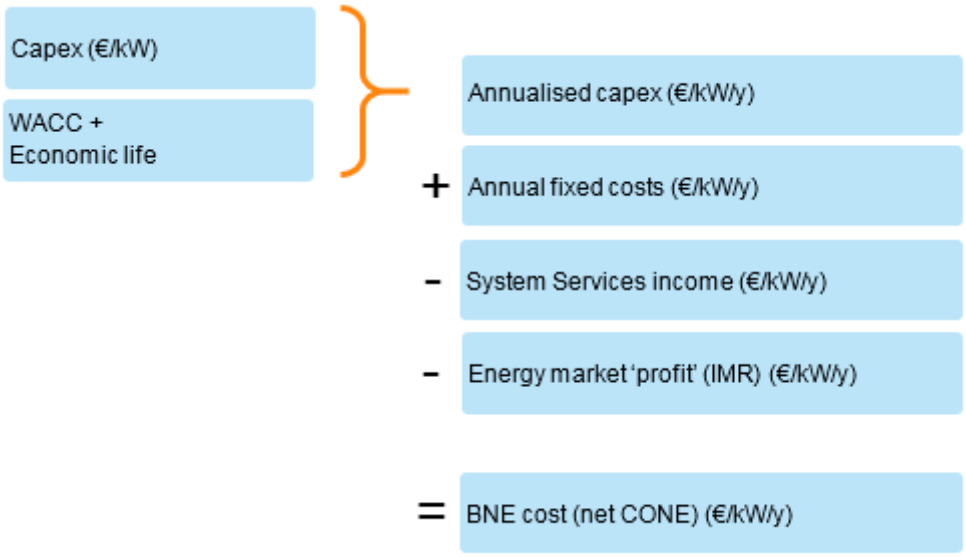
4.1.5 Based upon Figure 2 above the mid-point is proposed with a value of **€14.6/kW – installed for a peaking plant (OCGT)** and **€7.7/kW-installed for a CCGT** being the expected DS3 System Services income for a new entrant reference plant in nominal money terms.

5. SUMMARY BNE NET CONE ASSESSMENT

5.1 CALCULATION OF BNE NET CONE FOR CAPACITY YEAR 2022/23

5.1.1 Having carried out an assessment of each the components required to derive a proposed BNE Net CONE the calculation shown in Figure 3 below can be applied to determine the Gross BNE price/Gross CONE (before deduction of inframarginal rent and system services revenue) and the BNE Net CONE.

Figure 3: Calculation for BNE Net CONE



5.1.2 An important distinction between previous BNE calculations and this calculation is the need to convert from nameplate capacity to de-rated capacity. Within the SEM CPM arrangements the BNE values have been implicitly expressed per unit of nameplate MW. However, in the I-SEM CRM a capacity provider can only receive a Reliability Option equal to multiplying the unit's de-rated factor by the nameplate capacity. Therefore in calculating this BNE Net CONE it is required to reflect the de-rated capacity of the reference technologies.

5.1.3 Furthermore, as this BNE Net CONE is intended to be applied to the Capacity Year 2022/23 the capital costs have been inflated to the year before the first year of operation and a nominal WACC applied. The annual fixed costs presented below reflect the assumption that these costs are expected to continue to rise in line with inflation over the entire economic lifetime of the investment. A long term average 2% inflation for Ireland and Northern Ireland has been assumed for post 2020. As set out in Chapter 7 of the Poyry report a further adjustment is required to define the BNE Net CONE, applicable to Capacity Year 2022/23 in nominal money terms.

5.2 PROPOSED BEST NEW ENTRANT GROSS AND NET CONE

5.2.1 Table 7 below provides a summary of the 2022/23 Gross and Net CONE estimates for the different reference technologies in Ireland and Northern Ireland alongside the breakdown in the different cost and net revenues building blocks.

Table 7: Gross and Net CONE for Capacity Year 2022/23 (€/kW – de-rated, nominal)

Jurisdiction	**Ireland**			**Northern Ireland**		
Technology	OCGT Distillate	OCGT dual	CCGT dual	OCGT distillate	OCGT dual	CCGT dual
Annualised capital costs	71.9	70.6	90.0	72.5	71.7	91.3
Annual fixed costs	43.5	42.4	95.5	35.9	52.1	84.3
Gross CONE	**115.5**	**113.0**	**185.5**	**108.4**	**123.8**	**175.7**
Less: Inframarginal rent	4.0	4.0	80.8	4.0	4.0	80.8
Less: DS3 income	16.1	16.1	8.8	16.1	16.1	8.8
Net CONE	**95.4**	**93.0**	**95.9**	**88.4**	**103.8**	**86.0**

5.2.2 Based upon the above the lowest Net CONE, with a **value of €86.0/kW de-rated for Capacity Year 2022/23, corresponds to a CCGT built in Northern Ireland.**

5.2.3 The lowest Net CONE for the **reference peaking plant, with a value of €88.4/kW de-rated for Capacity Year 2022/23 is an OCGT firing on distillate fuel, sited in Northern Ireland.**

5.2.4 The SEM Committee is of the view that the lowest Net CONE value should represent the Best New Entrant as it provides an appropriate expectation of a rational investor within a competitive capacity auction process whilst also being mindful of the need to protect consumers. Therefore, based upon the analysis carried out for this consultation the SEM Committee propose that a CCGT located in Northern Ireland should represent the Best New Entrant based upon the lowest Net CONE.

