I-SEM Training
Instructor Led Training
Capacity Market Settlement

Version 1

Duration and Timing

The training session will run from 10AM to 4PM with the following breaks:

Break	11am – 11:15am
Lunch	12:30pm – 1:15pm
Break	14:15pm – 14:30pm

Training Guidelines

Please ensure that you allow yourself enough time to arrive at the training room both at the start of the day and after each break so that the training can finish on time.

Please limit use of mobile phones throughout the day so as not to distract other trainees and ensure that mobile phones are kept on silent mode throughout the day.

Please ensure you have left the training room before answering a phone call.

The instructor will stop at various points throughout this presentation to deal with any questions that arise.

Please feel free to ask questions during the training session or alternatively please contact the Query Management Team through the mailbox: I-SEMproject@sem-o.com.

Agenda

Training Topic
Learning Objectives
Topic 1: Processes and Data Inputs
Topic 2: Capacity Payments and Charges
Topic 3: Strike Price
Topic 4: Load Following Obligated Capacity Quantity
Topic 5: Market Difference Charges and Difference Payments
Topic 6: Stop-Loss Limits
Topic 7: Non-Performance Difference Charges and Imbalance Difference Payments
Topic 8: Difference Charges and Difference Payments Examples
Topic 9: Difference Payment Socialisation Charges and Socialisation Fund
Topic 10: Course Summary

Learning Objectives

- By the end of this training session you should:
  - Understand the timing and processes for Capacity Market Settlements
  - Understand the payment calculation for Capacity Market units
  - Understand the different payments and charges processes
  - Understand the supplier charging processes

Topic 1: Process and Data Inputs

Process and Data Inputs

Generator

Paid for capacity ("Reliability Option")

Capacity Market

Fund capacity payments for Reliability Options

Supplier

Paid for generation

Energy Market

Pay for consumption

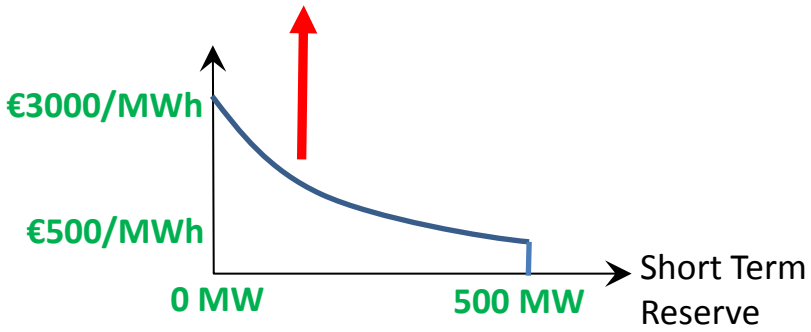
Pays difference between energy price and strike price on reliability option capacity

Paid difference between energy price and strike price on consumption.

*If **energy price** above **strike price***

Exposed if not generating

"Stop Loss Limits"
"Secondary Trade"



Exposed if not enough capacity sold

"Socialisation Fund"

Administered Scarcity Price varies with reserve shortfall or goes to max price if demand control used.

EIRGRID semo Single Electricity Market Operator SONI

Process and Data Inputs

- Activities related to Capacity Market settlement include:
  - Submission, collection and processing of data;
  - Calculation of settlement amounts by the Market Operator;
  - Publication and receipt of settlement data and settlement documents through the Balancing Market Interface;
  - Payment of amounts owed to and owed by participants;
  - Repeat process for settlement reruns.
- This training will focus on how the settlement amounts are calculated by the MO.

Process and Data Inputs

- Capacity Market Settlement is split into two main areas:
  - Capacity Payments, Capacity Charges, and Difference Payment Socialisation Charges:
    - These are defined as “Capacity Payments and Charges”;
    - They are included on Settlement Documents on a Capacity Period basis (i.e. monthly).
  - Difference Payments and Difference Charges:
    - These are defined as “Trading Payments and Charges”;
    - They are related to energy market settlement (i.e. based on ex-ante, balancing or imbalance market prices, enacts hedge for Suppliers against energy market prices);
    - They are included on Settlement Documents on the same basis as Balancing Market settlement, on a Billing Period basis (i.e. weekly).

Process and Data Inputs

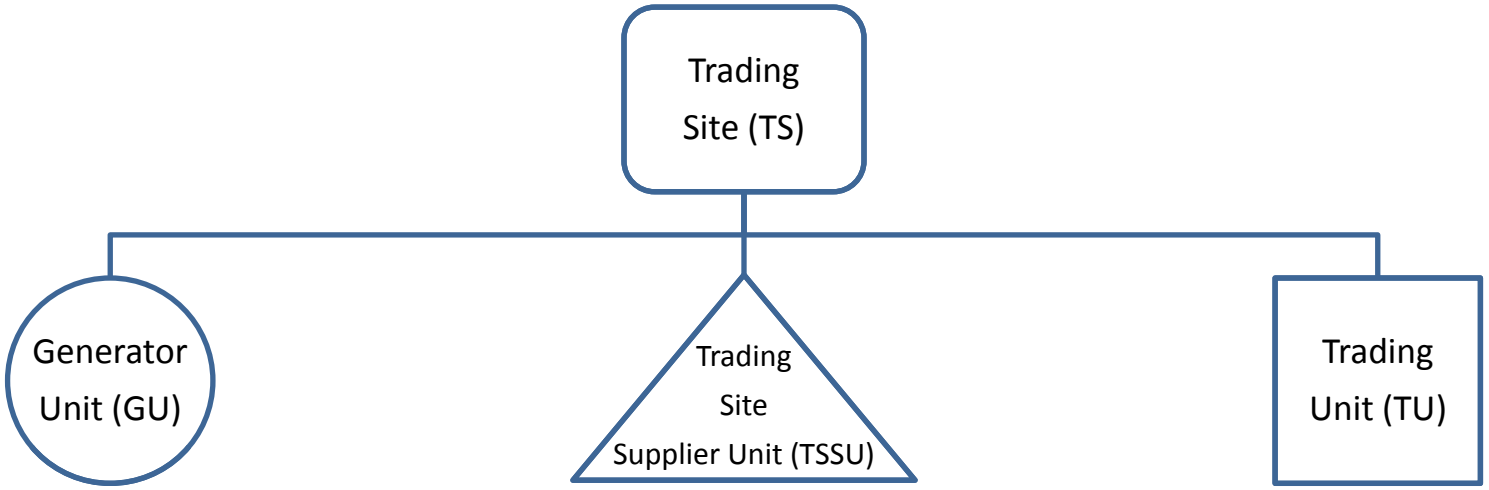
Applies | Sometimes Applies | Does Not Apply | Applies in Specific Way

These are the different components of the capacity market payments and charges, and an indication of the units to which they apply.

Payment / Charge Name	Capacity Market Unit (CMU)	CMU for Autoproducer Unit	CMU for Interconnector	CMU for Demand Side Unit	Supplier Unit (incl. ASU)	Trading Site Supplier Unit	
Capacity Payment	Applies	Applies	Applies	Applies	Does Not Apply	Does Not Apply	
Capacity Charge	Does Not Apply	Does Not Apply	Does Not Apply	Does Not Apply	Applies	Sometimes Applies	
Difference Payment Socialisation Charge	Does Not Apply	Does Not Apply	Does Not Apply	Does Not Apply	Applies	Sometimes Applies	
Day-ahead Difference Charge	Applies	Applies in Specific Way	Does Not Apply	Does Not Apply	Does Not Apply	Does Not Apply	Total Difference Charge
Within-day Difference Charge	Applies	Applies in Specific Way	Does Not Apply	Does Not Apply	Does Not Apply	Does Not Apply	
Non-Performance Difference Charge	Applies	Applies in Specific Way	Applies in Specific Way	Applies in Specific Way	Does Not Apply	Does Not Apply	
Day-ahead Difference Payment	Does Not Apply	Does Not Apply	Does Not Apply	Does Not Apply	Applies	Does Not Apply	Achievable Difference Payment
Intraday Difference Payment	Does Not Apply	Does Not Apply	Does Not Apply	Does Not Apply	Applies	Does Not Apply	
Imbalance Difference Payment	Does Not Apply	Does Not Apply	Does Not Apply	Does Not Apply	Applies	Sometimes Applies	
Difference Payment Shortfall Amount	Does Not Apply	Does Not Apply	Does Not Apply	Does Not Apply	Sometimes Applies	Sometimes Applies	
Difference Payment Reimbursement Amount	Does Not Apply	Does Not Apply	Does Not Apply	Does Not Apply	Sometimes Applies	Sometimes Applies	

Process and Data Inputs

- Trading Site Supplier Units (TSSUs) only receive Imbalance Difference Payments if the site is net importing:
  - This is the only scenario when they are exposed to the Imbalance Settlement Price, and therefore needs the payment to enact the hedge.
- TSSUs pay the Capacity Supplier Charge if the site is net importing;
- Autoproducers can trade ex-ante through a Trading Unit, representing the net position of their Trading Site;
- Therefore Difference Charges for Autoproducers are calculated at the Trading Site level:
  - Most equations are the same, just with an additional step of summing for all units on the site;
  - TSSU demand needs to be added to the amount of the CMU's obligation being met through an ex-ante market trade to reflect the fact that their Trading Unit's trade amounts are net of this demand.



Process and Data Inputs

- There are two registers mentioned in the Capacity Market Code, which contain some of the data used for Capacity Market Settlement;
- Qualification Capacity Register:
  - Contains data about the Capacity Market Units, records of qualified data, and information provided with opt-out notifications;
  - Used primarily for the qualification and capacity auction processes.
- Capacity and Trade Register:
  - Its entries are also known as “Contract Register Entries” for use in the TSC settlement;
  - Contains data from the results of Capacity Auctions and Secondary Trades;
  - Used primarily for settlement processes;
  - Each entry has its own stop-loss limit factors and exchange rates according to what was relevant at the time the capacity was awarded.

Process and Data Inputs

- Qualification Capacity Register:
  - Capacity Year applicable to Opt Out
  - Reason for Opting Out
  - Reason and date for SO Rejecting Opt Out
  - Details of unit
  - **CMU Identifier (Ω)**
  - Capacity Auction applicable to Qualification
  - **Unit Type**
  - Data from Application for Qualification
  - Qualified CMU
  - Initial Capacity (Existing)
  - Initial Capacity (Total)
  - Gross De-Rated Capacity (Existing)
  - Gross De-Rated Capacity (New)
  - **Gross De-Rated Capacity (Total) (qCDERATEG)**
  - Net De-Rated Capacity (Existing)
  - Net De-Rated Capacity (Total)
  - Maximum Capacity Duration
  - Offer Price Caps
  - Firm Offer Requirement
  - Data for each Generator in an AGU
  - **Gross De-Rating Factor (FDERATE)**

Of particular interest for settlement

Process and Data Inputs

- Capacity and Trade Register:
  - **Unique Identifier (Contract Register Entry, n)**
  - Status Flag
  - **CMU Identifier (Ω)**
  - **Capacity Quantity (qC)**
  - **Primary or Secondary (P/S)**
  - **Start Date and Time**
  - **End Date and Time**
  - Commissioning Flag
  - **Capacity Payment Price (PCP)**
  - **Commissioned Capacity (qCCOMMISS)**
  - Long Stop Date
  - **Annual Stop Loss Limit Factor (FSLLA)**
  - **Billing Period Stop Loss Limit Factor (FSLLB)**
  - **Capacity Duration Exchange Rate (XR)**

Of particular interest for settlement

Process and Data Inputs

- Example Qualification Capacity Register settlement data:

Ω	Unit Type	qCDERATEG	FDERATE
1	CCGT	70	0.875
2	Autoproducer	100	0.9
3	Wind	20	0.1
…	…	…	…

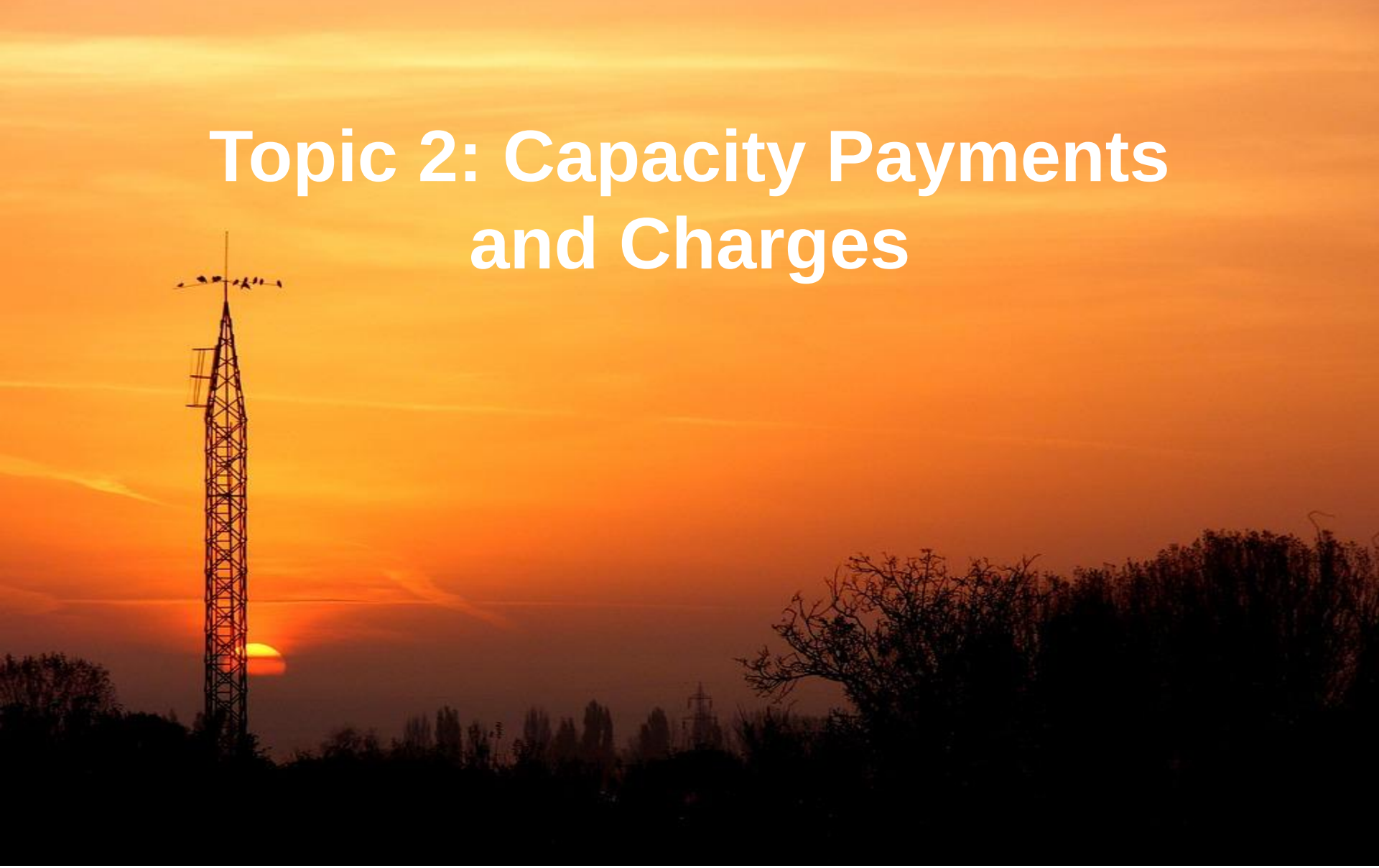
- Example Capacity and Trade Register settlement data:

n	Ω	qC	P/S	Start	End	PCP	qCCOMMISS	FSLLA	FSLLB	XR
1	1	70	P	01/08/2020	01/08/2021	100	80	1.5	0.75	1.1
2	1	-20	S	01/06/2021	07/06/2021	90	80	1.5	0.75	1
3	1	+10	S	08/06/2021	14/06/2021	110	80	1.5	0.75	0.9
…	…	…	…	…	…	…	…	…	…	…

Process and Data Inputs

- An annual exchange rate applies for Capacity Auctions and for Secondary Trades for delivery more than a year ahead:
  - An Annual Capacity Payment Exchange Rate applies to a Capacity Year.
- A monthly exchange rate for secondary trades within a year of delivery, and during, the capacity year.
  - A Monthly Capacity Payment Exchange Rate applies to trading days which fall within a Month.
- This recognises that secondary trade could occur close to the delivery date, for which a more current exchange rate would be more appropriate than an annual exchange rate;
- The exchange rates will be determined by the SOs and approved by the RAs, and should reflect expectations of the average exchange rate over the period to which the rate applies;
- For Capacity Charges for Supplier Units, there is also an Annual Capacity Charge Exchange Rate determined by the Market Operator and approved by the RAs.

Topic 2: Capacity Payments and Charges



Capacity Payments and Charges

- Capacity Payment:
  - This is the payment to a Capacity Market Unit for being successful in a Capacity Auction or Secondary Trade;
  - Each successful auction or secondary trade has an individual Contract Register Entry with Capacity Quantity and Capacity Payment Price;
- Capacity Payments only apply once the capacity is commissioned:
  - There are rules in the Capacity Market Code around what proportion of capacity must be delivered to be considered “commissioned”;
  - Similarly, Difference Charges only apply after commissioning.

Capacity Payments and Charges

- Capacity Payment:

$$CCP_{\Omega\gamma} = \sum_{n \in \gamma, qCCOMMISS \neq 0} \left(qC_{\Omega n} \times PCP_{\Omega n} \times \frac{1}{ISPIY_y} \right)$$

  - Total revenue for the whole length of the Contract Register Entry:
    - Capacity Payment Price (PCP) is in €/MW per year, i.e. the price which would result in an amount of annual revenue, regardless of the length of time over which the Contract Register Entry is active.

Capacity Payments and Charges

- Capacity Payment:

$$CCP_{\Omega\gamma} = \sum_{n \in \gamma, qCCOMMISS \neq 0} \left(qC_{\Omega n} \times PCP_{\Omega n} \times \frac{1}{ISPIY_y} \right)$$

  - Total revenue for the whole length of the Contract Register Entry:
    - Capacity Payment Price (PCP) is in €/MW per year, i.e. the price which would result in an amount of annual revenue, regardless of the length of time over which the Contract Register Entry is active.
  - Scale from the total revenue for the capacity to the amount of that revenue in a single Imbalance Settlement Period over which the Contract Register Entry is active;

Capacity Payments and Charges

- Capacity Payment:

$$CCP_{\Omega\gamma} = \sum_{n \in \gamma, qCCOMMISS \neq 0} \left(qC_{\Omega n} \times PCP_{\Omega n} \times \frac{1}{ISPIY_y} \right)$$

  - Total revenue for the whole length of the Contract Register Entry:
    - Capacity Payment Price (PCP) is in €/MW per year, i.e. the price which would result in an amount of annual revenue, regardless of the length of time over which the Contract Register Entry is active.
  - Scale from the total revenue for the capacity to the amount of that revenue in a single Imbalance Settlement Period over which the Contract Register Entry is active;
  - Sum over all Contract Register Entries active in that Imbalance Settlement Period, for capacity which has been commissioned:
    - Later further calculations sum all payments over the Capacity Period, for all Capacity Market Units of a Participant, etc.

