**Supplement to CMP316 Workgroup Report**

Includes numerical tariff calculation for the WACM

August 2022 (amended January 2024)

Supporting calculations to note

Wider tariffs by generation category:

### 

### Conventional Carbon Generators

(Biomass, CHP, Coal, Gas, Pump Storage)

**ALF**

**Peak Element**

**Year Round Shared**

**Element**

**Year Round Not Shared Element**

**Adjustment Tariff**

**ALF**

### Conventional Low Carbon Generators

(Hydro, Nuclear)

**Adjustment Tariff**

**Peak Element**

**Year Round Shared Element**

**Year Round Not Shared Element**

**ALF**

### Intermittent Generators

(Wind, Wave, Tidal)

**Year Round Shared Element**

**Year Round Not Shared Element**

**Adjustment Tariff**

**ALF**

Co-located generation site examples

Power station A has TEC of 60MW, and it consists of three BMUs/technology types. The capacity and the annual outputs (MWh) are listed below

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Maximum Capacity (MW)** | **Fuel type** | **Annual exporting (MWh)** |
| BMU1 | 50 | Wind | 135,000 |
| BMU2 | 40 | CHP | 250,000 |
| BMU3 | 15 | Battery | 35,000 |

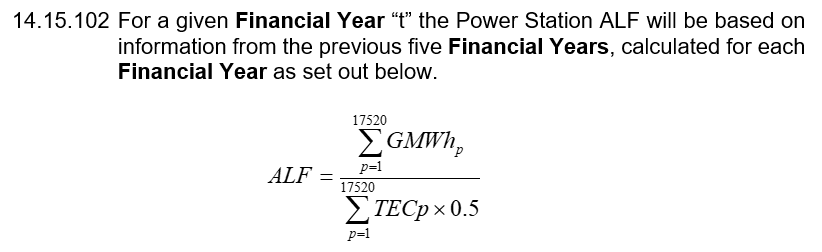
Given the following wider generation tariffs (note these are not current tariffs provided for illustration only)

|  |  |  |  |
| --- | --- | --- | --- |
| **Wider Tariffs (£/kW)** | | | |
| **Peak Security** | **Shared Year Round** | **Not Shared Year-Round** | **Adjustment** |
| 5 | 15 | 12 | 0 |

1. Baseline

As the predominant technology is wind, the power station is treated as wind.

As CUSC Section 14



The Power Station ALF will use the sum of the annual exporting MWh for each technology type.

ALF = (135000+250000+35000)/(60\*8760)=80%

Then for the intermittent generation, its wider tariff is (15X80%+12+0=)£24/kW, and its wider charge is (24X60=) **£1,440k**

1. CMP316 Original solution

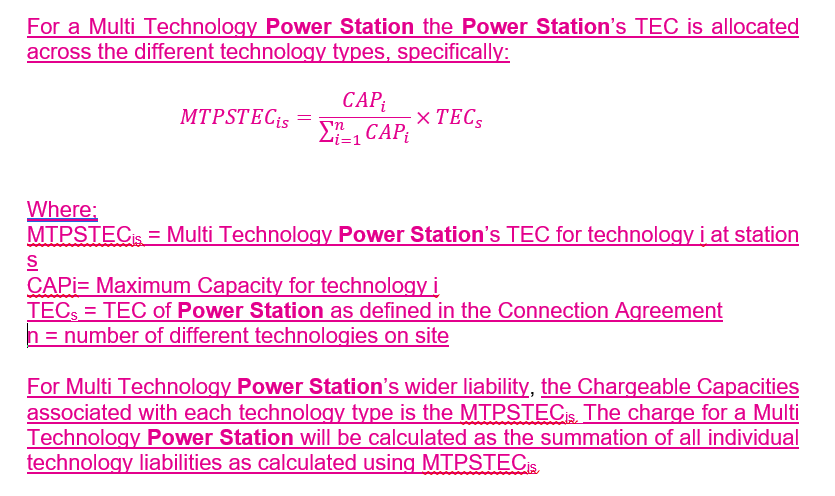
**ALFs for each technology type are used to calculate a tariff for each technology type, and then these tariffs are applied by multiplying against a scaled capacity for each.**