6. STYLISED EXAMPLES OF CAPACITY AUCTION PARAMETERS LINKED TO BEST NEW ENTRANT VALUES

6.1.1 As mentioned previously, the BNE Gross Investment Cost and Net CONE calculation are key drivers in setting the following auction parameters:

- **Auction Price Cap (APC):** The maximum price qualified bidders may bid their qualified volume at, and is therefore the maximum price that the auction can clear at. This is set as a multiple of Net CONE.
- **Existing Capacity Price Cap (ECPC):** A uniform price cap to apply to all existing capacity providers (except DSUs), with the exception of those who apply and receive a Unit Specific Price Cap. This is set as a multiple of Net CONE.
- **New Capacity Investment Rate Threshold (NCIRT):** The amount that a new investor must invest per de-rated MW of capacity to qualify for a multi-year Reliability Option. This parameter is based upon a percentage of the gross BNE investment cost

6.1.2 This section provides examples to show how the BNE values are used to determine the above mentioned parameters for the enduring capacity auctions. It is important to note that further consultation is required to determine other inputs associated with these parameters and these examples should not be considered as anything other than stylised examples.

Auction Price Cap (APC)

6.1.3 This cap is most relevant to qualified bidders associated with new capacity and DSUs who can choose to bid up to this maximum cap in the capacity auction. As is the case with other capacity auctions, the CRM will set the Auction Price Cap at a multiple of Net Cost of New Entrant (Net CONE). The multiple will be consulted upon separately in advance of the first T-4 capacity auction.

Based upon the CCGT Net CONE calculation above of €86.0/de-rated kW per year and taking, for example, a multiple of 1.5 the Auction Price Cap works out as €129.0/ de-rated kW.

Existing Capacity Price Cap (ECPC)

6.1.4 This cap is most relevant to those qualified bidders who are existing capacity providers in the all-island market and is also set as a multiple of Net CONE. Again, the multiple will be consulted upon separately in advance of the first T-4 capacity auction.

6.1.5 Based upon the CCGT Net CONE calculation above of €86.0/de-rated kW per year and taking, for example, a multiple of 0.5 the Existing Capacity Price Cap works out as €43.0/ de-rated kW.

New Capacity Investment Rate Threshold (NCIRT)

6.1.6 As part of the capacity auction qualification criteria, a new capacity provider seeking to be awarded a multi-year Reliability Option of up to 10 years in the auction must invest at least a specified amount per MW of capacity to qualify for a multi-year Reliability Option. This

threshold makes reference to a percentage of gross BNE investment cost, being the upfront capital investment which is separate from the Gross and Net CONE which are annualised fixed costs.

6.1.7 Below in Table 8 is an example of the inputs and how they are used as part of the assessment when considering the level to set the New Capacity Investment Rate Threshold parameter.

Table 8: Stylised Example of New Capacity Investment Rate Threshold Calculation

Description	Workings	CCGT Northern Ireland
Capital Cost Estimate (€)		€ 337,500,000
Nameplate Capacity (MW)		447.4
De-rating factor (CY2018/19)		87.20%
De-rated MW	Nameplate capacity x de-rating factor	390.13
€/de-rated MW	Capacity cost / de-rated MW	€ 865,090
NCIRT	**Estimate 40% of Gross Investment cost expressed as €/de-rated MW**	**€ 346,036**

7. CONSULTATION QUESTION

7.1.1 The SEM Committee welcomes views and responses on any aspect of this consultation paper and the appended Poyry report. However, the overriding question is:

7.1.2 Do respondents agree that the Best New Entrant applicable for the competitive capacity auction process should be the reference technology analysed which results in the lowest Net CONE (based upon the analysis for this consultation the BNE Net CONE is proposed as a CCGT located in Northern Ireland)? The SEM Committee would particularly want to receive evidence supporting any alternative to the proposal, where possible supported by quantitative analysis.

8. NEXT STEPS

8.1.1 The SEM Committee intends to make a decision by September 2018 on the BNE Net CONE value to be applied to the Capacity Year 2022/23 for which the capacity auction is due to take place in March 2019.

8.1.2 Responses to the consultation paper should be sent to Karen Shiels (Karen.Shiels@uregni.gov.uk) and Kevin Lenaghan (Kevin.Lenaghan@uregni.gov.uk) by 17.00 on Friday, 15 June 2018.

8.1.3 Please note that we intend to publish all responses unless marked confidential. While respondents may wish to identify some aspects of their responses as confidential, we request that non-confidential versions are also provided, or that the confidential information is provided in a separate annex. Please note that both Regulatory Authorities are subject to Freedom of Information legislation.