Capacity Payments and Charges

- Example Capacity and Trade Register entries for a single unit:

n	Ω	qC	P/S	Start	End	PCP	qCCOMMISS	FSLLA	FSLLB	XR
1	**1**	**+70**	**P**	**01/08/2020**	**01/08/2021**	**100**	**80**	**1.5**	**0.75**	**1.1**
2	1	-20	S	01/06/2021	07/06/2021	90	80	1.5	0.75	1
3	1	+10	S	08/06/2021	14/06/2021	110	80	1.5	0.75	0.9
…	…	…	…	…	…	…	…	…	…	…

- Calculating Capacity Payments for an Imbalance Settlement Period on 01/05/2021:
  - 70 x 100 = 7,000 € or £ is the total amount of revenue the participant should receive over a year for the only active awarded capacity in that period;
  - Amount of this revenue in a single Imbalance Settlement Period 70 x 100 x (1/17520) ≈ 0.4 € or £;
  - Total revenue for the 1488 Imbalance Settlement Periods in the month of May is 594.52 € or £.

Capacity Payments and Charges

- Example Capacity and Trade Register entries for a single unit:

n	Ω	qC	P/S	Start	End	PCP	qCCOMMISS	FSLLA	FSLLB	XR
1	**1**	**+70**	**P**	**01/08/2020**	**01/08/2021**	**100**	**80**	**1.5**	**0.75**	**1.1**
2	**1**	**-20**	**S**	**01/06/2021**	**07/06/2021**	**90**	**80**	**1.5**	**0.75**	**1**
3	1	+10	S	08/06/2021	14/06/2021	110	80	1.5	0.75	0.9
…	…	…	…	…	…	…	…	…	…	…

- Calculating Capacity Payments for an Imbalance Settlement Period on 02/06/2021:
  - In addition to the primary auction awarded capacity, a secondary trade reducing the capacity position is also active. It is active for one week, so while the total revenue from this trade would be -20 x 90 = -1,800 € or £, since it is only active for a week the actual total revenue over the year for this trade would be -1,800 x (1/52) = -34.62 € or £.
  - The amount of total revenue in a single Imbalance Settlement Period is (70 x 100 x (1/17520)) + (-20 x 90 x (1/17520)) ≈ 0.3 € or £.

Capacity Payments and Charges

- Example Capacity and Trade Register entries for a single unit:

n	Ω	qC	P/S	Start	End	PCP	qCCOMMISS	FSLLA	FSLLB	XR
1	**1**	**+70**	**P**	**01/08/2020**	**01/08/2021**	**100**	**80**	**1.5**	**0.75**	**1.1**
2	1	-20	S	01/06/2021	07/06/2021	90	80	1.5	0.75	1
3	**1**	**+10**	**S**	**08/06/2021**	**14/06/2021**	**110**	**80**	**1.5**	**0.75**	**0.9**
…	…	…	…	…	…	…	…	…	…	…

- Calculating Capacity Payments for an Imbalance Settlement Period on 09/06/2021:
  - In addition to the primary auction awarded capacity, a secondary trade increasing the capacity position is also active. It is active for one week, so while the total revenue from this trade would be 10 x 110 = 1,100 € or £, since it is only active for a week the actual total revenue over the year for this trade would be 1,100 x (1/52) = 21.15 € or £.
  - The amount of total revenue in a single Imbalance Settlement Period is (70 x 100 x (1/17520)) + (10 x 110 x (1/17520)) ≈ 0.46 € or £.

Capacity Payments and Charges

- Example Capacity and Trade Register entries for a single unit:

n	Ω	qC	P/S	Start	End	PCP	qCCOMMISS	FSLLA	FSLLB	XR
1	1	+70	P	01/08/2020	01/08/2021	100	80	1.5	0.75	1.1
2	1	-20	S	01/06/2021	07/06/2021	90	80	1.5	0.75	1
3	1	+10	S	08/06/2021	14/06/2021	110	80	1.5	0.75	0.9
…	…	…	…	…	…	…	…	…	…	…

- Total Revenue in June:
  - Total revenue in June is ≈ 0.3 € or £ for each Imbalance Settlement Period for the first week (336 ISPs), ≈ 0.46 € or £ for each Imbalance Settlement Period for the second week, and ≈ 0.4 € or £ for each Imbalance Settlement Period in the remaining 16 days (768 ISPs);
  - Total revenue in June is in the month which is 561.92 € or £.

Capacity Payments and Charges

- Capacity Charge:
  - This is a charge to recover the costs of the Capacity Payments for Capacity Market Units;
  - It is based on a tariff calculated by considering total Capacity Payments and year ahead demand forecasts;
  - This tariff is then applied against a Supplier Unit's net metered demand, in a pre-defined subset of Imbalance Settlement Periods;
  - Since Storage units are Generator Units, not Supplier Units, these charges do not apply to them;
  - Charges only apply to Trading Site Supplier Units if the Trading Site is net importing.

Capacity Payments and Charges

- Capacity Charge:

$$CCC_{v\gamma} = QMLF_{v\gamma} \times FQMCC_{\gamma} \times PCCSUP_{y}$$

  - QMLF is net demand for the Supplier Unit;
  - PCCSUP is the tariff calculated by the MO to recover the money required for Capacity Payments;

Capacity Payments and Charges

- Capacity Charge:

$$CCC_{v\gamma} = QMLF_{v\gamma} \times FQMCC_{\gamma} \times PCCSUP_{y}$$

  - QMLF is net demand for the Supplier Unit;
  - PCCSUP is the tariff calculated by the MO to recover the money required for Capacity Payments;
  - FQMCC is a factor which determines the periods in which the charge applies:
    - If a value of zero, charge doesn't apply;
    - If a value of one, charge applies.

Capacity Payments and Charges

- Capacity Charge for TSSUs:

$$CCC_{v\gamma} = Min\left(\sum_{u \in s} QMLF_{u\gamma} + \sum_{v \in s} QMLF_{v\gamma}, 0\right) \times FQMCC_{\gamma} \times PCCSUP_{y}$$

  - Sum over all metered quantities on the Trading Site;

Capacity Payments and Charges

- Capacity Charge for TSSUs:

$$CCC_{v\gamma} = Min\left(\sum_{u \in s} QMLF_{u\gamma} + \sum_{v \in s} QMLF_{v\gamma}, 0\right) \times FQMCC_{\gamma} \times PCCSUP_{y}$$

  - Sum over all metered quantities on the Trading Site;
  - Determine if the site is net importing or net exporting;

Capacity Payments and Charges

- Capacity Charge for TSSUs:

$$CCC_{v\gamma} = Min\left(\sum_{u \in s} QMLF_{u\gamma} + \sum_{v \in s} QMLF_{v\gamma}, 0\right) \times FQMCC_{\gamma} \times PCCSUP_{y}$$

  - Sum over all metered quantities on the Trading Site;
  - Determine if the site is net importing or net exporting;
  - If the site is net importing (i.e. the value of the sum is negative), in a period where FQMCC is non-zero, then Capacity Charges apply at PCCSUP.

Topic 3: Strike Price

Strike Price

- Strike Price:
  - This is the price which determines whether Difference Charges and Difference Payments are to be calculated;
  - If the market reference price exceeds this price, charges and payments for those volumes exposed and eligible are to be calculated;
  - Determined monthly based inputs for DSU prices and fuel cost of an inefficient oil or gas plant.

Strike Price

- Strike Price:

$$PSTR_m = Max\left(\frac{1}{FTHEORYPU_y} \times Max\left(PFUELNG_m + \left(PCARBON_m \times FCARBONING_y\right), PFUELO_m + \left(PCARBON_m \times FCARBONIO_y\right)\right), PTHEORYDSU_y\right)$$

- Want the maximum of the resulting prices using the oil reference fuel price and natural gas reference fuel price;

Strike Price

- Strike Price:

$$PSTR_m = Max\left(\frac{1}{FTHEORYPU_y} \times Max\left(PFUELNG_m + \left(PCARBON_m \times FCARBONING_y\right), PFUELO_m + \left(PCARBON_m \times FCARBONIO_y\right)\right), PTHEORYDSU_y\right)$$

- Want the maximum of the resulting prices using the oil reference fuel price and natural gas reference fuel price;
- Include carbon cost of fuel using carbon reference price and carbon intensity factors;

Strike Price

- Strike Price:

$$PSTR_m = Max\left(\frac{1}{FTHEORYPU_y} \times Max\left(PFUELNG_m + \left(PCARBON_m \times FCARBONING_y\right), PFUELO_m + \left(PCARBON_m \times FCARBONIO_y\right)\right), PTHEORYDSU_y\right)$$

- Want the maximum of the resulting prices using the oil reference fuel price and natural gas reference fuel price;
- Include carbon cost of fuel using carbon reference price and carbon intensity factors;
- Calculate the price an inefficient unit with the higher priced fuel would bid into the market by including the efficiency;

Strike Price

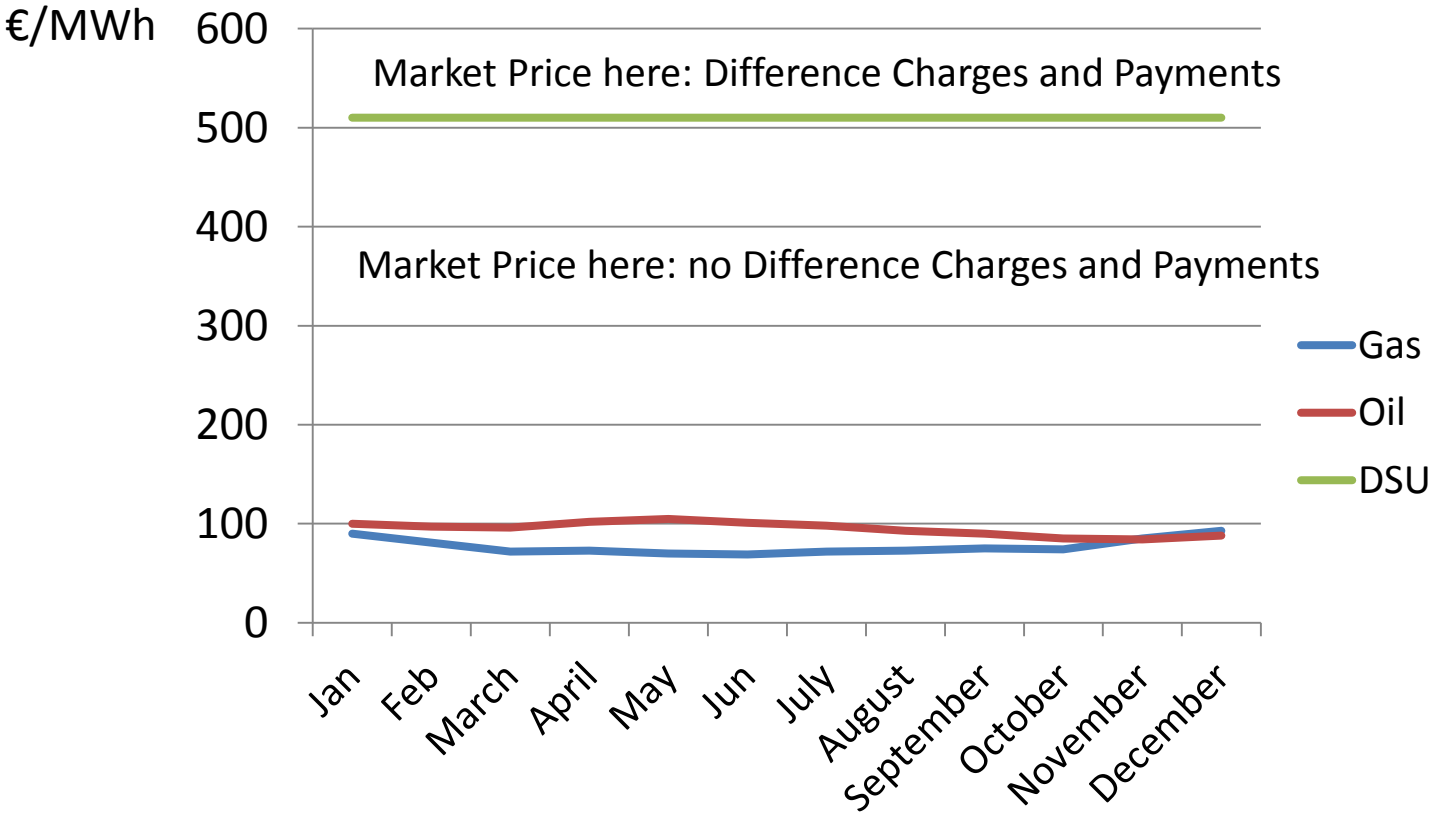
- Strike Price:

$$PSTR_m = Max\left(\frac{1}{FTHEORYPU_y} \times Max\left(PFUELNG_m + \left(PCARBON_m \times FCARBONING_y\right), PFUELO_m + \left(PCARBON_m \times FCARBONIO_y\right)\right), PTHEORYDSU_y\right)$$

- Want the maximum of the resulting prices using the oil reference fuel price and natural gas reference fuel price;
- Include carbon cost of fuel using carbon reference price and carbon intensity factors;
- Take the highest price of these, and calculate the price an inefficient unit with that fuel would bid into the market by including the efficiency;
- If higher, take a theoretical DSU market bid price, RA parameter.

Strike Price

Example:



Topic 4: Load Following Obligated Capacity Quantity

Load Following Obligated Capacity Quantity

- The Obligated Capacity Quantity is the amount of Capacity which needs to be provided in energy markets in each Imbalance Settlement Period;
- This is the quantity up to which Differences Charges apply:
  - If this amount is provided through energy market trades, then the “obligation” is met and exposure to Non-Performance Difference Charges is prevented;
  - Difference charges in market timeframes only apply up to this value, for trades above that the Participant retains their energy market revenue.
- It is calculated based on every Contract Register Entry active in the Imbalance Settlement Period:
  - The net of all Capacity Quantities is taken, meaning Secondary Trading can increase or reduce the Capacity Market Unit’s obligation over the period it is active.
- The obligation for each CMU and Imbalance Settlement Period is scaled down by load and by capacity not participating in Capacity Market;
- The obligation is also capped by the CMU’s de-rated capacity, or Commissioned Capacity if allowed to secondary trade up to that level.

Load Following Obligated Capacity Quantity

- Capacity Quantity Scaling Factor (FSQC):
  - This factor reduces every CMU's obligation to trade in the energy markets in line with reduction in demand;
  - It also reduces obligations in line with capacity provided by units which are not participating in the Capacity Market;
  - Since the reduction is only intended to cover those two elements, any reserve requirement included in the demand curve for a Capacity Auction needs to be explicitly taken into account;
  - The scaling factor cannot exceed value of 1 (i.e. cannot increase obligation above the net Awarded Capacity held by the CMU);
  - The adjustment due to non-participating capacity is not constant, it scales down with decreasing load along with other capacity:
    - i.e. assumes that non-participating capacity is not constantly available, at some stage their contribution and impact on reducing the obligations of others is "depleted".

Load Following Obligated Capacity Quantity

- The factor calculation includes the following elements:
  - The Capacity Requirement;
    - Conceptually, this only takes peak demand into account.
  - The sum of all Awarded Capacity active in the period:
    - Conceptually, this takes peak demand and any adjustments due to reserve requirements and plant not participating in the Capacity Market into account.
  - The sum of all metered demand in the period;
    - Conceptually, this only takes demand into account.

Load Following Obligated Capacity Quantity

$$FSQC_{\gamma} = Min\left(\frac{\left|\sum_{v} Min\left(QMLF_{v\gamma}, 0\right)\right| + \left(qCREQAR_{y} \times DISP\right)}{\sum_{\Omega}\sum_{n \in \gamma, qCCOMMISS \neq 0}\left(qCLF_{\Omega n}\right) \times DISP}, \frac{\sum_{\Omega}\sum_{n \in \gamma, qCCOMMISS \neq 0}\left(qCLF_{\Omega n}\right) \times DISP}{qCREQ_{y} \times DISP}, 1\right)$$

- Second item in function:
  - The sum of all Capacity Quantities (qCLF), i.e. all Awarded Capacity active in that period of the Capacity Year, implicitly includes adjustment to the capacity auction demand curves due to reserve and non-participating capacity;

Load Following Obligated Capacity Quantity

$$FSQC_{\gamma} = Min\left(\frac{\left|\sum_{v} Min\left(QMLF_{v\gamma}, 0\right)\right| + \left(qCREQAR_{y} \times DISP\right)}{\sum_{\Omega}\sum_{n \in \gamma, qCCOMMISS \neq 0}\left(qCLF_{\Omega n}\right) \times DISP}, \frac{\sum_{\Omega}\sum_{n \in \gamma, qCCOMMISS \neq 0}\left(qCLF_{\Omega n}\right) \times DISP}{qCREQ_{y} \times DISP}, 1\right)$$

- Second item in function:
  - The sum of all Capacity Quantities (qCLF), i.e. all Awarded Capacity active in that period of the Capacity Year, implicitly includes adjustment to the capacity auction demand curves due to reserve and non-participating capacity;
  - Dividing by the Capacity Requirement (qCREQ) creates a constant scaling factor for non-participating capacity, until demand reduces to a level where it is no longer being met by this non-participating capacity.

Load Following Obligated Capacity Quantity

$$FSQC_{\gamma} = Min\left(\frac{\left|\sum_{v} Min\left(QMLF_{v\gamma}, 0\right)\right| + \left(qCREQAR_{y} \times DISP\right)}{\sum_{\Omega}\sum_{n \in \gamma, qCCOMMISS \neq 0}\left(qCLF_{\Omega n}\right) \times DISP}, \frac{\sum_{\Omega}\sum_{n \in \gamma, qCCOMMISS \neq 0}\left(qCLF_{\Omega n}\right) \times DISP}{qCREQ_{y} \times DISP}, 1\right)$$

- First item in function:
  - Because the sum of all supplier demand in the numerator only takes demand into account, but the denominator of the sum of all Capacity Quantities takes demand, reserve and non-participating capacity into account, the numerator must have the reserve component added to it, so that obligations are scaled only for non-participating capacity and for demand;
  - The numerator only takes the constant reserve requirement adjustment into account as this part of the function is intended to reflect when the component for non-participating capacity has been "depleted";
  - This creates a variable scaling reflecting the relationship between demand and the amount of capacity required to cover it, means less capacity is required to meet less demand.