**Note that the scaled capacities must equal the total power station capacity.**

**However, the ALFs for each technology type will not necessarily equate to the weighted average ALF of the total site. This difference will occur when the metered export of one of the technologies is not exported from the site, but is instead imported by the storage technology instead. In this case the weighted average ALF of the technologies will be greater than the site ALF.**

The TEC of the power station is apportioned to each technology according to the Maximum Capacity (as defined within the Grid Code) of the relevant BMUs

As CUSC 14.18.7



|  |  |
| --- | --- |
|  | **MTPSTEC (MW)** |
| Technology 1 (Wind) | 28.6 |
| Technology 2 (CHP) | 22.9 |
| Technology 3 (Battery) | 8.6 |
| **Total (TEC)** | **60** |

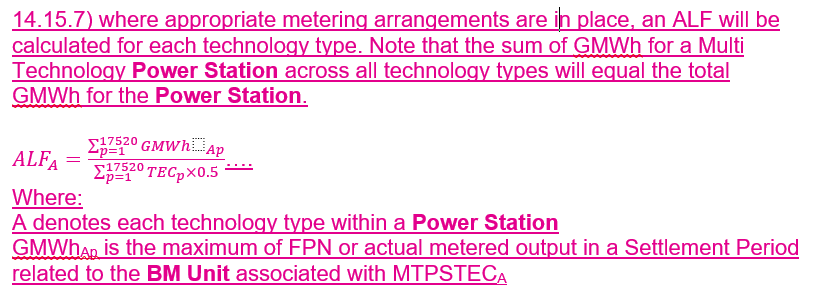
N.B MTPSTEC values are rounded for ease of reading, but will total the site TEC when added

**Generation charge**

Given the wider generation tariffs

|  |  |  |  |
| --- | --- | --- | --- |
| **Wider Tariffs (£/kW)** | | | |
| **Peak Security** | **Shared Year Round** | **Not Shared Year-Round** | **Adjustment** |
| 5 | 15 | 12 | 1 |

As CUSC 14.15.102  

ALF1=135000/(60\*8760)=25.7%

ALF2= 250000/(60\*8760)=47.6%

ALF3=35000/(60\*8760)=6.7%

There is some rounding in the illustration above. In this example the sum of the technology ALFs does sum exactly to the Power Station ALF with additional decimal places because in this example we assume the battery is importing from the system rather than another on-site technology. If importing from on-site technology, the sum of the technology ALFs could be higher than the site ALF.

Wider tariffs for each technology are

Wind: (15X25.7%+12+1=)£16.85/kW

CHP: (5+15X47.6%+12X47.6%+1=)£18.84/kW

Battery: (5+15X6.7%+12X6.7%+1=)£7.80/kW

Total charges for each technology are

Wind = 16.85 X 28.6 X 1000 = £481.51k

CHP = 18.84 X 22.9 X 1000 = £430.68k

Battery = 7.89 X 8.6 X 1000 = £66.84k

And the wider charge for this power station is (£481.51k + £430.68k + £66.84k4 =) **£979.03k**

The table below shows how much each tariff component contributes to each charge, for comparison to WACM1:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Technology | Peak Charge | YRS | YRNS | Adjustment | Total |
| Wind | 0 | £110,078 | £342,857 | £28,571 | £481,507 |
| CHP | £114,286 | £163,079 | £130,463 | £22,857 | £430,685 |
| Battery | £42,857 | £8,561 | £6,849 | £8,571 | £66.840 |
| Total | £157,143 | £281,719 | £480,170 | £60,000 | £979,031 |

**N.B the Adjustment Charge is calculated using MTPSTEC. Some rounding is used in these examples – refer to accompanying spreadsheet for exact figures.**

**Methodology when any wider tariffs are negative**

When one of the wider tariffs is negative, the calculation is treated differently. Instead of using installed capacity, the methodology uses the average output of each technology type over the three settlement periods of highest output from November to the end of February each year. These three settlement periods are specific to each unit, and must be separated from each other by ten clear days. Total site maximum outputs are also used instead of TEC.