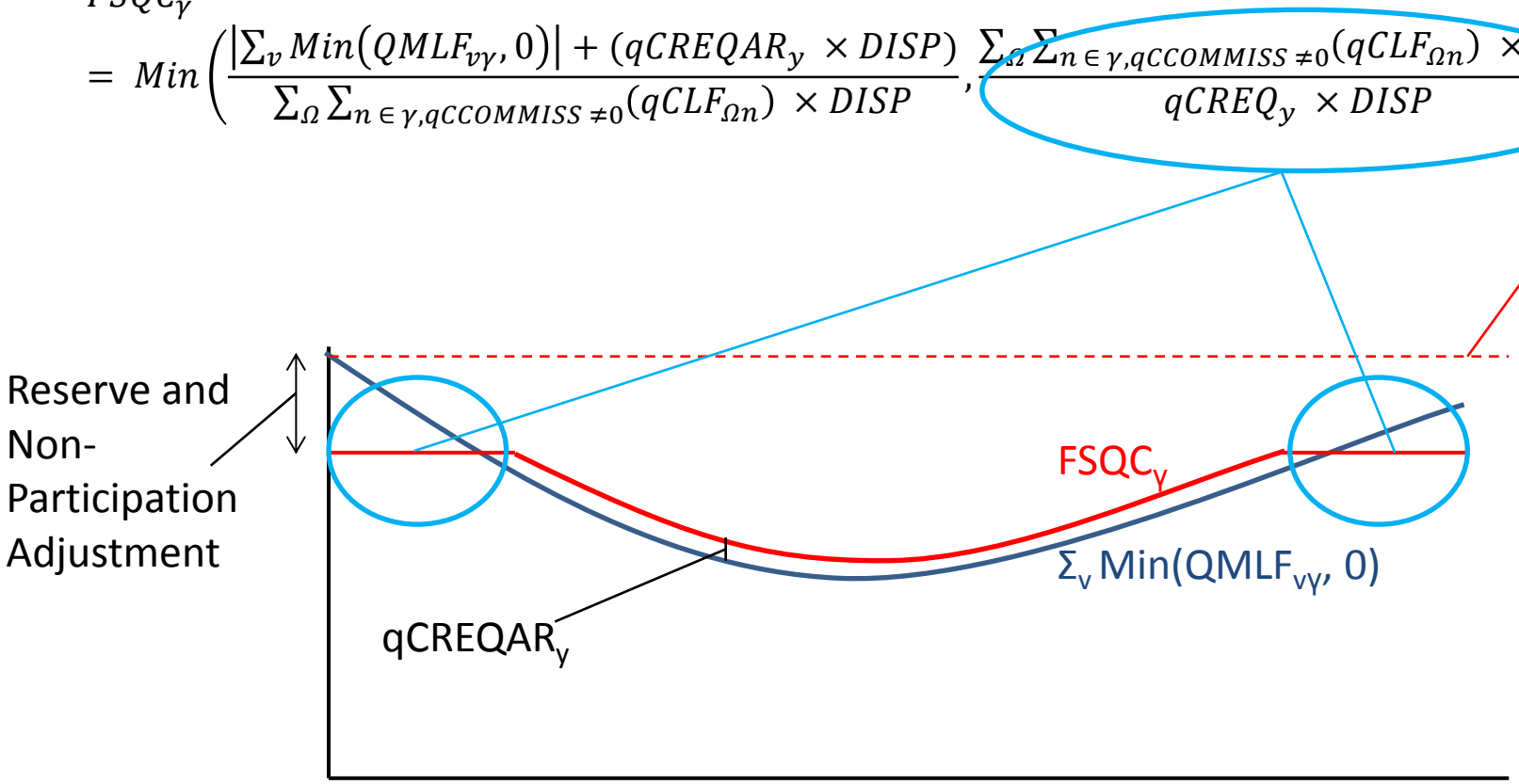
Load Following Obligated Capacity Quantity

$$FSQC_{\gamma} = Min\left(\frac{\left|\sum_{v} Min\left(QMLF_{v\gamma}, 0\right)\right| + \left(qCREQAR_{y} \times DISP\right)}{\sum_{\Omega}\sum_{n \in \gamma, qCCOMMISS \neq 0}\left(qCLF_{\Omega n}\right) \times DISP}, \frac{\sum_{\Omega}\sum_{n \in \gamma, qCCOMMISS \neq 0}\left(qCLF_{\Omega n}\right) \times DISP}{qCREQ_{y} \times DISP}, 1\right)$$

- Last item in function:
  - Cap value at 1, so that no matter the result of the inputs, a CMU's obligation cannot be greater than its Net Capacity Quantity.

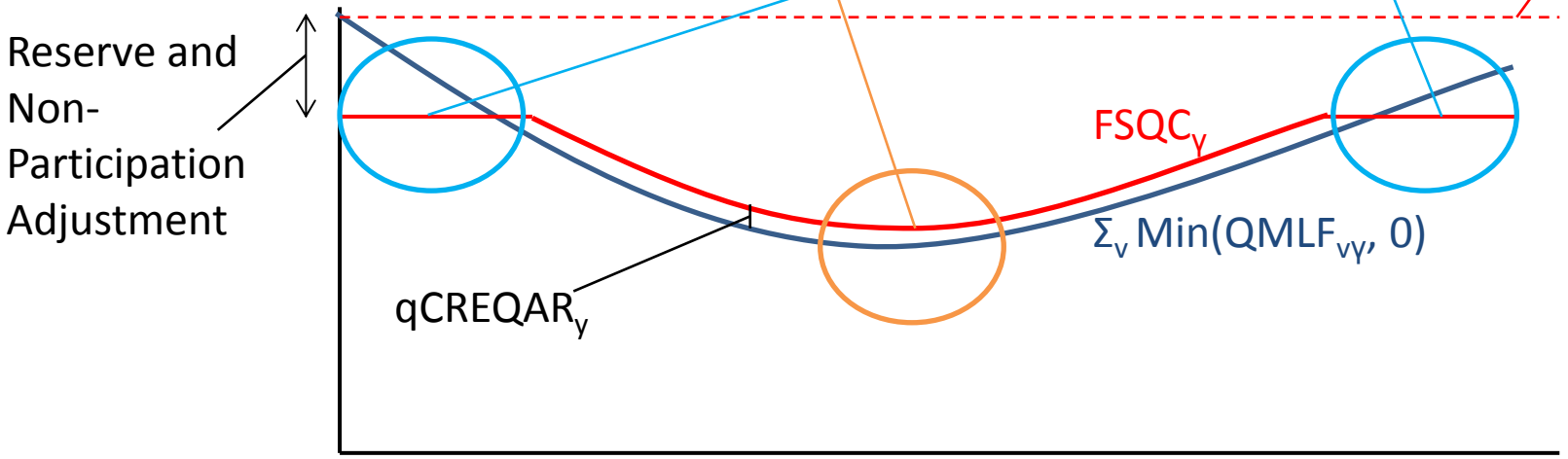
Load Following Obligated Capacity Quantity

$$FSQC_{\gamma} = Min\left(\frac{\left|\sum_{v} Min\left(QMLF_{v\gamma}, 0\right)\right| + \left(qCREQAR_{y} \times DISP\right)}{\sum_{\Omega}\sum_{n \in \gamma, qCCOMMISS \neq 0}\left(qCLF_{\Omega n}\right) \times DISP}, \frac{\sum_{\Omega}\sum_{n \in \gamma, qCCOMMISS \neq 0}\left(qCLF_{\Omega n}\right) \times DISP}{qCREQ_{y} \times DISP}, 1\right)$$



Load Following Obligated Capacity Quantity

$$FSQC_{\gamma} = Min\left(\frac{\left|\sum_{v} Min\left(QMLF_{v\gamma}, 0\right)\right| + \left(qCREQAR_{y} \times DISP\right)}{\sum_{\Omega}\sum_{n \in \gamma, qCCOMMISS \neq 0}\left(qCLF_{\Omega n}\right) \times DISP}, \frac{\sum_{\Omega}\sum_{n \in \gamma, qCCOMMISS \neq 0}\left(qCLF_{\Omega n}\right) \times DISP}{qCREQ_{y} \times DISP}, 1\right)$$



Load Following Obligated Capacity Quantity

- Example:
  - Say the Capacity Requirement (qCREQ) determined by the SOs was 7,200MW;
  - Say the capacity cleared in the Capacity Auctions for the Capacity Year (after loss adjustments, the sum of all qC) was 7,000MW. this is less than the requirement possibly because of adjustments from capacity requirement for the auction demand curve for non-participating wind capacity or economic reasons, assuming that there is no adjustment for reserve (qCREQAR = 0MW);
  - Say that instantaneous demand in a particular Imbalance Settlement Period is 6000MW, this would be appear on meters as a sum of all QMLF of -3000MWh

$$FSQC_\gamma = Min\left(\frac{|-3000| + (0 \times 0.5)}{7000 \times 0.5}, \frac{7000 \times 0.5}{7200 \times 0.5}, 1\right) = \frac{6}{7} \approx 0.857$$

Load Following Obligated Capacity Quantity

- Capacity Requirement and Auctions do not include losses:
  - These are expected to be “at the station gate”;
  - CMUs do not have to take losses into account when submitting into Capacity Auction, for payments or for obligation to deliver.
- There are no loss adjustments in Capacity Payments – these are paid as awarded;
- Trade quantities in the energy markets include losses:
  - Day-ahead and intraday bids and offers are considered “at the trading boundary” and need to have losses incorporated, and balancing quantities are adjusted for losses;
  - To compare like-with-like for Difference Charges, Capacity Quantities also need to be loss-adjusted when calculating the obligation.
- Combined Loss Adjustment Factor (FCLAF) of the Generator Units or Interconnector represented by the CMU are taken;
- If multiple units aggregated under one CMU, then a Registered Capacity-weighted average of their loss factors is taken.

Load Following Obligated Capacity Quantity

- Capacity Market Unit Loss Factors:

$$If \sum_{u \in \Omega} qCR_u \neq 0, then$$

$$FCLAF_{\Omega\gamma} = \frac{\sum_{u \in \Omega} FCLAF_{u\gamma} \times qCR_u}{\sum_{u \in \Omega} qCR_u}$$

$$Else$$

$$FCLAF_{\Omega\gamma} = Max\left(\left\{FCLAF_{u\gamma}\right\} \forall\, u \in \Omega\right)$$

- Approach where Maximum is taken is applied to ensure there are no divide-by-zero circumstances which could arise.

Load Following Obligated Capacity Quantity

- Net Capacity Quantity:

$$QCNET_{\Omega\gamma} = \sum_{n \in \gamma} qCLF_{\Omega n} \times DISP$$

  - Applies Loss Factor to the Capacity Quantity;

Load Following Obligated Capacity Quantity

- Net Capacity Quantity:

$$QCNET_{\Omega\gamma} = \sum_{n \in \gamma} qCLF_{\Omega n} \times DISP$$

  - Applies Loss Factor to the Capacity Quantity;
  - Converts MW quantity to MWh quantity, energy quantity to compare with energy trade quantities;

Load Following Obligated Capacity Quantity

- Net Capacity Quantity:

$$QCNET_{\Omega\gamma} = \sum_{n \in \gamma} qCLF_{\Omega n} \times DISP$$

  - Applies Loss Factor to the Capacity Quantity;
  - Converts MW quantity to MWh quantity, energy quantity to compare with energy trade quantities;
  - A sum of these quantities over all Contract Register Entries for whom the Imbalance Settlement Period is within the entry's Start and End time.

Load Following Obligated Capacity Quantity

- The Obligated Capacity Quantity needs to be capped at the maximum physical capacity levels a CMU could be expected to deliver:
  - This reflects the fact that there may be forecast errors in the product load following factor, so that the unit may have sold an amount which they expected to be scaled down by the actual Capacity Quantity Scaling Factor to result in an obligation equal to their commissioned capacity in those periods where it is allowed to trade to that level, or their de-rated capacity in all other periods;
  - However if the outturn scaling factor results in an obligation which is greater than their commissioned capacity (or de-rated capacity), then there is no way they can physically deliver this (or they would not be expected to deliver this).
- Which cap should apply to the obligation (de-rated capacity or commissioned capacity) depends on whether unit is allowed to secondary trade above its Gross De-Rated Capacity (Total).

Load Following Obligated Capacity Quantity

- The different caps for different Secondary Trading circumstances is enacted through the calculation of the Above De-Rated Capacity Factor (FCADERATE):
  - This factor uses the Gross De-Rated Capacity Quantity (Total);
  - The Secondary Trading system will have functionality to allow trading above Gross De-Rated Capacity (Total) in the appropriate circumstances, so in settlement it can be determined if the unit was allowed by checking if its Net Capacity Quantity is greater than its Gross De-Rated Capacity (Total);
  - If the unit was allowed trade above in secondary trading (QCNET > qCDERATEGLF x DISP), then the Obligated Capacity Quantity should be limited to the Commissioned Capacity (by setting FCADERATE = 1).
  - If the unit was not allowed trade above in secondary trading (QCNET ≤ qCDERATEGLF x DISP), then the Obligated Capacity Quantity should be limited to the de-rated Commissioned Capacity (by setting FCADERATE = FDERATE).

Load Following Obligated Capacity Quantity

- Obligated Capacity Quantity:

$$QCOB_{\Omega\gamma} = Min\left(QCNET_{\Omega\gamma} \times FSQC_{\gamma}, qCCOMMISSLF_{\Omega\gamma} \times FDERATE_{\Omega} \times \frac{FCADERATE_{\Omega\gamma}}{FDERATE_{\Omega}} \times DISP\right)$$

  - Scales down Net Capacity Quantity by load-following Capacity Quantity Scaling Factor;

Load Following Obligated Capacity Quantity

- Obligated Capacity Quantity:

$$QCOB_{\Omega\gamma} = Min\left(QCNET_{\Omega\gamma} \times FSQC_{\gamma}, qCCOMMISSLF_{\Omega\gamma} \times FDERATE_{\Omega} \times \frac{FCADERATE_{\Omega\gamma}}{FDERATE_{\Omega}} \times DISP\right)$$

  - Scales down Net Capacity Quantity by load-following Capacity Quantity Scaling Factor;
  - Caps obligation by Commissioned Capacity Quantity:

Load Following Obligated Capacity Quantity

- Obligated Capacity Quantity:

$$QCOB_{\Omega\gamma} = Min\left(QCNET_{\Omega\gamma} \times FSQC_{\gamma}, qCCOMMISSLF_{\Omega\gamma} \times FDERATE_{\Omega} \times \frac{1}{FDERATE_{\Omega}} \times DISP\right)$$

  - Scales down Net Capacity Quantity by load-following Capacity Quantity Scaling Factor;
  - Caps obligation by Commissioned Capacity Quantity:
    - Full Commissioned Capacity if allowed trade above de-rated;

Load Following Obligated Capacity Quantity

- Obligated Capacity Quantity:

$$QCOB_{\Omega\gamma} = Min\left(QCNET_{\Omega\gamma} \times FSQC_{\gamma}, qCCOMMISSLF_{\Omega\gamma} \times FDERATE_{\Omega} \times \frac{FDERATE_{\Omega}}{FDERATE_{\Omega}} \times DISP\right)$$

  - Scales down Net Capacity Quantity by load-following Capacity Quantity Scaling Factor;
  - Caps obligation by Commissioned Capacity Quantity:
    - Full Commissioned Capacity if allowed trade above de-rated;
    - De-rated Commissioned Capacity if not allowed trade above.

Load Following Obligated Capacity Quantity

- Example Capacity and Trade Register entries for a single unit:

n	Ω	qC	P/S	Start	End	PCP	qCCOMMISS	FSLLA	FSLLB	XR
1	1	+70	P	01/08/2020	01/08/2021	100	80	1.5	0.75	1.1
2	1	-20	S	01/06/2021	07/06/2021	90	80	1.5	0.75	1
3	1	+10	S	08/06/2021	14/06/2021	110	80	1.5	0.75	0.9
…	…	…	…	…	…	…	…	…	…	…

- Assuming a loss factor of 1:
- QCNET for an Imbalance Settlement Period on 01/05/2021 would be 70 x 0.5 = 35MWh;
- QCNET for an Imbalance Settlement Period on 02/06/2021 would be (70 x 0.5) + (-20 x 0.5) = 25MWh;
- QCNET for an Imbalance Settlement Period on 09/06/202 would be (70 x 0.5) + (10 x 0.5) = 40MWh.

Load Following Obligated Capacity Quantity

- Example Capacity and Trade Register entries for a single unit:

n	Ω	qC	P/S	Start	End	PCP	qCCOMMISS	FSLLA	FSLLB	XR
1	1	+70	P	01/08/2020	01/08/2021	100	80	1.5	0.75	1.1
2	1	-20	S	01/06/2021	07/06/2021	90	80	1.5	0.75	1
3	1	+10	S	08/06/2021	14/06/2021	110	80	1.5	0.75	0.9
…	…	…	…	…	…	…	…	…	…	…

- Assuming FSQC = 6/7 from before, FDERATE = 0.875 and qCDERATEGLF = 70MW from register:
- QCOB for an Imbalance Settlement Period on 01/05/2021 would be Min(35 x (6/7), 70 x 0.875 x 0.5) = 30MWh;
- QCOB for an Imbalance Settlement Period on 02/06/2021 would be Min(25 x (6/7), 80 x 0.875 x 0.5) ≈ 21.43MWh;
- QCOB for an Imbalance Settlement Period on 09/06/2021 would be Min(40 x (6/7), 80 x 1 x 0.5) ≈ 34.29MWh.

Topic 5: Stop-Loss Limits

Stop-Loss Limits

- Annual limits are a multiple of annual revenue;
- Billing Period limits are a multiple of annual limits;
- Factors used depend on what was active at time the contract was awarded:
  - Could be different for T-1 or T-4 auction awarded capacity, primary vs secondary awarded capacity.
- Accumulated financial losses due to Difference Charges are considered on a unit basis:
  - The unit which incurred the loss retains the loss regardless of their activity in secondary trading.
- A unit's Stop-Loss Limits consider increases in revenue arising out of secondary trading:
  - Limits increase when additional awarded capacity is taken on through secondary trading;
  - Limits stay the same when awarded capacity is relinquished in secondary trading.
- Revenue calculation for secondary trades feeding into Stop-Loss Limits takes the maximum of the Capacity Payment Price for the secondary trade's Contract Register Entry, or the price of the first primary auction for the Capacity Year in question:
  - If based only on revenue, a unit could take on another's obligation without any exposure if the trade was cleared at a price of zero;
  - First primary auction price for the year acts as a proxy for the price of the primary auction in which the volume cleared, as it is not possible to actually track these primary prices with centralised auction based secondary trading mechanism;
  - Known in advance of year, can be taken into account in secondary trading bids and offers.