The previous example has been recalculated using the following tariff components:

|  |  |  |  |
| --- | --- | --- | --- |
| Peak Security | YRS | YRNS | Adjustment |
| -5 | -15 | -12 | -1 |

BMU 1 Wider Tariff = -16.85

BMU 2 Wider Tariff = -18.84

BMU 3 Wider Tariff = -7.8

This initial results in a negative wider tariff for each technology type, meaning that the alternative ‘Chargeable MTSPSTEC’ calculation is used.

For example, to calculate Chargeable MTPSTEC for BMU1:

MTPSTEC = Child Station Chargeable Capacity/(Chargeable Capacity BMU1 + BMU2 + BMU3)\* Station Chargeable Capacity

Chargeable Capacities for this example (average of three highest between Feb – Nov) are shown in table below

MTPSTEC = 45/(45+36+13.5)\*54 = 25.71

**Station Chargeable Capacity = 54**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Maximum Capacity (MW)** | **Fuel type** | **Annual exporting (MWh)** | **Child Station Chargeable Capacity** | **MTPSTEC (Negative Tariff)** |
| BMU1 | 50 | Wind | 135,000 | 45 | 25.7 |
| BMU2 | 40 | CHP | 250,000 | 36 | 20.6 |
| BMU3 | 15 | Battery | 35,000 | 13.5 | 7.7 |

The rest of the methodology is then treated in the same way, multiplying by the wider tariffs to give the charges:

|  |  |  |
| --- | --- | --- |
|  | Scaled chargeable capacity (MW) /  Chargeable MTPSTEC (MW) | Charge (£k) |
| BMU 1 | 22.5 | -£ 433.36 |
| BMU 2 | 18.0 | -£ 387.62 |
| BMU 3 | 13.5 | -£ 60.16 |
| Total liabililty: | | -£ 881.13 |

1. CMP316 WACM Solution

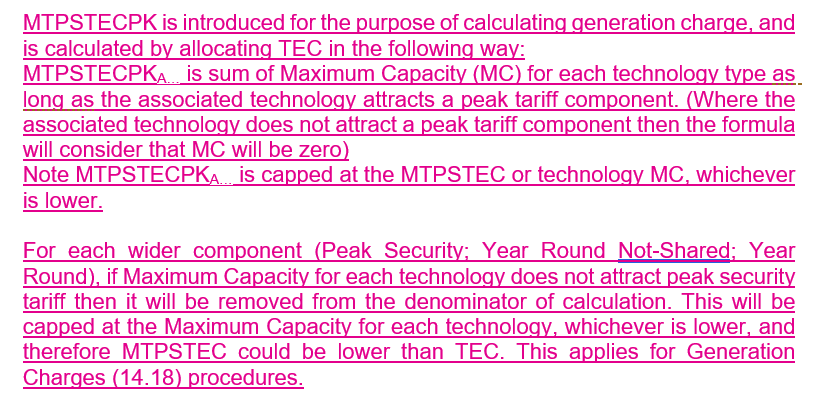
**The WACM calculates the charges for each technology type by component, with a different calculation for each. The ALF is treated differently, proportioning on MTPSTEC rather than site TEC.**

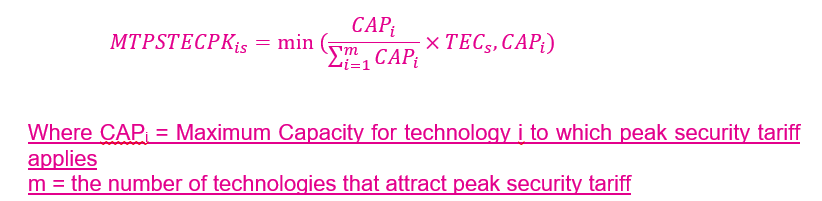
The TEC of the power station is apportioned to each technology according to the maximum capacity of the relevant BMUs.