Stop-Loss Limits

- Annual Stop-Loss Limit:

$$CSLLA_{\Omega b} = \left(\sum_{\gamma \in b' \leq b} \left(\sum_{primary\ n \in \gamma, qCCOMMISS \neq 0} Max\left(qC_{\Omega n} \times PCP_{\Omega n} \times \frac{1}{ISPIY_y} \times FSLLA_n, 0 \right) \right.\right.$$
$$\left. + Max\left(\sum_{secondary\ n \in \gamma, qCCOMMISS \neq 0} \left(qC_{\Omega n} \times Max(PCP_{\Omega n}, PCPIPA_y) \times \frac{1}{ISPIY_y} \times FSLLA_n \right), 0 \right) \right)$$
$$+ \sum_{\gamma \in b' > b} \left(\sum_{primary\ n \in \gamma, qCCOMMISS \neq 0} Max\left(qC_{\Omega n} \times PCP_{\Omega n} \times \frac{1}{ISPIY_y} \times FSLLA_n, 0 \right) \right.$$
$$\left.\left. + Max\left(\sum_{secondary\ n \in \gamma, qCCOMMISS \neq 0} \left(qC_{\Omega n} \times Max(PCP_{\Omega n}, PCPIPA_y) \times \frac{1}{ISPIY_y} \times FSLLA_n \right), 0 \right) \right) \right)$$

Stop-Loss Limits

- Annual Stop-Loss Limit:

Past and Present Actual Revenue

$$CSLLA_{\Omega b} = \left(\sum_{\gamma \in b' \leq b} \left(\sum_{primary\ n \in \gamma, qCCOMMISS \neq 0} Max\left(qC_{\Omega n} \times PCP_{\Omega n} \times \frac{1}{ISPIY_y} \times FSLLA_n, 0 \right) \right. \right.$$
$$\left. + Max\left(\sum_{secondary\ n \in \gamma, qCCOMMISS \neq 0} \left(qC_{\Omega n} \times Max(PCP_{\Omega n}, PCPIPA_y) \times \frac{1}{ISPIY_y} \times FSLLA_n \right), 0 \right) \right)$$
$$+ \sum_{\gamma \in b' > b} \left(\sum_{primary\ n \in \gamma, qCCOMMISS \neq 0} Max\left(qC_{\Omega n} \times PCP_{\Omega n} \times \frac{1}{ISPIY_y} \times FSLLA_n, 0 \right) \right.$$
$$\left. \left. + Max\left(\sum_{secondary\ n \in \gamma, qCCOMMISS \neq 0} \left(qC_{\Omega n} \times Max(PCP_{\Omega n}, PCPIPA_y) \times \frac{1}{ISPIY_y} \times FSLLA_n \right), 0 \right) \right) \right)$$

Future Forecast Revenue

Stop-Loss Limits

- Annual Stop-Loss Limit:

Past and Present Actual Revenue

$$CSLLA_{\Omega b} = \left(\sum_{\gamma \in b' \leq b} \left(\sum_{primary\ n \in \gamma, qCCOMMISS \neq 0} Max\left(qC_{\Omega n} \times PCP_{\Omega n} \times \frac{1}{ISPIY_y} \times FSLLA_n, 0 \right) \right. \right.$$
$$\left. + Max\left(\sum_{secondary\ n \in \gamma, qCCOMMISS \neq 0} \left(qC_{\Omega n} \times Max(PCP_{\Omega n}, PCPIPA_y) \times \frac{1}{ISPIY_y} \times FSLLA_n \right), 0 \right) \right)$$
$$+ \sum_{\gamma \in b' > b} \left(\sum_{primary\ n \in \gamma, qCCOMMISS \neq 0} Max\left(qC_{\Omega n} \times PCP_{\Omega n} \times \frac{1}{ISPIY_y} \times FSLLA_n, 0 \right) \right.$$
$$\left. \left. + Max\left(\sum_{secondary\ n \in \gamma, qCCOMMISS \neq 0} \left(qC_{\Omega n} \times Max(PCP_{\Omega n}, PCPIPA_y) \times \frac{1}{ISPIY_y} \times FSLLA_n \right), 0 \right) \right) \right)$$

Positive Primary Revenue

Future Forecast Revenue

Stop-Loss Limits

- Annual Stop-Loss Limit:

Past and Present Actual Revenue

$$CSLLA_{\Omega b} = \left(\sum_{\gamma \in b' \leq b} \left(\sum_{primary\ n \in \gamma, qCCOMMISS \neq 0} Max\left(qC_{\Omega n} \times PCP_{\Omega n} \times \frac{1}{ISPIY_y} \times FSLLA_n, 0 \right) + Max\left(\sum_{secondary\ n \in \gamma, qCCOMMISS \neq 0} \left(qC_{\Omega n} \times Max(PCP_{\Omega n}, PCPIPA_y) \times \frac{1}{ISPIY_y} \times FSLLA_n \right), 0 \right) \right) + \sum_{\gamma \in b' > b} \left(\sum_{primary\ n \in \gamma, qCCOMMISS \neq 0} Max\left(qC_{\Omega n} \times PCP_{\Omega n} \times \frac{1}{ISPIY_y} \times FSLLA_n, 0 \right) + Max\left(\sum_{secondary\ n \in \gamma, qCCOMMISS \neq 0} \left(qC_{\Omega n} \times Max(PCP_{\Omega n}, PCPIPA_y) \times \frac{1}{ISPIY_y} \times FSLLA_n \right), 0 \right) \right) \right)$$

Positive Primary Revenue

Secondary Net Increase in Revenue with Max of Prices

Future Forecast Revenue

Stop-Loss Limits

- Billing Period Stop-Loss Limit:

Past and Present Actual Revenue

$$CSLLB_{\Omega b} = \left(\sum_{\gamma \in b' \leq b} \left(\sum_{primary\ n \in \gamma, qCCOMMISS \neq 0} Max\left(qC_{\Omega n} \times PCP_{\Omega n} \times \frac{1}{ISPIY_y} \times FSLLA_n, 0 \right) \right. \right.$$
$$\left. + Max\left(\sum_{secondary\ n \in \gamma, qCCOMMISS \neq 0} \left(qC_{\Omega n} \times Max\left(PCP_{\Omega n}, PCPIPA_y\right) \times \frac{1}{ISPIY_y} \times FSLLA_n \times FSLLB_n \right), 0 \right) \right)$$
$$+ \sum_{\gamma \in b' > b} \left(\sum_{primary\ n \in \gamma, qCCOMMISS \neq 0} Max\left(qC_{\Omega n} \times PCP_{\Omega n} \times \frac{1}{ISPIY_y} \times FSLLA_n, 0 \right) \right)$$
$$+ Max\left(\sum_{secondary\ n \in \gamma, qCCOMMISS \neq 0} \left(qC_{\Omega n} \times Max\left(PCP_{\Omega n}, PCPIPA_y\right) \times \frac{1}{ISPIY_y} \times FSLLA_n \times FSLLB_n \right), 0 \right) \right)$$

Future Forecast Revenue

Positive Primary Revenue

Secondary Net Increase in Revenue with Max of Prices

For Billing Period Stop Loss Limit, just include extra multiplier

Stop-Loss Limits

- Example Capacity and Trade Register entries for a single unit:

n	Ω	qC	P/S	Start	End	PCP	qCCOMMISS	FSLLA	FSLLB	XR
1	1	+70	P	01/08/2020	01/08/2021	100	80	1.5	0.75	1.1
2	1	-20	S	01/06/2021	07/06/2021	90	80	1.5	0.75	1
3	1	+10	S	08/06/2021	14/06/2021	110	80	1.5	0.75	0.9
…	…	…	…	…	…	…	…	…	…	…

- In this example, assuming there were no other primary Capacity Auctions carried out for that year, $PCPIPA_y$ would be = 100;
- The total Stop-Loss Limit for this unit, on the basis of the known trades which are those above, would consider the revenue from n = 1 being active for the whole year, and n = 2 and n = 3 being active for a week each.

Stop-Loss Limits

- Example Capacity and Trade Register entries for a single unit:

n	Ω	qC	P/S	Start	End	PCP	qCCOMMISS	FSLLA	FSLLB	XR
1	1	+70	P	01/08/2020	01/08/2021	100	80	1.5	0.75	1.1
2	1	-20	S	01/06/2021	07/06/2021	90	80	1.5	0.75	1
3	1	+10	S	08/06/2021	14/06/2021	110	80	1.5	0.75	0.9
…	…	…	…	…	…	…	…	…	…	…

- For n = 1, Max(70 x 100 x [1/17520] x 1.5, 0) for the whole year = 10,500 € or £;
- For n = 2, Max(-20 x Max(90, 100) x [1/17520] x 1.5, 0) for one week out of the year = 0 € or £;
- For n = 3, Max(10 x Max(110, 100) x [1/17520] x 1.5, 0) for one week out of the year = 31.73 € or £;
- Total Annual Stop-Loss Limit is 10,531.73 € or £.

Topic 6: Market Difference Payments and Difference Charges

Market Difference Payments and Difference Charges

- All markets are reference markets, i.e. CMUs can meet capacity obligation with, and Suppliers can be hedged against prices in:
  - Traded quantities in the Day-ahead Market (charges and payments);
  - Traded quantities in the Intraday Market (charges and payments);
  - Accepted quantities in Balancing Market (charges only);
  - Provision of certain reserve system services (charges only);
  - Imbalances (payments only).
- The complexity in the settlement algebra is trying to implement the following philosophies:
  - Don't expose / make eligible the same quantity multiple times, only once;
  - Where the quantity is traded first is where it is exposed / eligible;
  - The reference price is the price associated with the traded quantity;
  - Only charge for quantities selling power, only pay for quantities buying power;
  - If a trade increases the unit's balancing obligation (i.e. they have to provide more energy), it should reduce their remaining capacity obligation (i.e. that amount would not be seen as non-performance), and vice versa (i.e. if they trade out of an energy position so that they have to provide less energy, this amount would be seen as non-performance).

Market Difference Payments and Difference Charges

- The principles are implemented in a mechanism which can be explained with the following three step iterative process, looking at each trade in order of acceptance:

1. Calculate the quantity of that trade which is to be exposed to Difference Charges / eligible for Difference Payments, considering:
   A. Tracking variables (has this quantity been traded before? If so, don't expose it / make it eligible again);
   B. Capping variables (will this quantity be traded back again in future trades, or has the unit met its obligation already? If so, don't expose it / make it eligible).
2. Calculate the Difference Charge or Difference Payment for that exposed / eligible quantity if the trade price is above the strike price;
3. Update the tracking variables to account for changes to capacity obligations having been met, or amount of consumption hedged, by this trade.

- Repeat the three steps with each trade, until there are no trades left.

- Quantities from each Generator Unit represented by the CMU are considered together to meet the CMU's obligations.

Market Difference Payments and Difference Charges

- Day-ahead Difference Quantity:

$$QDIFFDA_{\Omega\gamma} = Min\left(\sum_{u \in \Omega}\sum_{x} qTDA_{xuh} \times Min(DTDA_x, DISP), QCOB_{\Omega\gamma}, \sum_{u \in \Omega} QEX_{u\gamma}\right)$$

- Day-ahead Difference Charge:

$$CDIFFCDA_{\Omega\gamma} = Max\left(QDIFFDA_{\Omega\gamma}, 0\right) \times Min(0, PSTR_m - PTDA_{xuh})$$

- The Day-ahead Difference Quantity is the quantity which is exposed to difference charges at the Day-ahead Market Price;
- Calculate how much of the Day-ahead Trade Quantity is in the Imbalance Settlement Period, and convert from MW to MWh.

Market Difference Payments and Difference Charges

- Day-ahead Difference Quantity:

$$QDIFFDA_{\Omega\gamma} = Min\left(\sum_{u \in \Omega}\sum_{x} qTDA_{xuh} \times Min(DTDA_x, DISP), QCOB_{\Omega\gamma}, \sum_{u \in \Omega} QEX_{u\gamma}\right)$$

- Day-ahead Difference Charge:

$$CDIFFCDA_{\Omega\gamma} = Max\left(QDIFFDA_{\Omega\gamma}, 0\right) \times Min(0, PSTR_m - PTDA_{xuh})$$

- Capacity Market Units are only exposed to paying Difference Charges up to their Obligated Capacity Quantity, therefore if the amount they have traded is greater than this amount, cap the Day-ahead Difference Quantity at their Obligated Capacity Quantity.

Market Difference Payments and Difference Charges

- Day-ahead Difference Quantity:

$$QDIFFDA_{\Omega\gamma} = Min\left(\sum_{u \in \Omega}\sum_{x} qTDA_{xuh} \times Min(DTDA_x, DISP), QCOB_{\Omega\gamma}, \sum_{u \in \Omega} QEX_{u\gamma}\right)$$

- Day-ahead Difference Charge:

$$CDIFFCDA_{\Omega\gamma} = Max\left(QDIFFDA_{\Omega\gamma}, 0\right) \times Min(0, PSTR_m - PTDA_{xuh})$$

- If the Capacity Market Unit eventually trades out of the energy position it gains through this day-ahead market trade, that should be treated as a Non-Performance Difference Quantity. This would mean that it should be exposed to Difference Charges at the Imbalance Settlement Price. In order to ensure that the unit is not exposed to Difference Charges at both the Day-ahead Market Price and the Imbalance Settlement Price for the same capacity, the amount exposed day-ahead is capped at the net traded position (Ex-ante Quantity).

Market Difference Payments and Difference Charges

- Day-ahead Difference Quantity:

$$QDIFFDA_{\Omega\gamma} = Min\left(\sum_{u \in \Omega}\sum_{x} qTDA_{xuh} \times Min(DTDA_x, DISP), QCOB_{\Omega\gamma}, \sum_{u \in \Omega} QEX_{u\gamma}\right)$$

- Day-ahead Difference Charge:

$$CDIFFCDA_{\Omega\gamma} = Max\left(QDIFFDA_{\Omega\gamma}, 0\right) \times Min(0, PSTR_m - PTDA_{xuh})$$

- Once the quantity exposed has been calculated, the charge, if applicable, can be calculated. Difference Charges only apply to positive trades (i.e. trades to sell power), therefore remove any negative quantities.

Market Difference Payments and Difference Charges

- Day-ahead Difference Quantity:

$$QDIFFDA_{\Omega\gamma} = Min\left(\sum_{u \in \Omega}\sum_{x} qTDA_{xuh} \times Min(DTDA_x, DISP), QCOB_{\Omega\gamma}, \sum_{u \in \Omega} QEX_{u\gamma}\right)$$

- Day-ahead Difference Charge:

$$CDIFFCDA_{\Omega\gamma} = Max\left(QDIFFDA_{\Omega\gamma}, 0\right) \times Min(0, PSTR_m - PTDA_{xuh})$$

- The Difference Charge is at the difference between the market reference price (in this case the Day-ahead Trade Price) and the Strike Price…

Market Difference Payments and Difference Charges

- Day-ahead Difference Quantity:

$$QDIFFDA_{\Omega\gamma} = Min\left(\sum_{u \in \Omega}\sum_{x} qTDA_{xuh} \times Min(DTDA_x, DISP), QCOB_{\Omega\gamma}, \sum_{u \in \Omega} QEX_{u\gamma}\right)$$

- Day-ahead Difference Charge:

$$CDIFFCDA_{\Omega\gamma} = Max\left(QDIFFDA_{\Omega\gamma}, 0\right) \times Min(0, PSTR_m - PTDA_{xuh})$$

- …however it only applies when the market reference price exceeds the Strike Price. When this happens, a negative value will result and a charge can be calculated from the positive quantity exposed, and the negative difference in the price. When the market reference price is less than the Strike Price, this will result in the exposed quantity being multiplied by zero.

Market Difference Payments and Difference Charges

- Because Intraday and Balancing trade quantities can be cleared / accepted over the same timescale for the same period, they are considered together in “Within-day” Difference Charges to ensure the order of their acceptance is correctly applied in determining which trade should be exposed to Difference Charges.
- A ranked set is created, where all Intraday and Balancing Market quantities are placed in order of time they were accepted;
- Since Balancing Market Quantities are calculated based on Final Physical Notification which should be updated by Participants to reflect Intraday Market trades, and biased quantities are removed from Balancing Market Quantities into account, it is ensured that there is no double-counting of capacity in balancing and intraday, and the trade quantity reflecting the capacity should appear in the ranked set in the correct order of where the trade was finalised.

Market Difference Payments and Difference Charges

- Intraday quantities are calculated similar to Day-ahead quantities: how much of the Intraday Trade Quantity is in the Imbalance Settlement Period is calculated, and converted from MW to MWh, with its trade price as the reference price:

$$QTID_{u\gamma k} = qTID_{xuhk} \times Min(DTID_x, DISP)$$
$$PTID_{u\gamma k} = PTID_{xuhk}$$

Market Difference Payments and Difference Charges

- Balancing Market Quantities are adjusted for the following:
  - Quantities which have already been traded in other market trades:
    - Subtract Biased Quantities (to ensure against double counting from ex-ante market trades);
    - Subtract Trade Opposite TSO quantities if applicable (TOTSO quantities are considered as an imbalance at the Imbalance Settlement Price rather than an Accepted Offer at the Bid Offer Price);
    - Subtract Offer Price Only (by definition if the offer is appearing as an Offer Price Only quantity then it has already been traded, as Offer Price Only quantities are for an undo of a previous order);
  - Only care for positive quantities, charges only on trades in direction of Obligated Capacity Quantity:
    - To consider negative quantities would result in the TSO limiting the ability for a participant to meet their capacity requirement when dispatching down for reserve and other system services.
  - Ignore all negative BM quantities in Difference Quantity tracker (i.e. take QTB = QABLF' = 0 in all cases of Accepted Bids). This means that if a unit is dispatched down for reserve, for example, this does not count against them meeting their obligations through ex-ante

Market Difference Payments and Difference Charges

- Calculate the Balancing Trade Quantities for Accepted Offers as follows:

$$QTB_{u\gamma k} = QAOLF'_{uoi\gamma}$$
$$= QAOLF_{uoi\gamma} - Max\left(QAOOPOLF_{uoi\gamma}, QAOBIAS_{uoi\gamma}, QAOTOTSOLF_{uoi\gamma}\right)$$

- The Market Reference Price is the one used to settle the trade quantity, for Accepted Offers this is the higher of their Bid Offer Price and the Imbalance Price:

$$PTB_{u\gamma k} = Min\left(PBO_{uoi\gamma}, PIMB_{\gamma}\right)$$

Market Difference Payments and Difference Charges

- **Within-day Trade Difference Quantity:**

$$If\ the\ quantity\ at\ position, k, is\ QTID_{u\gamma k} > 0, then$$

$$QDIFFCTWD_{\Omega\gamma k} = Min\left(\sum_{u \in \Omega} QEX_{u\gamma} - QDIFFTRACKID_{\Omega\gamma(k-1)}, QCOB_{\Omega\gamma} - QDIFFTRACKB_{\Omega\gamma(k-1)}, QDIFFDA_{\Omega\gamma} + \sum_{k'<k} QTID_{u\gamma k} + \sum_{k'<k} QTB_{u\gamma k} + QTID_{u\gamma k} - QDIFFTRACKB_{\Omega\gamma(k-1)}\right)$$

$$else\ if\ the\ quantity\ at\ position, k, is\ QTB_{u\gamma k} > 0, then$$

$$QDIFFCTWD_{\Omega\gamma k} = Min\left(QCOB_{\Omega\gamma} - QDIFFTRACKB_{\Omega\gamma(k-1)}, QDIFFDA_{\Omega\gamma} + \sum_{k'<k} QTID_{u\gamma k} + \sum_{k'<k} QTB_{u\gamma k} + QTB_{u\gamma k} - QDIFFTRACKB_{\Omega\gamma(k-1)}\right)$$

$$else$$

$$QDIFFCTWD_{\Omega\gamma k} = 0$$

- **Intraday Tracked Difference Quantity:**

$$QDIFFTRACKID_{\Omega\gamma k} = Min\left(Max\left(QDIFFTRACKID_{\Omega\gamma(k-1)}, QDIFFDA_{\Omega\gamma} + \sum_{k' \le k} QTID_{u\gamma k}\right), QCOB_{\Omega\gamma}, \sum_{u \in \Omega} QEX_{u\gamma}\right)$$

- **Balancing Tracked Difference Quantity:**

$$QDIFFTRACKB_{\Omega\gamma k} = Min\left(Max\left(QDIFFTRACKB_{\Omega\gamma(k-1)}, Min\left(QDIFFDA_{\Omega\gamma} + \sum_{k' \le k} QTID_{u\gamma k}, \sum_{u \in \Omega} QEX_{u\gamma}\right) + \sum_{k' \le k} QTB_{u\gamma k}\right), QCOB_{\Omega\gamma}\right)$$

Do everything on this slide for each position (trade) in the ranked set.