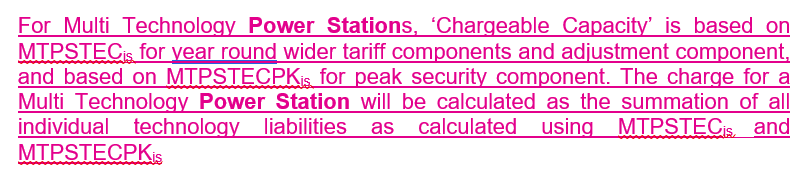
**The metered export of each technology type is still used as the numerator in the ALF calculations.**

The solution does not change the calculation of the tariffs. The tariff calculation is as the Original proposal. The charges differ by use of MTPSTECPK, MTPSECS and a scaling adjustment to account for the different capacity denominator used in the ALF calculation .

As CUSC 14.8.7 (note MTPSTECPK – used for each technology type could sum to less than the Power Station TEC but cannot higher than TEC)







|  |  |  |
| --- | --- | --- |
|  | **MTPSTEC (MW)** | **Peak Capacity (MW) MTPSTECPK** |
| Technology 1 (Wind) | 28.6 | 0 |
| Technology 2 (CHP) | 22.9 | 40 |
| Technology 3 (Battery) | 8.6 | 15 |
| **Total** | **60** | **55** |

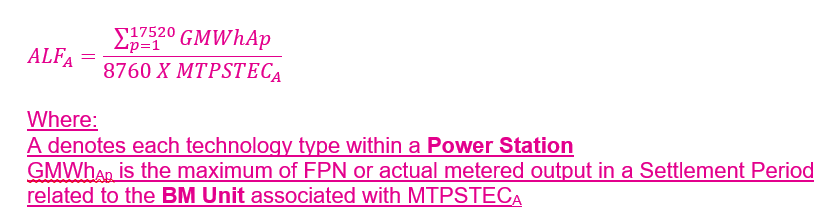
Note MTPSTECPK is less than site TEC in this example.

**Generation charge**

Given the wider generation tariffs

|  |  |  |  |
| --- | --- | --- | --- |
| **Wider Tariffs (£/kW)** | | | |
| **Peak Security** | **Shared Year Round** | **Not Shared Year-Round** | **Adjustment** |
| 5 | 15 | 12 | 1 |

As CUSC 14.15.102



ALF1=135000/(28.6\*8760)=54%

ALF2= 250000/(22.9\*8760)=125%

ALF3=35000/(8.6\*8760)=47%  
(note that an ALF at technology level, for the WACM, can exceed 100%,but the station ALF would not exceed 100%)

*The Peak charge for each technology type is MTPSTECPKi x Peak Security Tariff:*

*Wind = 0 x 5 = £0*

*CHP = 40 x 5 = £200k*

*Battery = 15 x 5 = £75k*

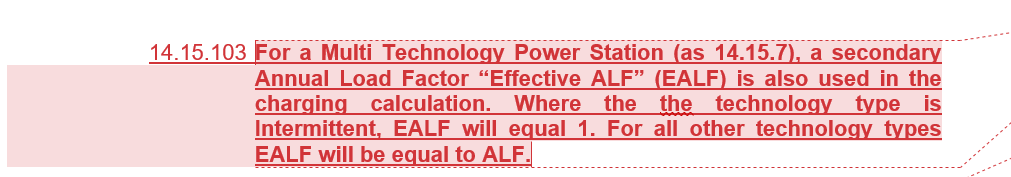
*The Year Round Shared charge for each technology type is ALF x MTPSTEC x Shared Year Round Tariff:*

*Wind = 54% x 28.6 x 15 = £231.16k*

*CHP = 125% x 22.9 x 15 = £428.08k*

*Battery = 47% x 8.6 x 15 = £59.93k*

The Year Round Not Shared charge is then based off a different scaled capacity.



An effective capacity is calculated which calculates how much capacity each technology would be liable for if they were separate stations with full TEC.

**Intermittent and Conventional Low Carbon Effective ALF is treated as 1, Conventional Carbon is the same as the usual ALF**

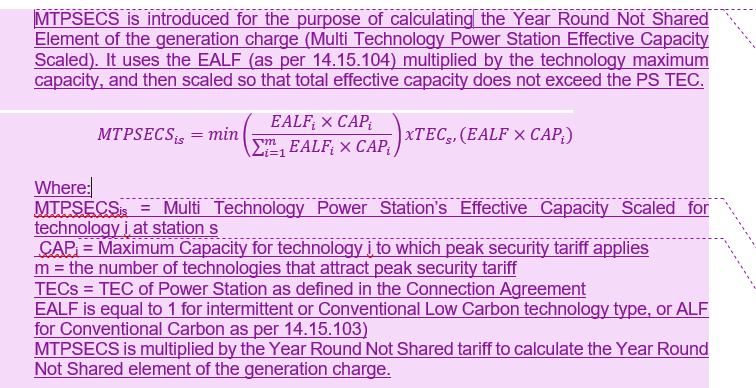
**EALF1**=135000/(28.6\*8760)=100%

**EALF2**= 250000/(22.9\*8760)=125%

**EALF3**=35000/(8.6\*8760)=47%

Effective Capacity = Max Capacity x **EALF**

If installed liability exceeds TEC (which it does in this example), it is then scaled to equal TEC (Scaled Liability). This is summarised in legal text by introducing MTPSECS (Muti Technology Power Station Effective Capacity Scaled)



Effective Capacity = **EALF** x Max Capacity:

Wind = 100% x 50 = 50MW

CHP = 125% x 40 = 49.9MW

Battery = 46% x 15 = 6.97MW

This gives a total of 107 MW, meaning that capacity needs to be scaled by 60/107:

Effective Capacity Scaled

Wind: 28.1MW

CHP 28.0MW

Battery = 3.9MW

This could also be calculated by using the summarised legal text formula e.g:

The Year Round Not Shared charge for each technology type is Scaled Liability x Not Shared Year Round Tariff:

Wind = 28.1MW x 12 = £336.65k

CHP = 28.0MW x 12 = £336.27k

Battery = 3.9MW x 12 = £47.08k

The Adjustment Charge for each technology type is Adjustment Tariff x MTPSTEC:

Wind = 1 x 28.6 = 28.6

CHP = 1 x 22.9 = 22.9

Battery = 1 x 8.6 = 8.6

**Total Charges:**

Wind = 0 + 231.16 + 336.65 + 28.57 = £596k

CHP = 200 + 428.08 + 336.27 + 22.86 = £987.21

Battery = 75 + 59.93 + 47.08 + 8.57 = £190.58

Total = £1714.18k

The table below shows how much each tariff component contributes to each charge, for comparison to the original:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Technology | Peak Charge | YRS | YRNS | Adjustment | Total |
| Wind | 0 | £231,160 | £336,650 | £28,570 | £596,390 |
| CHP | £200,000 | £428,080 | £336,270 | £22,860 | £987,210 |
| Battery | £75,000 | £59,930 | £47,080 | £8,570 | £190,580 |
| Total |  |  |  |  | £1,774,180 |