Market Difference Payments and Difference Charges

- Within-day Trade Difference Quantity (for Intraday Trades):

$$If\ the\ quantity\ at\ position, k, is\ QTID_{u\gamma k} > 0, then\ QDIFFCTWD_{\Omega\gamma k}$$

$$= Min\left(\sum_{u \in \Omega} QEX_{u\gamma} - QDIFFTRACKID_{\Omega\gamma(k-1)}, QCOB_{\Omega\gamma} - QDIFFTRACKB_{\Omega\gamma(k-1)}, QDIFFDA_{\Omega\gamma} + \sum_{k'<k} QTID_{u\gamma k} + \sum_{k'<k} QTB_{u\gamma k} + QTID_{u\gamma k} - QDIFFTRACKB_{\Omega\gamma(k-1)}\right)$$

- Sum of all trades prior to the one for whom the calculation is being carried out…

Market Difference Payments and Difference Charges

- Within-day Trade Difference Quantity (for Intraday Trades):

$$If\ the\ quantity\ at\ position, k, is\ QTID_{u\gamma k} > 0, then$$

$$QDIFFCTWD_{\Omega\gamma k} = Min\left(\sum_{u \in \Omega} QEX_{u\gamma} - QDIFFTRACKID_{\Omega\gamma(k-1)}, QCOB_{\Omega\gamma} - QDIFFTRACKB_{\Omega\gamma(k-1)}, QDIFFDA_{\Omega\gamma} + \sum_{k'<k} QTID_{u\gamma k} + \sum_{k'<k} QTB_{u\gamma k} + QTID_{u\gamma k} - QDIFFTRACKB_{\Omega\gamma(k-1)}\right)$$

- Sum of all trades prior to the one for whom the calculation is being carried out…
- …subtract the Tracked Difference Quantity prior to this point. This can be thought of as a "ratchet" of the maximum net energy position the unit has reached through trades up to this point. If this results in a negative number then it means that the unit previously traded out of its previous maximum energy position, and must have a positive trade equal to this negative amount and then more, before it increases its net energy position, and before difference charges will start to apply again…

Market Difference Payments and Difference Charges

- Within-day Trade Difference Quantity (for Intraday Trades):

$$If\ the\ quantity\ at\ position, k, is\ QTID_{u\gamma k} > 0, then$$

$$QDIFFCTWD_{\Omega\gamma k} = Min\left(\sum_{u \in \Omega} QEX_{u\gamma} - QDIFFTRACKID_{\Omega\gamma(k-1)}, QCOB_{\Omega\gamma} - QDIFFTRACKB_{\Omega\gamma(k-1)}, QDIFFDA_{\Omega\gamma} + \sum_{k'<k} QTID_{u\gamma k} + \sum_{k'<k} QTB_{u\gamma k} + QTID_{u\gamma k} - QDIFFTRACKB_{\Omega\gamma(k-1)}\right)$$

- …add the trade for whom the calculation is being carried out. If this results in a positive number, then difference charges may apply: the unit has increased its energy position, and the charge is applied to the amount by which the trade increased the position, not the whole trade quantity. If this results in a negative number, this trade has not resulted in an increase in the unit's maximum energy position, and therefore difference charges should not apply.

Market Difference Payments and Difference Charges

- Within-day Trade Difference Quantity (for Intraday Trades):

$$If\ the\ quantity\ at\ position, k, is\ QTID_{u\gamma k} > 0, then$$

$$QDIFFCTWD_{\Omega\gamma k} = Min\left(\sum_{u \in \Omega} QEX_{u\gamma} - QDIFFTRACKID_{\Omega\gamma(k-1)}, QCOB_{\Omega\gamma} - QDIFFTRACKB_{\Omega\gamma(k-1)}, QDIFFDA_{\Omega\gamma} + \sum_{k'<k} QTID_{u\gamma k} + \sum_{k'<k} QTB_{u\gamma k} + QTID_{u\gamma k} - QDIFFTRACKB_{\Omega\gamma(k-1)}\right)$$

- The previous point will consider the amount of the trade quantity which increases the energy position of the unit to be that exposed to difference charges, however this may be the trade at which the unit reaches their Obligated Capacity Quantity. Quantities above the obligation should not be exposed to charges, therefore the difference between the maximum energy position the unit has reached up to this point and the unit's obligation is calculated, so that if this is less than the total increase in energy position due to the trade, only the amount up to the obligation, is taken for Difference Charges.

Market Difference Payments and Difference Charges

- Within-day Trade Difference Quantity (for Intraday Trades):

$$If\ the\ quantity\ at\ position, k, is\ QTID_{u\gamma k} > 0, then$$

$$QDIFFCTWD_{\Omega\gamma k} = Min\left(\sum_{u \in \Omega} QEX_{u\gamma} - QDIFFTRACKID_{\Omega\gamma(k-1)}, QCOB_{\Omega\gamma} - QDIFFTRACKB_{\Omega\gamma(k-1)}, QDIFFDA_{\Omega\gamma} + \sum_{k'<k} QTID_{u\gamma k} + \sum_{k'<k} QTB_{u\gamma k} + QTID_{u\gamma k} - QDIFFTRACKB_{\Omega\gamma(k-1)}\right)$$

- If a unit trades out of its energy position, that should be treated as a Non-Performance Difference Quantity. This would mean that it should be exposed to Difference Charges at the Imbalance Settlement Price. In order to ensure that the unit is not exposed to Difference Charges at both the Intraday Trade Price and the Imbalance Settlement Price for the same capacity, the amount exposed within-day is capped at the net traded position (Ex-ante Quantity). This considers a different tracker, the Intraday Tracked Quantity, which tracks the net energy position due to ex-ante trades in order to correctly apply this cap only to difference charges for ex-ante market trades – the unit could still be eligible for difference charges for balancing trades.

Market Difference Payments and Difference Charges

- Within-day Trade Difference Quantity (for Balancing Trades):

$$else\ if\ the\ quantity\ at\ position, k, is\ QTB_{u\gamma k} > 0, then$$

$$QDIFFCTWD_{\Omega\gamma k} = Min\left(QCOB_{\Omega\gamma} - QDIFFTRACKB_{\Omega\gamma(k-1)}, QDIFFDA_{\Omega\gamma} + \sum_{k'<k} QTID_{u\gamma k} + \sum_{k'<k} QTB_{u\gamma k} + QTB_{u\gamma k} - QDIFFTRACKB_{\Omega\gamma(k-1)}\right)$$

- Basically the same as for Intraday Trades (considers the amount by which the current Balancing Trade increases the net energy position up to the Obligated Capacity Quantity to be exposed to Difference Charges), except the cap due to the Ex-ante Quantity is removed;
- If neither case is true, e.g. if the quantity is less than or equal to zero, a value of zero is taken for QDIFFCTWD;
- This quantity is then used to calculate Difference Charges. Before the quantity to be exposed to difference charges for the next trade in the ranked set can be calculated, the tracker quantities need to be updated.

Market Difference Payments and Difference Charges

- Need two trackers: one to track the ex-ante trades only, to correctly apply the Ex-ante Quantity cap to ex-ante market trades which ensures the Non-Performance Difference Charge signal is maintained, and one to represent the net traded position in all markets to be considered as meeting the unit's capacity obligation;
- The starting value for both is the Day-ahead Difference Quantity, QDIFFDA.

Market Difference Payments and Difference Charges

- Intraday Tracked Difference Quantity:

$$QDIFFTRACKID_{\Omega\gamma k} = Min\left(Max\left(QDIFFTRACKID_{\Omega\gamma(k-1)}, QDIFFDA_{\Omega\gamma} + \sum_{k' \le k} QTID_{u\gamma k}\right), QCOB_{\Omega\gamma}, \sum_{u \in \Omega} QEX_{u\gamma}\right)$$

- Normally consider the sum of all ex-ante trade quantities up to and including this point as the net energy position so far;

Market Difference Payments and Difference Charges

- Intraday Tracked Difference Quantity:

$$QDIFFTRACKID_{\Omega\gamma k} = Min\left(Max\left(QDIFFTRACKID_{\Omega\gamma(k-1)}, QDIFFDA_{\Omega\gamma} + \sum_{k' \le k} QTID_{u\gamma k}\right), QCOB_{\Omega\gamma}, \sum_{u \in \Omega} QEX_{u\gamma}\right)$$

- Normally consider the sum of all ex-ante trade quantities up to and including this point as the net energy position so far;
- Also include the previous value of the tracker, and take this if it is higher. This means that the tracker variable will stay at the maximum value it has been up to this point, for example if a unit is trading out of its energy position, but when a subsequent trade increases the net energy position of the unit above this value, that becomes the new value for the tracker;
- This “ratchet” effect is used to ensure that capacity traded multiple times is not double-exposed – only when the value of the tracker increases will a charge be applicable.

Market Difference Payments and Difference Charges

- Intraday Tracked Difference Quantity:

$$QDIFFTRACKID_{\Omega\gamma k} = Min\left(Max\left(QDIFFTRACKID_{\Omega\gamma(k-1)}, QDIFFDA_{\Omega\gamma} + \sum_{k' \le k} QTID_{u\gamma k} \right), QCOB_{\Omega\gamma}, \sum_{u \in \Omega} QEX_{u\gamma} \right)$$

- As explained previously, charges should only apply up to the Obligated Capacity Quantity Once this value has been reached in the tracker, there is no need to track higher values, so the value is kept constant at QCOB;

Market Difference Payments and Difference Charges

- Intraday Tracked Difference Quantity:

$$QDIFFTRACKID_{\Omega\gamma k} = Min\left(Max\left(QDIFFTRACKID_{\Omega\gamma(k-1)}, QDIFFDA_{\Omega\gamma} + \sum_{k' \le k} QTID_{u\gamma k} \right), QCOB_{\Omega\gamma}, \sum_{u \in \Omega} QEX_{u\gamma} \right)$$

- As explained previously, charges should only apply up to the Obligated Capacity Quantity Once this value has been reached in the tracker, there is no need to track higher values, so the value is kept constant at QCOB;
- For Intraday Trades only, charges should only apply up to the net ex-ante market traded position of the unit, with any charges for capacity above that being due to Balancing Trades or being seen as Non-Performance. Therefore a cap of this quantity at the Ex-ante Quantity is also included.

Market Difference Payments and Difference Charges

- Balancing Tracked Difference Quantity:

$$QDIFFTRACKB_{\Omega\gamma k} = Min\left(Max\left(QDIFFTRACKB_{\Omega\gamma(k-1)}, Min\left(QDIFFDA_{\Omega\gamma} + \sum_{k' \le k} QTID_{u\gamma k}, \sum_{u \in \Omega} QEX_{u\gamma}\right) + \sum_{k' \le k} QTB_{u\gamma k}\right), QCOB_{\Omega\gamma}\right)$$

- Since this is intended to cover the net traded position from all trades, the first component considers the net position possible from the Intraday Tracked Quantity, which considers the Day-ahead and Intraday Trades up to and including this point, while also keeping the cap if the unit subsequently trades out of that position;

Market Difference Payments and Difference Charges

- Balancing Tracked Difference Quantity:

$$QDIFFTRACKB_{\Omega\gamma k} = Min\left(Max\left(QDIFFTRACKB_{\Omega\gamma(k-1)}, Min\left(QDIFFDA_{\Omega\gamma} + \sum_{k' \le k} QTID_{u\gamma k}, \sum_{u \in \Omega} QEX_{u\gamma}\right) + \sum_{k' \le k} QTB_{u\gamma k}\right), QCOB_{\Omega\gamma}\right)$$

- Since this is intended to cover the net traded position from all trades, the first component considers the net position possible from the Intraday Tracked Quantity, which considers the Day-ahead and Intraday Trades up to and including this point, while also keeping the cap if the unit subsequently trades out of that position;
- To these ex-ante trade quantity the Balancing Trade Quantities for all trades up to and including this point are added. Since a value of zero is taken for any Dec actions / Accepted Bids, this only counts when a balancing trade increases the net energy position of the unit (i.e. if a unit is dispatched down to provide reserve, their tracked quantity stays at their higher traded position).

Market Difference Payments and Difference Charges

- Balancing Tracked Difference Quantity:

$$QDIFFTRACKB_{\Omega\gamma k} = Min\left(Max\left(QDIFFTRACKB_{\Omega\gamma(k-1)}, Min\left(QDIFFDA_{\Omega\gamma} + \sum_{k' \le k} QTID_{u\gamma k}, \sum_{u \in \Omega} QEX_{u\gamma}\right) + \sum_{k' \le k} QTB_{u\gamma k}\right), QCOB_{\Omega\gamma}\right)$$

- Similar to the Intraday Tracked Quantity, the previous value for the Balancing Tracked Quantity is included and the maximum of these is taken, giving the same “ratchet” effect explained previously;

Market Difference Payments and Difference Charges

- Balancing Tracked Difference Quantity:

$$QDIFFTRACKB_{\Omega\gamma k} = Min\left(Max\left(QDIFFTRACKB_{\Omega\gamma(k-1)}, Min\left(QDIFFDA_{\Omega\gamma} + \sum_{k' \le k} QTID_{u\gamma k}, \sum_{u \in \Omega} QEX_{u\gamma} \right) + \sum_{k' \le k} QTB_{u\gamma k} \right), QCOB_{\Omega\gamma} \right)$$

- Similar to the Intraday Tracked Quantity, the previous value for the Balancing Tracked Quantity is included and the maximum of these is taken, giving the same “ratchet” effect explained previously;
- Similar to the Intraday Tracked Quantity, once the Obligated Capacity Quantity has been reached, Difference Charges should not apply to further trades. This is implemented through capping the value of the tracker at this level once it has been reached.

Market Difference Payments and Difference Charges

- Within-day Trade Difference Charge once the quantity has been calculated:

$$CDIFFCTWD_{\Omega\gamma k} = Max\left(QDIFFCTWD_{\Omega\gamma k}, 0\right) \times Min\left(0, PSTR_m - PTID_{u\gamma k}\right)$$

- Price compared with the Strike Price is the Balancing Trade Price ($PTB_{u\gamma k}$) instead of the Intraday Trade Price ($PTID_{u\gamma k}$) if the trade in the ranked set was from the balancing market.
- The sum of the charges for all trades in the period is taken to be the total Within-day Difference Charge.

Market Difference Payments and Difference Charges

- Difference payments implement the hedge against prices in all energy markets;
- In the case of ex-ante market trades, Supplier Units are separately paying a NEMO, then receiving payments from the MO under the TSC to enact the hedge. For imbalances, the net of their imbalance charges and these Difference Payments appear on settlement documents;
- The functionality of calculating the quantities and amounts mirrors that of Difference Charges for CMUs:
  - Payments occur if the price for a supplier trade or imbalance exceeds the strike price;
  - A “ratchet” tracking approach ensures there is no double-paying on trades covering same consumption volume – the amount by which the trade quantity increases the traded consumption level is taken as eligible for Difference Payments;
  - A cap with the Ex-ante Quantity is also present – if a Supplier Unit traded out of their energy position, but ended up with consumption at a greater level than their net ex-ante market trades, that would be seen as an imbalance in energy settlement and therefore should have a Difference Payment at the Imbalance Price;
  - The payments only apply to negative quantity trades, i.e. trades to buy power.
- There are some differences which make them simpler than Difference Charge calculations:
  - It doesn’t need to consider something like an Obligated Capacity Quantity after which payments no longer apply – payments can apply up to any amount of consumption;
  - There is only one tracking variable, because there cannot be balancing market trades at the same time as intraday trades as is the case with CMUs – only intraday trades are included in the ranked set.

Market Difference Payments and Difference Charges

- Day-ahead Difference Quantity:

$$QDIFFDA_{v\gamma} = Max\left(\sum_{x} qTDA_{xvh} \times Min(DTDA_x, DISP), QEX_{v\gamma}\right)$$

- For the ranked set of Intraday Trade Quantities (order by time of clearing):

$$QTID_{v\gamma k} = qTID_{xvhk} \times Min(DTID_x, DISP)$$
$$PTID_{v\gamma k} = PTID_{xvhk}$$

- Intraday Trade Difference Quantity:

$$QDIFFTRACK_{v\gamma(k=0)} = QDIFFDA_{v\gamma}$$
$$If\ QTID_{v\gamma k} < 0, then$$
$$QDIFFPTID_{v\gamma k} = Min\left(QDIFFDA_{v\gamma} + \sum_{k' < k} QTID_{v\gamma k} + QTID_{v\gamma k} - QDIFFTRACK_{v\gamma(k-1)}, 0\right)$$
$$else$$
$$QDIFFPTID_{v\gamma k} = 0$$

- Tracked Difference Quantity (for Intraday Trade Difference Quantities):

$$QDIFFTRACK_{v\gamma k} = Min\left(QDIFFTRACK_{v\gamma(k-1)}, QDIFFDA_{v\gamma} + \sum_{k' \le k} QTID_{v\gamma k}, QEX_{v\gamma}\right)$$

Repeat all Intraday Trade Difference Quantity steps for all Intraday Trades in the ranked set

Market Difference Payments and Difference Charges

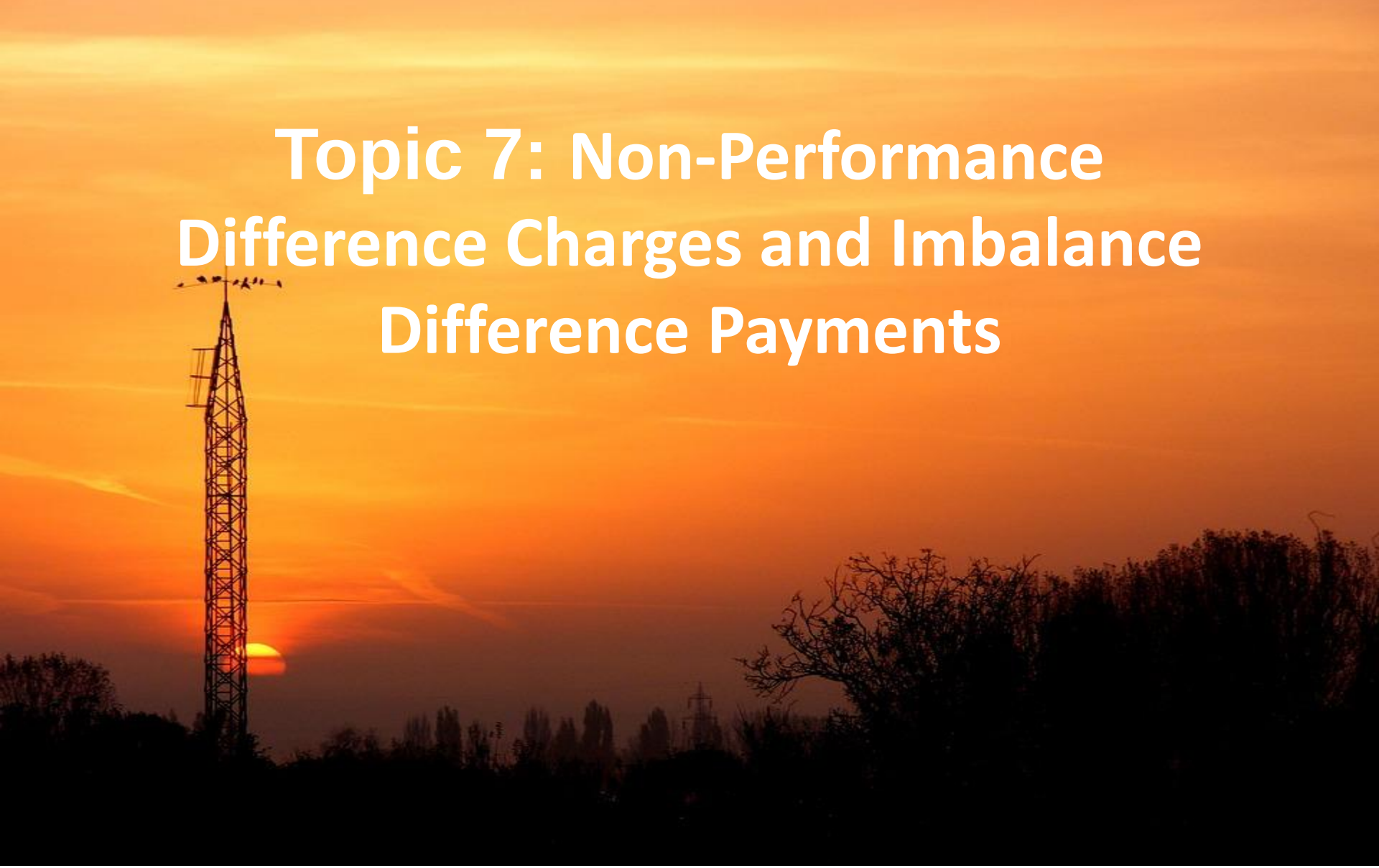
- Day-ahead Difference Charge:

$$CDIFFPDA_{vd} = \sum_{\gamma \in d} \left(Min\left(QDIFFDA_{v\gamma}, 0\right) \times Min(0, PSTR_m - PTDA_{xvh}) \right)$$

- Intraday Trade Difference Charge:

$$CDIFFPTID_{v\gamma k} = Min\left(QDIFFPTID_{v\gamma k}, 0\right) \times Min\left(0, PSTR_m - PTID_{xv\gamma k}\right)$$

- All Intraday Trade Difference Charges are summed up to a single Intraday Difference Charge.



Topic 7: Non-Performance Difference Charges and Imbalance Difference Payments

Non-Performance Difference Charges and Imbalance Difference Payments

- Imbalance arrangements are also a reference market;
- For CMUs, this is through the Non-performance Difference Charge:
  - If the CMU fails to meet its obligation through means allowed, it is exposed to charges for the quantity between level of obligation met and total load-scaled obligation;
  - In other market timeframes, CMUs have revenue from the trade to offset the charge;
  - For Non-performance, they don't have this revenue, resulting in actual financial loss;
  - This gives a strong incentive to sell power at times of scarcity (The Administered Scarcity Price could apply);
  - Because of the potential for high exposure, Stop-Loss Limits are applied to reduce risk;
  - The provision of some reserves is counted towards meeting the capacity obligation, and reduces the non-performance quantity.
- For Supplier Units, this is through the Imbalance Difference Payment:
  - If a supplier has a negative imbalance (i.e. where they would normally have to pay), they are eligible for a payment to act as a hedge against the imbalance price.
- Demand Side Units and Interconnectors are only exposed to this element:
  - Interconnectors: obligation is met if they were available to import to level of obligation;
  - DSUs: obligation is met unless TSO determines they didn't meet their obligation.

Non-Performance Difference Charges and Imbalance Difference Payments

Reason for System Service Difference Quantity:

- The detailed design allows for capacity utilised for DS3 System Services such as capacity providing reserve to count towards obligations;
- For situations where the SOs dispatch a unit down from its market trade position to provide reserves, this Accepted Bid is taken to be a zero value in Capacity Market Settlement, meaning the reserve being held on the unit between their traded position and their dispatched position helps them meet their capacity obligations;
- Units which are desynchronised and providing replacement reserves would not normally clear in the market, and may not be able to clear in the market if they tried without creating unintended outcomes. However in system security events, the constraint to maintain a minimum level of replacement reserve may bind and prevent these units from being dispatched up to help resolve the event, also preventing them from meeting their capacity obligations through balancing market trades;
- To handle those scenarios, the capacity obligation met through quantities held for replacement reserve is calculated separately.

Non-Performance Difference Charges and Imbalance Difference Payments

Solution at a high level:

- System Service Flag ($FSS_{u\gamma}$):
  - Used to trigger quantity calculation based on the same tests as Imbalance Pricing, where the Flagging and Tagging process identifies if the constraint is binding on a unit.
- System Service Difference Quantity ($QDIFFCSS_{u\gamma}$):
  - Calculate the quantity of a unit's Obligated Capacity Quantity deemed to be satisfied through being utilised for the provision of the relevant services;
  - Calculate a non-zero value for $QDIFFCSS_{u\gamma}$ if $FSS_{u\gamma}$ is = 0 for that Imbalance Settlement Period, otherwise $QDIFFCSS_{u\gamma}$ has a value of zero;
  - Based on the difference between the Actual Availability ($qAA_{u\gamma}$) and the maximum of:
    - QD (for level of headroom held between dispatch and availability); and
    - QEX (to ensure against double-counting of market volumes).
- Tracked Difference Quantity (QDIFFTRACK):
  - Add QDIFFCSS to QDIFFTRACK before it is considered in Non-performance Difference Charges.

Non-Performance Difference Charges and Imbalance Difference Payments

Outcomes of this approach:

- Calculates a quantity held for reserves with the information available to the market:
  - Quantities are only calculated when they are required (i.e. “free” reserve is not counted, only count when unit is at a position to provide reserve, when the constraint is binding on the unit);
  - Quantities are calculated on a Generator Unit basis, therefore can be used with Capacity Market Units that represent multiple Generator Units – if some units contributing to these constraints while others are not, the quantity for the relevant units will contribute to meeting the aggregator CMU’s obligation;
  - Calculated as a difference quantity in a similar manner to the calculation of other quantities, easier to integrate into the overall solution;
  - Based on availability to ensure units which are not available to be dispatched up to the level required to meet its Obligated Capacity Quantity are still exposed;
  - Since it is based on availability, it applies to those reserve system services where full availability can be provided (i.e. Replacement Reserve).
- System Service Difference Quantity counts towards meeting the unit’s Obligated Capacity Quantity without itself being subject to a Difference Charge:
  - The price component is not considered based on the assumption that the price of utilisation of this quantity will always be less than the Strike Price.

Non-Performance Difference Charges and Imbalance Difference Payments

Solution detail:

- System Service Flag ($FSS_{u\gamma}$):
  - If a unit contributing to a binding operational constraint for the provision of Replacement Reserve, in any Imbalance Pricing Period within an Imbalance Settlement Period, set the value of FSS for that Imbalance Settlement Period equal to 0.
- System Service Difference Quantity Calculation:
  - Based on System Service Flag, calculate System Service Difference Quantity as follows:

$$QDIFFCSS_{u\gamma} = Max\left(\left(qAA_{u\gamma} \times DISP\right) - Max\left(QEX_{u\gamma}, QD_{u\gamma}\right), 0\right) \times \left(1 - FSS_{u\gamma}\right)$$

- Tracked Difference Quantity Calculation:
  - Increase the Tracked Difference Quantity, so that QDIFFCSS can count towards meeting the capacity obligation through reducing the quantity exposure to Non-performance Difference Charges, as follows (with the equivalent equation also for autoproducers):

$$QDIFFTRACK_{\Omega\gamma} = Min\left(QCOB_{\Omega\gamma}, QDIFFTRACK'_{\Omega\gamma} + \sum_{u \in \Omega} QDIFFCSS_{u\gamma}\right)$$

  - QDIFFTRACK' is the value for QDIFFTRACK calculated after Within-day Difference Quantities and Charges have been concluded;
  - The value of QDIFFTRACK calculated here is used in the Non-performance Difference Quantity calculation.

Non-Performance Difference Charges and Imbalance Difference Payments

- Non-Performance Difference Quantity:
  - This is the quantity of the capacity obligation deemed to have not have been met;
  - The final Tracked Difference Quantity is deemed to be the amount of the obligation met, and this is compared with the Obligated Capacity Quantity:

$$QDIFFCNP_{\Omega\gamma} = Max\left(QCOB_{\Omega\gamma} - QDIFFTRACK_{\Omega\gamma}, 0\right)$$

  - If the Imbalance Settlement Price is greater than the Strike Price, this quantity will be exposed to a Non-Performance Difference Charge:

$$CDIFFCNP1_{\Omega\gamma} = QDIFFCNP_{\Omega\gamma} \times Min\left(0, PSTR_m - PIMB_\gamma\right)$$

Non-Performance Difference Charges and Imbalance Difference Payments

- Following the calculation of the base Non-Performance Difference Charge which would normally apply to a CMU in the absence of other functions in this area, Stop-Loss Limits are then applied;
- Stop-Loss Limits are applied through:
  - Keeping track of the amount of losses built up in a Billing Period and Capacity Year in order to know how much extra losses can be incurred before the limit is reached:
    - The Billing Period tracker is reset to be zero at the end of each Billing Period, and the Annual tracker is reset to be zero at the end of each Capacity Year.

$$CDIFFCNPB_{\Omega\gamma} = CDIFFCNPB_{\Omega(\gamma-1)} + CDIFFCNP_{\Omega\gamma}$$

$$CDIFFCNPA_{\Omega\gamma} = CDIFFCNPA_{\Omega(\gamma-1)} + CDIFFCNP_{\Omega\gamma}$$

  - Taking whichever is the smaller: the base charge as calculated, or the amount of additional loss which can be incurred before the Billing Period limit is reached;

$$CDIFFCNP2_{\Omega\gamma} = Max\left(CDIFFCNP1_{\Omega\gamma}, Min\left(-CSLLB_{\Omega b} - CDIFFCNPB_{\Omega(\gamma-1)}, 0\right)\right)$$

  - Taking whichever is the smaller: the charge as resulting from the previous point, or the amount of additional loss which can be incurred before the Annual limit is reached:

$$CDIFFCNP_{\Omega\gamma} = Max\left(CDIFFCNP2_{\Omega\gamma}, Min\left(-CSLLA_{\Omega b} - CDIFFCNPA_{\Omega(\gamma-1)}, 0\right)\right)$$

Non-Performance Difference Charges and Imbalance Difference Payments

- Example Capacity and Trade Register entries for a single unit:

n	Ω	qC	P/S	Start	End	PCP	qCCOMMISS	FSLLA	FSLLB	XR
1	1	+70	P	01/08/2020	01/08/2021	100	80	1.5	0.75	1.1
2	1	-20	S	01/06/2021	07/06/2021	90	80	1.5	0.75	1
3	1	+10	S	08/06/2021	14/06/2021	110	80	1.5	0.75	0.9
…	…	…	…	…	…	…	…	…	…	…

- Say the period is in 01/05/2021, FSLLA = 10,531.73 € or £, FSLLB = 7,898.80 € or £;
- Say the unit didn't trade, the imbalance price spiked to 3,000 € or £, Strike Price 500 € or £;
- If no losses up to this point, both $CDIFFCNPB_{\Omega(\gamma-1)}$ and $CDIFFCNPA_{\Omega(\gamma-1)}$ will be 0;
- QDIFFCNP = Max(30 – 0, 0) = 30;
- CDIFFCNP1 = 30 x Min(0, 500 – 3000) = -75,000 € or £;
- CDIFFCNP2 = Max(-75000, Min(-7898.80 – 0, 0)) = -7,898 € or £;
- CDIFFCNP = Max(-7898, Min(-10531.73 – 0, 0)) = -7,898 € or £.

Non-Performance Difference Charges and Imbalance Difference Payments

- Functionality if importing:

$$QDIFFCNP_{\Omega\gamma} = Max\left(Min\left(QCOB_{\Omega\gamma} - \left(qCMAMAXILF_{l\gamma} \times DISP\right), QCOB_{\Omega\gamma} - QMLF_{l\gamma}\right), 0\right)$$

- Amount of requirement not met by import…

Non-Performance Difference Charges and Imbalance Difference Payments

- Functionality if importing:

$$QDIFFCNP_{\Omega\gamma} = Max\left(Min\left(QCOB_{\Omega\gamma} - \left(qCMAMAXILF_{l\gamma} \times DISP\right), QCOB_{\Omega\gamma} - QMLF_{l\gamma}\right), 0\right)$$

- Amount of requirement not met by import…
- …to the extent it is driven by lack of availability, not due to market or SO scheduling.

Non-Performance Difference Charges and Imbalance Difference Payments

- Functionality if importing:

$$QDIFFCNP_{\Omega\gamma} = Max\left(Min\left(QCOB_{\Omega\gamma} - \left(qCMAMAXILF_{l\gamma} \times DISP\right), QCOB_{\Omega\gamma} - QMLF_{l\gamma}\right), 0\right)$$

- Amount of requirement not met by import…
- …to the extent it is driven by lack of availability, not due to market or SO scheduling.
- Exclude negative quantities, if negative then obligation must have been exceeded.

Non-Performance Difference Charges and Imbalance Difference Payments

- Functionality for DSUs:

$$QDIFFCNP_{\Omega\gamma} = Max\left(QCOB_{\Omega\gamma} - QDIFFTRACK_{\Omega\gamma}, 0\right) \times FNDDS_{\Omega\gamma}$$

- QDIFFTRACK will be calculated as zero, because the previous calculations which lead to QDIFFTRACK don't apply for DSUs (kept in to allow for easier changing of implementation approach if desired in future);
- Equation becomes the obligation times the amount of the obligation the SOs determine was not delivered by the DSU;
- Methodology for determining FNDDS being drafted, would include consideration of the Obligated Capacity Quantity, the calculated delivered demand reduction, the Dispatch Quantity, and the Outturn Availability of the unit;
- A value for FNDDS is not likely to be available for Initial Settlement based on timelines of performance monitoring, but it would be included for Settlement Recalculation, for example at M+4 stage.