**Change to methodology when any wider tariffs are negative**

The trigger for the methodology change in the WACM is when any of the tariff components are negative. As in the original, this triggers the use of maximum metered outputs instead of installed capacities and TEC. If the tariff components are as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Peak Security | YRS | YRNS | Adjustment |
| -5 | 15 | 12 | -1 |

Peak and Adjustment Charges use maximum metered values

YRS and YRNS uses the standard methodology to calculate MTPSTEC and MTPSECS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Chargeable MTPSTEC (MW) (Adjustment) | Chargeable MTPSTECPK (MW) (Peak Charge) | MTPSTEC (YRS Charge) | MTPSECS (YRNS Charge) |
| BMU 1 | 25.7 | 0 | 28.6 | 28.1 |
| BMU 2 | 20.6 | 36 | 22.9 | 28 |
| BMU 3 | 7.7 | 13.5 | 8.6 | 3.9 |

Tariffs will then be as follows:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Technology | Peak Charge | YRS | YRNS | Adjustment | Total |
| Wind | 0 | £231,160 | £336,650 | £-25,710 | £542,100 |
| CHP | £-180,000 | £428,080 | £336,270 | £-20,570 | £563,780 |
| Battery | £-67,500 | £59,930 | £47,080 | £-7,710 | £31,790 |
| Total |  |  |  |  | £1,137,680 |

1. Comparison of Original and WACM

**Baseline**

Total charge = £1,140,000

**Original**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Technology | Peak Charge | YRS | YRNS | Adjustment | Total |
| Wind | 0 | £110,078 | £342,857 | £28,571 | £481,507 |
| CHP | £114,286 | £163,079 | £130,463 | £22,857 | £430,685 |
| Battery | £42,857 | £8,561 | £6,849 | £8,571 | £66.840 |
| Total | £157,143 | £281,719 | £480,170 | £60,000 | £979,031 |

**WACM**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Technology | Peak Charge | YRS | YRNS | Adjustment | Total |
| Wind | 0 | £231,160 | £336,650 | £28,570 | £596,390 |
| CHP | £200,000 | £428,080 | £336,270 | £22,860 | £987,210 |
| Battery | £75,000 | £59,930 | £47,080 | £8,570 | £190,580 |
| Total |  |  |  |  | £1,774,180 |

* WACM costs are higher than Original because the ALF is divided by MTPSTEC rather than TEC (resulting in a higher individual ALF and larger component costs)

1. Acronyms and Key Terms

|  |  |
| --- | --- |
| **Acronym / key term** | **Meaning** |
| ALF | Annual Load Factor |
| BMU | Balancing Mechanism Unit |
| BSC | Balancing and Settlement Code |
| CAPi | Maximum Capacity for Technology i |
| Chargeable Capacity | Chargeable Capacity is the basis of the generation charge, where Local Annual Liability = Chargeable Capacity x Local Tariff |
| CHP | Combined heat and power |
| CMP | CUSC Modification Proposal |
| CUSC | Connection and Use of System Code |
| EALF | Effective ALF |
| EBR | Electricity Balancing Regulation |
| ESO | Electricity System Operator |
| GC | Generation Capacity |
| GWh | Gigawatt hours |
| MTPSECS | Multi Technology Power Station Effective Capacity Scaled |
| MTPSTEC | Multi Technology Power Station TEC for each technology |
| MTPSTECPk | Multi Technology Power Station TEC (Peak) |
| Mod App | Modification Application (to a Connection Contract) |
| MWh | Megawatt hours |
| NETS | National Electricity Transmission System |
| PV | Photo Voltaic |
| SCR | Significant Code Review |
| SQSS | Security and Quality of Supply Standards |
| STC | System Operator Transmission Owner Code |
| T&Cs | Terms and Conditions |
| TDR | Transmission Demand Residual |
| TEC | Transmission Entry Capacity |
| TNUoS | Transmission Network Use of System |
| YRNS | Year Round Not Shared |
| YRS | Year Round Shared |