Non-Performance Difference Charges and Imbalance Difference Payments

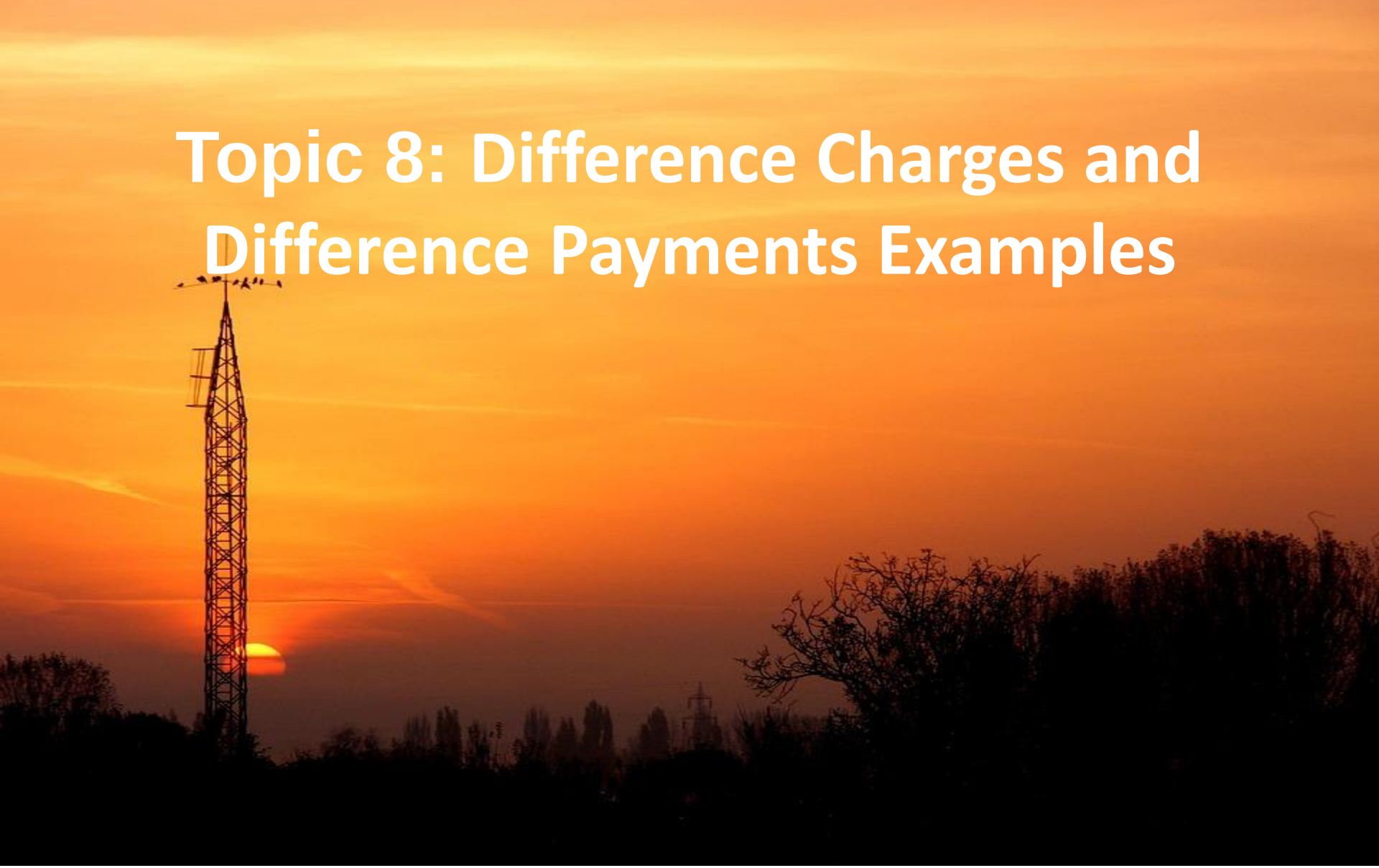
- Supplier Unit Imbalance Difference Quantities and Payments are calculated as follows:

$$QDIFFPIMB_{v\gamma} = Min\left(QMLF_{v\gamma} - QDIFFTRACK_{v\gamma}, 0\right)$$

$$CDIFFPIMB_{vd} = \sum_{\gamma \in d} \left(QDIFFPIMB_{v\gamma} \times Min\left(0, PSTR_m - PIMB_{\gamma}\right)\right)$$

- Trading Site Supplier Units are eligible for these difference charges if their site is net importing.

Topic 8: Difference Charges and Difference Payments Examples

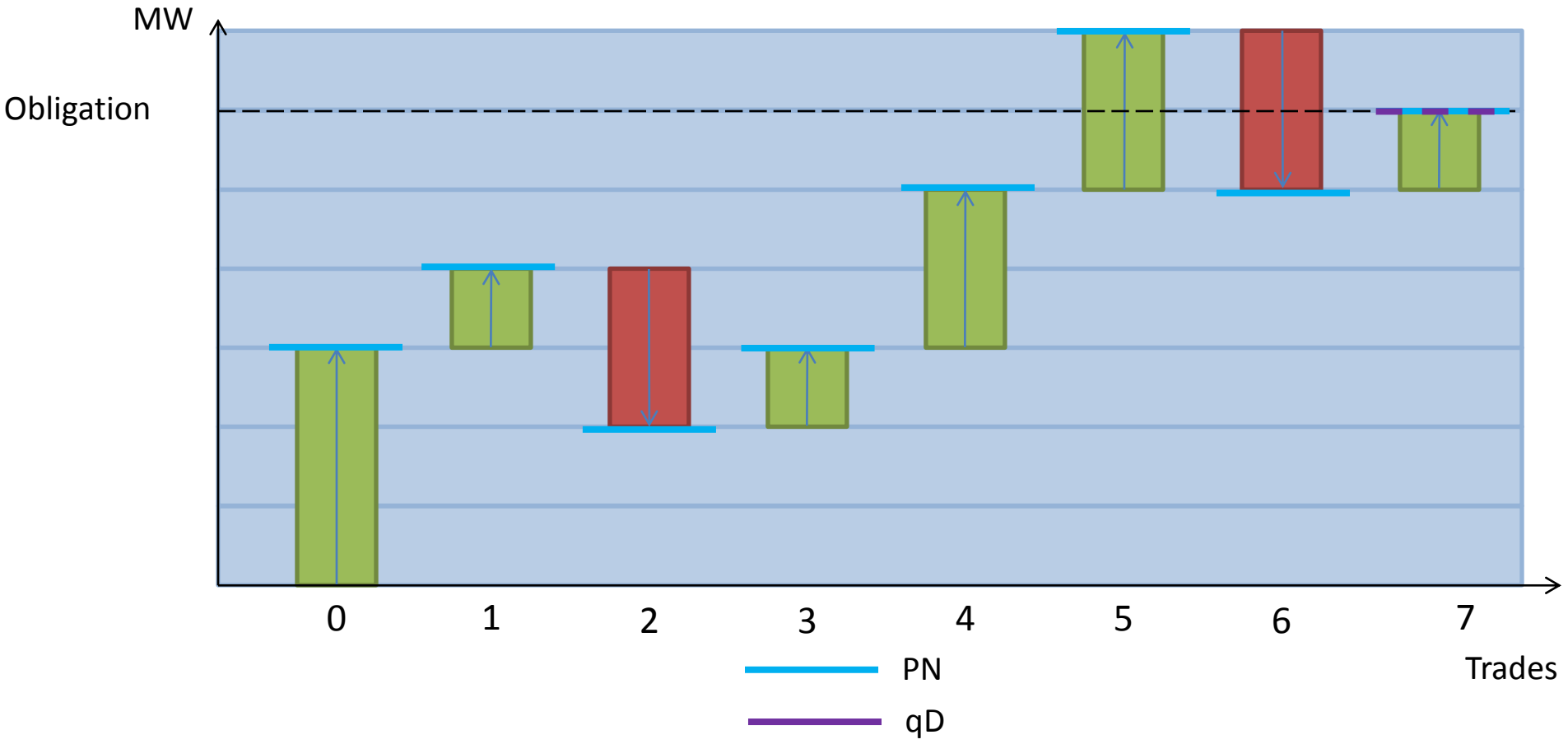


Difference Charges and Difference Payments Examples

- The following examples visualise the difference charges and payments that can result from different scenarios of trading, bidding data submission and dispatch;
- The slides show the trades in all market timeframes which occur in a single period, how this compares against the obligations of the unit in that period, and the resulting quantities which would be exposed to Difference Charges if their price was greater than the Strike Price;
- The trade in step 0 is always a Day-ahead Market Trade, others are either Intraday Market, or Balancing Market (these are explicitly marked as a “BM Trade”);
- Numerical values are provided on tables following the diagrams to allow participants to see how the values included in equations can result in such outcomes;
- A simplification made in these slides is that everything is brought to an hour period, in order to have MW and MWh quantities for trades and dispatch all on the same scale for easier visualisation of the concepts. For example, an Obligated Capacity Quantity of 30MWh for a half hour is visualised here as 60MW. However in reality these calculations will be based on the energy quantities in MWh in a half-hour Imbalance Settlement Period, so that a unit would meet its 30MWh obligation through trading to 60MW in the day-ahead market, for example.

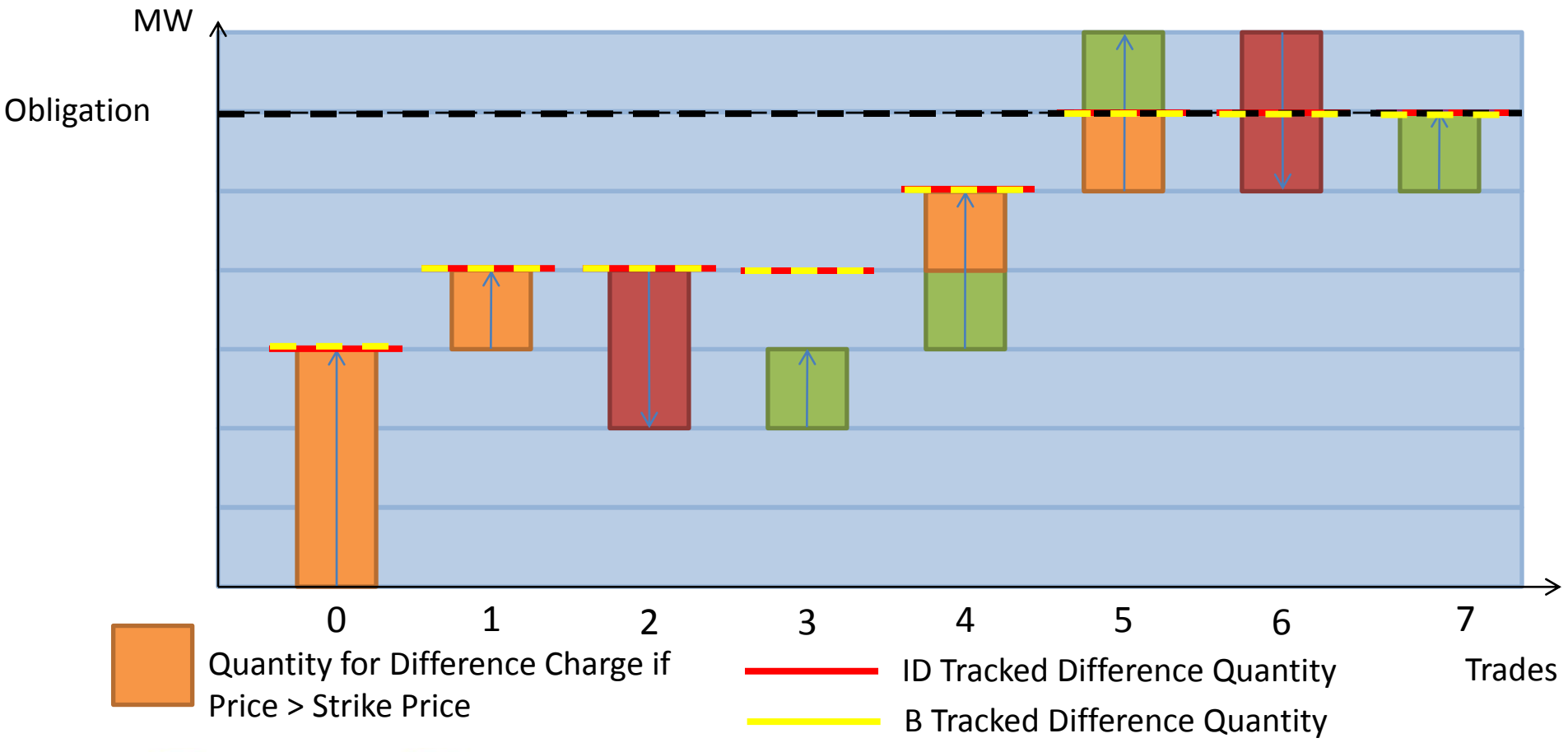
Difference Charges and Difference Payments Examples

- Difference Charge Example 1 – Day-ahead and Intraday:



Difference Charges and Difference Payments Examples

- Difference Charge Example 1 – Day-ahead and Intraday:

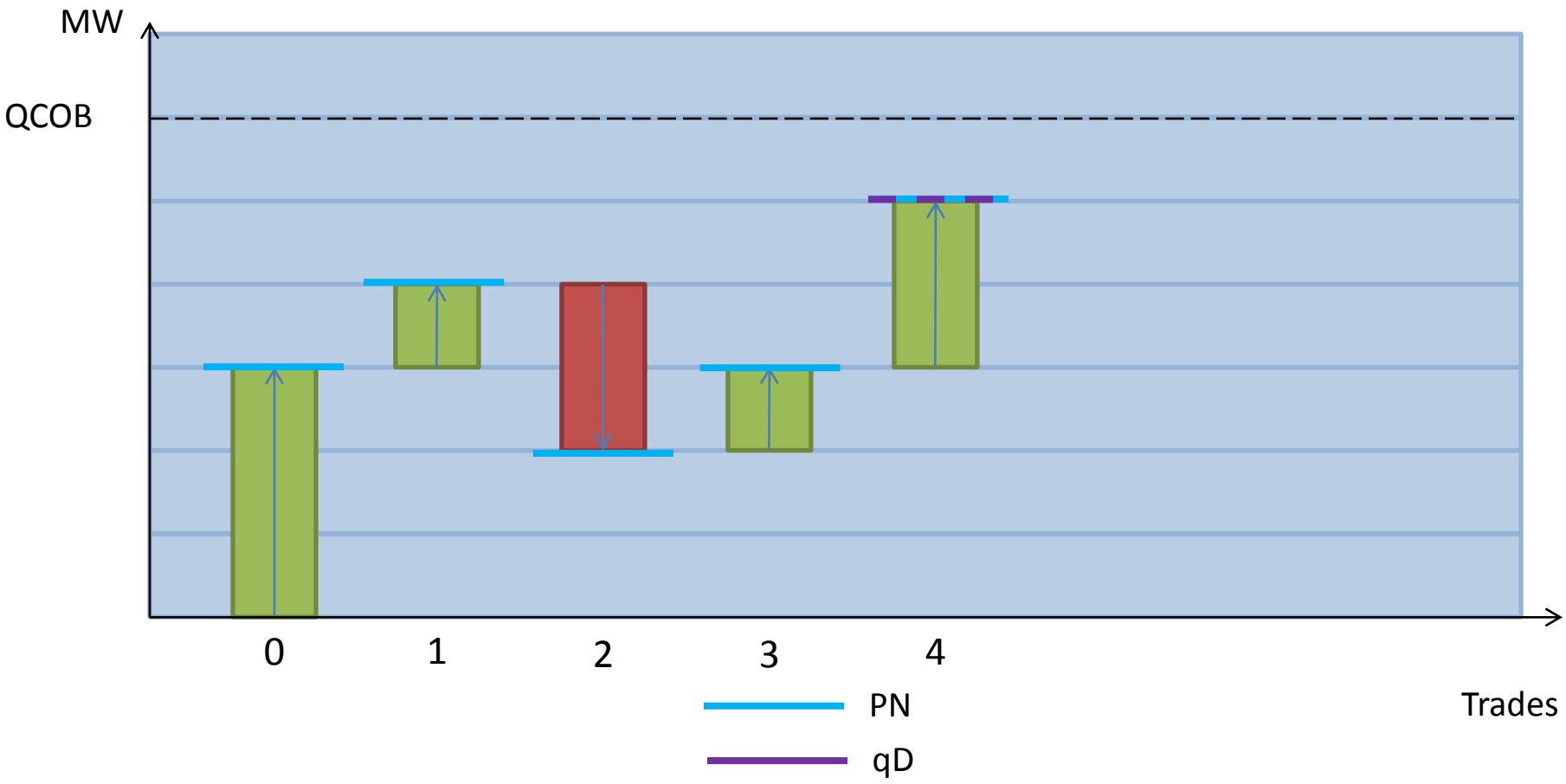


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	60	60	60	60	60	60	60	60
Volume of this Trade	30	10	-20	10	20	20	-20	10
QEX Ex-ante Quantity	60	60	60	60	60	60	60	60
Total Ex-Ante Traded Position After This Step	30	40	20	30	50	70	50	60
Total Traded Position After This Step	30	40	20	30	50	70	50	60
QDIFFDA Day-ahead Difference Quantity	30	30	30	30	30	30	30	30
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	10	0	0	10	10	0	0
Sum of the Volumes Eligible for Market Difference Charges After This Step	30	40	40	40	50	60	60	60
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	30	40	40	40	50	60	60	60
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	30	40	40	40	50	60	60	60
qAA Actual Availability Quantity	70	70	70	70	70	70	70	70
qD Dispatch Quantity	60	60	60	60	60	60	60	60
QDIFFCSS System Service Difference Quantity	0	0	0	0	0	0	0	0
QDIFFCNP Non-Performance Difference Quantity	0	0	0	0	0	0	0	0

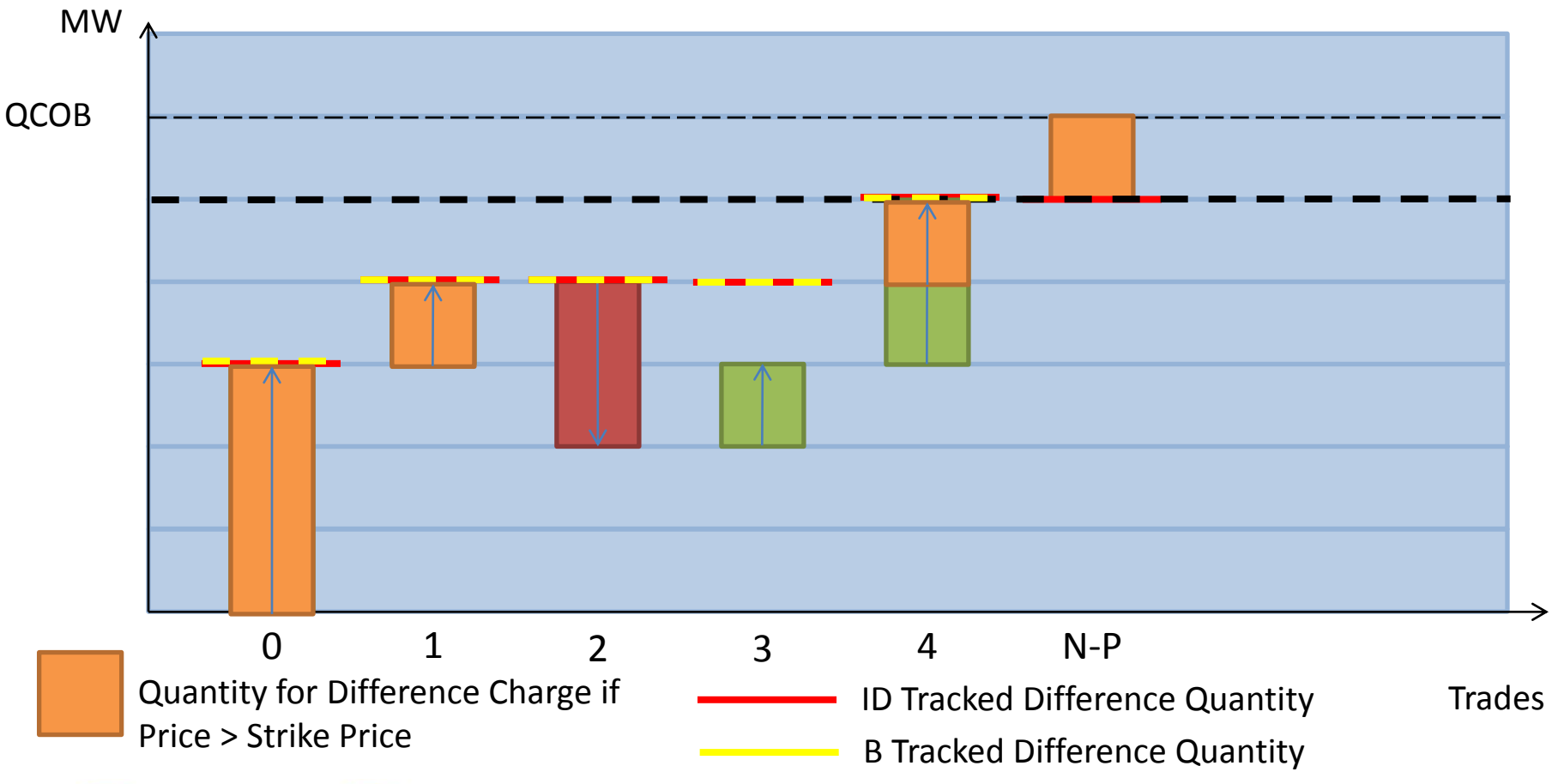
Difference Charges and Difference Payments Examples

- Difference Charge Example 2 – Day-ahead, Intraday and Non-performance:



Difference Charges and Difference Payments Examples

- Difference Charge Example 2 – Day-ahead, Intraday and Non-performance:

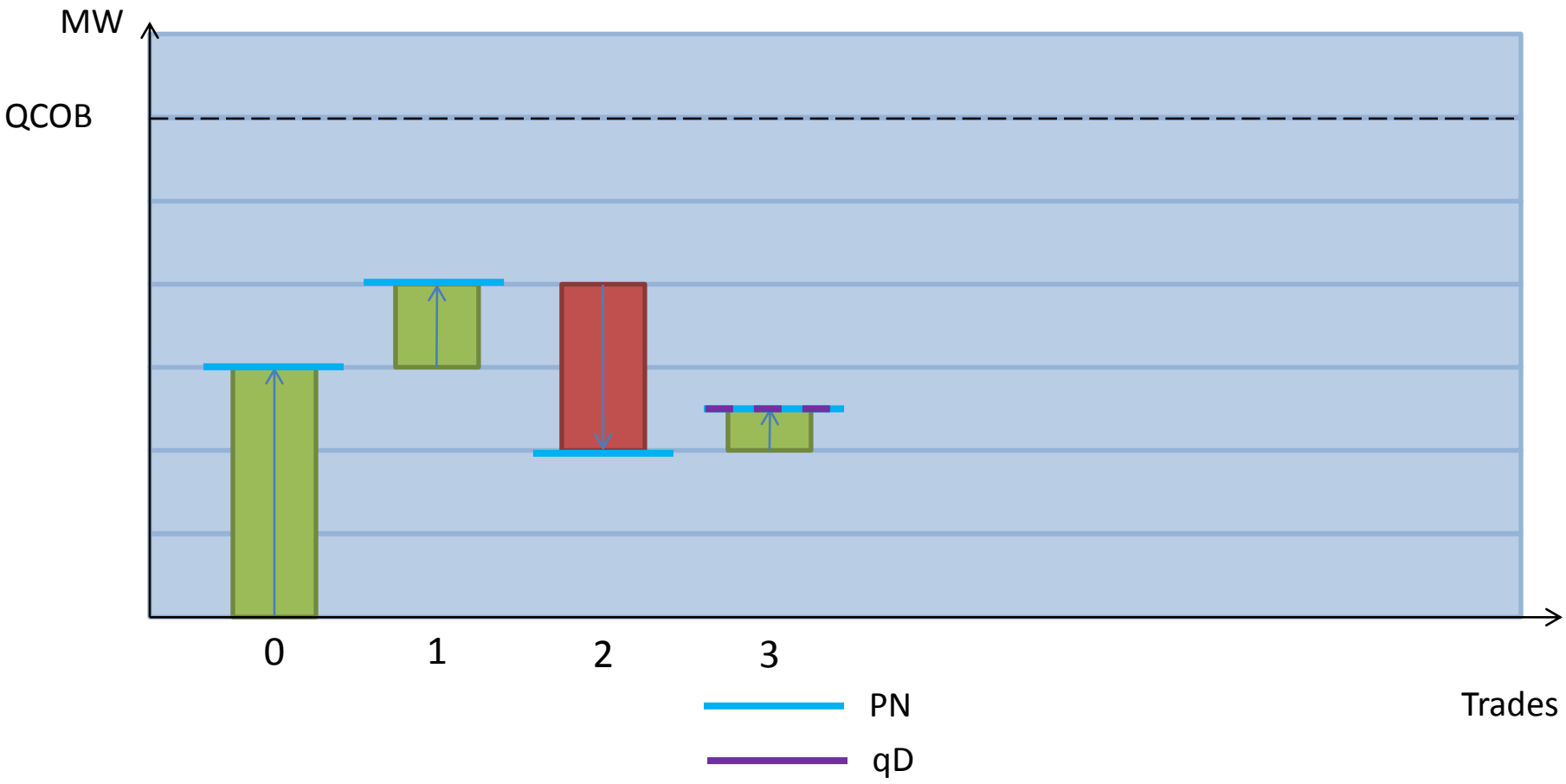


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	60	60	60	60	60	60	N/A	N/A
Volume of this Trade	30	10	-20	10	20	0	N/A	N/A
QEX Ex-ante Quantity	50	50	50	50	50	50	N/A	N/A
Total Ex-Ante Traded Position After This Step	30	40	20	30	50	50	N/A	N/A
Total Traded Position After This Step	30	40	20	30	50	50	N/A	N/A
QDIFFDA Day-ahead Difference Quantity	30	30	30	30	30	30	N/A	N/A
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	10	0	0	10	0	N/A	N/A
Sum of the Volumes Eligible for Market Difference Charges After This Step	30	40	40	40	50	50	N/A	N/A
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	30	40	40	40	50	50	N/A	N/A
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	30	40	40	40	50	50	N/A	N/A
qAA Actual Availability Quantity	70	70	70	70	70	70	N/A	N/A
qD Dispatch Quantity	50	50	50	50	50	50	N/A	N/A
QDIFFCSS System Service Difference Quantity	0	0	0	0	0	0	N/A	N/A
QDIFFCNP Non-Performance Difference Quantity	0	0	0	0	0	10	N/A	N/A

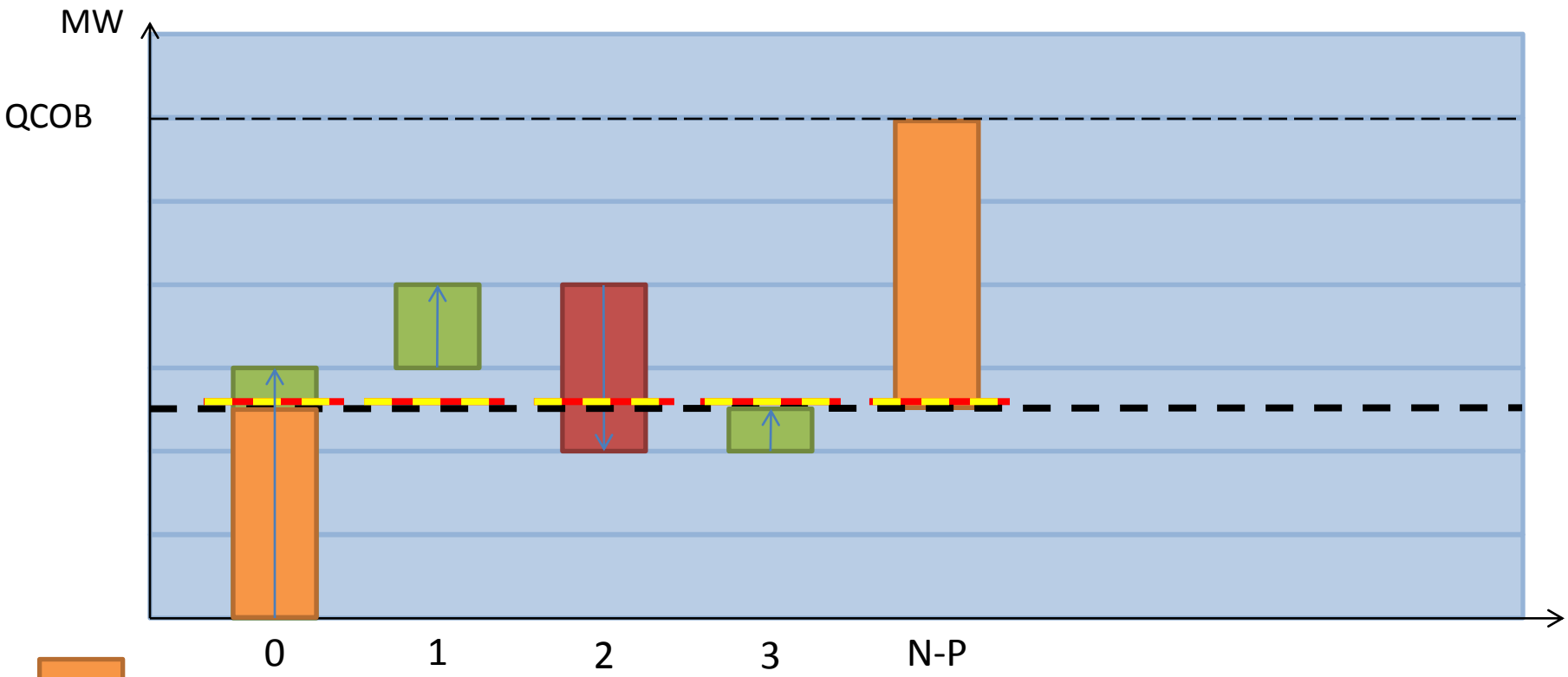
Difference Charges and Difference Payments Examples

- Difference Charge Example 3 – Day-ahead, Intraday and Non-performance:



Difference Charges and Difference Payments Examples

- Difference Charge Example 3 – Day-ahead, Intraday and Non-performance:

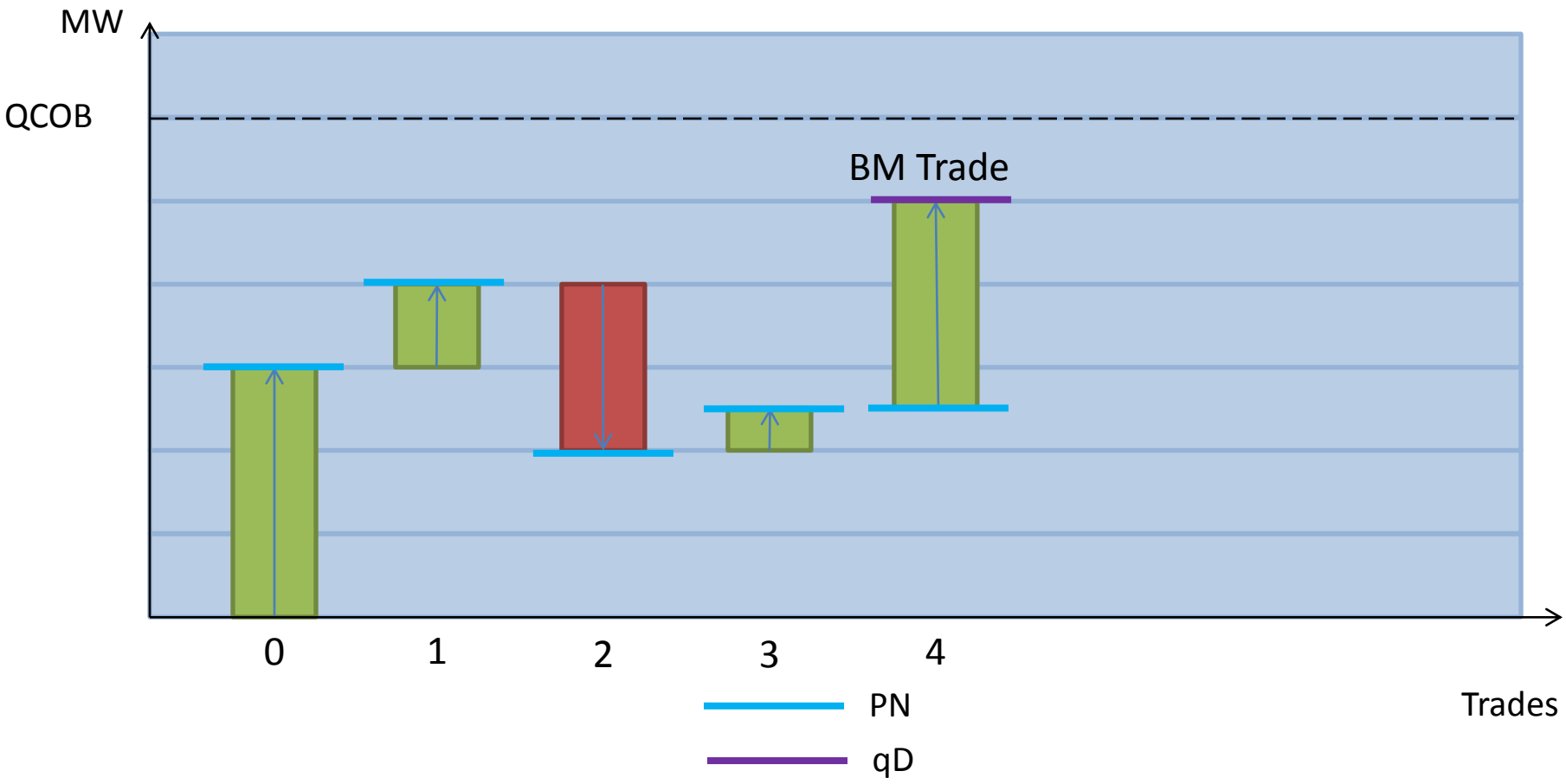


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	60	60	60	60	60	N/A	N/A	N/A
Volume of this Trade	30	10	-20	5	0	N/A	N/A	N/A
QEX Ex-ante Quantity	25	25	25	25	25	N/A	N/A	N/A
Total Ex-Ante Traded Position After This Step	30	40	20	25	25	N/A	N/A	N/A
Total Traded Position After This Step	30	40	20	25	25	N/A	N/A	N/A
QDIFFDA Day-ahead Difference Quantity	25	25	25	25	25	N/A	N/A	N/A
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	0	0	0	0	N/A	N/A	N/A
Sum of the Volumes Eligible for Market Difference Charges After This Step	25	25	25	25	25	N/A	N/A	N/A
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	25	25	25	25	25	N/A	N/A	N/A
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	25	25	25	25	25	N/A	N/A	N/A
qAA Actual Availability Quantity	70	70	70	70	70	N/A	N/A	N/A
qD Dispatch Quantity	25	25	25	25	25	N/A	N/A	N/A
QDIFFCSS System Service Difference Quantity	0	0	0	0	0	N/A	N/A	N/A
QDIFFCNP Non-Performance Difference Quantity	0	0	0	0	35	N/A	N/A	N/A

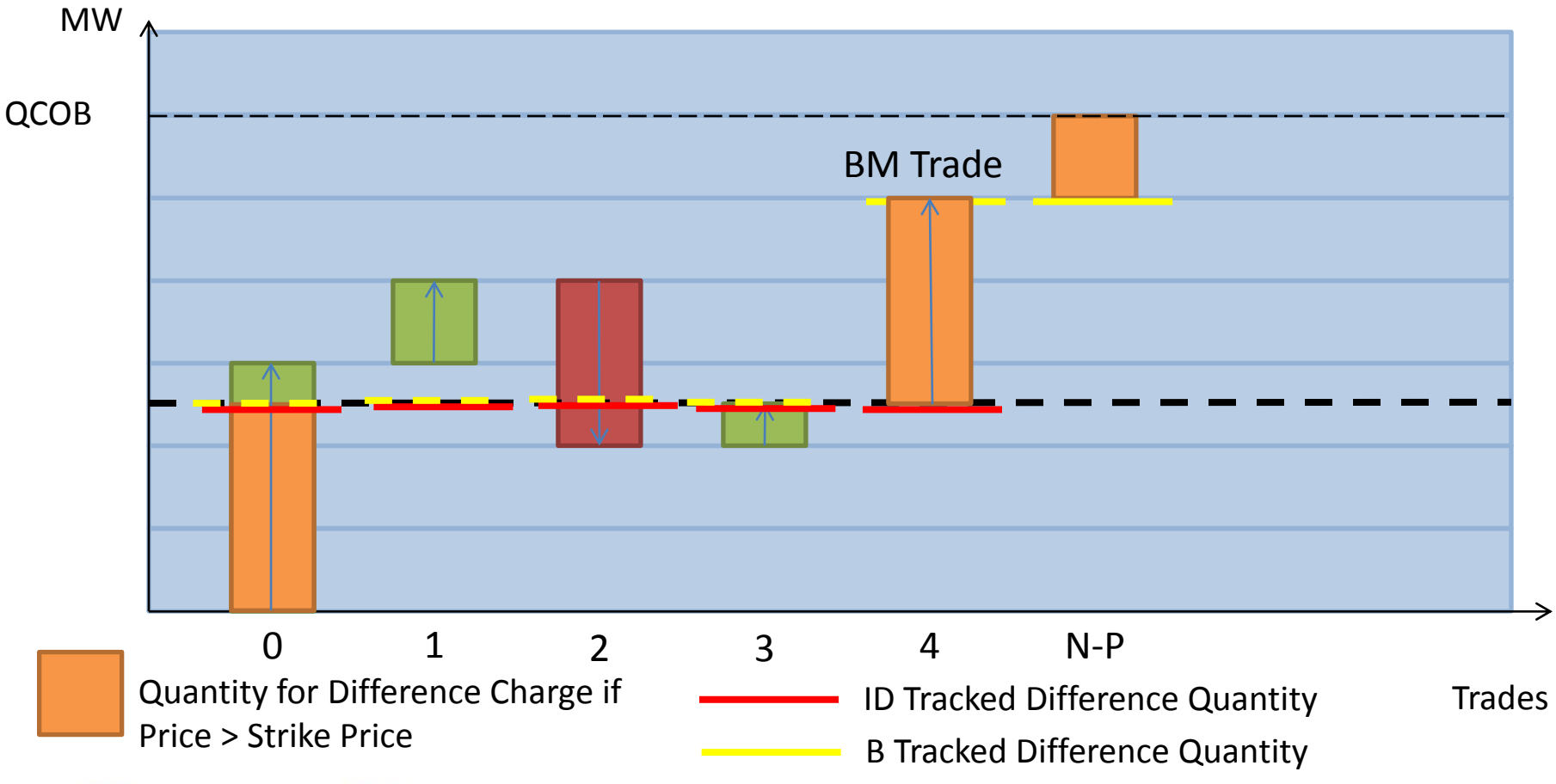
Difference Charges and Difference Payments Examples

- Difference Charge Example 4 – Day-ahead, Intraday, Balancing and Non-performance:



Difference Charges and Difference Payments Examples

- Difference Charge Example 4 – Day-ahead, Intraday, Balancing and Non-performance:

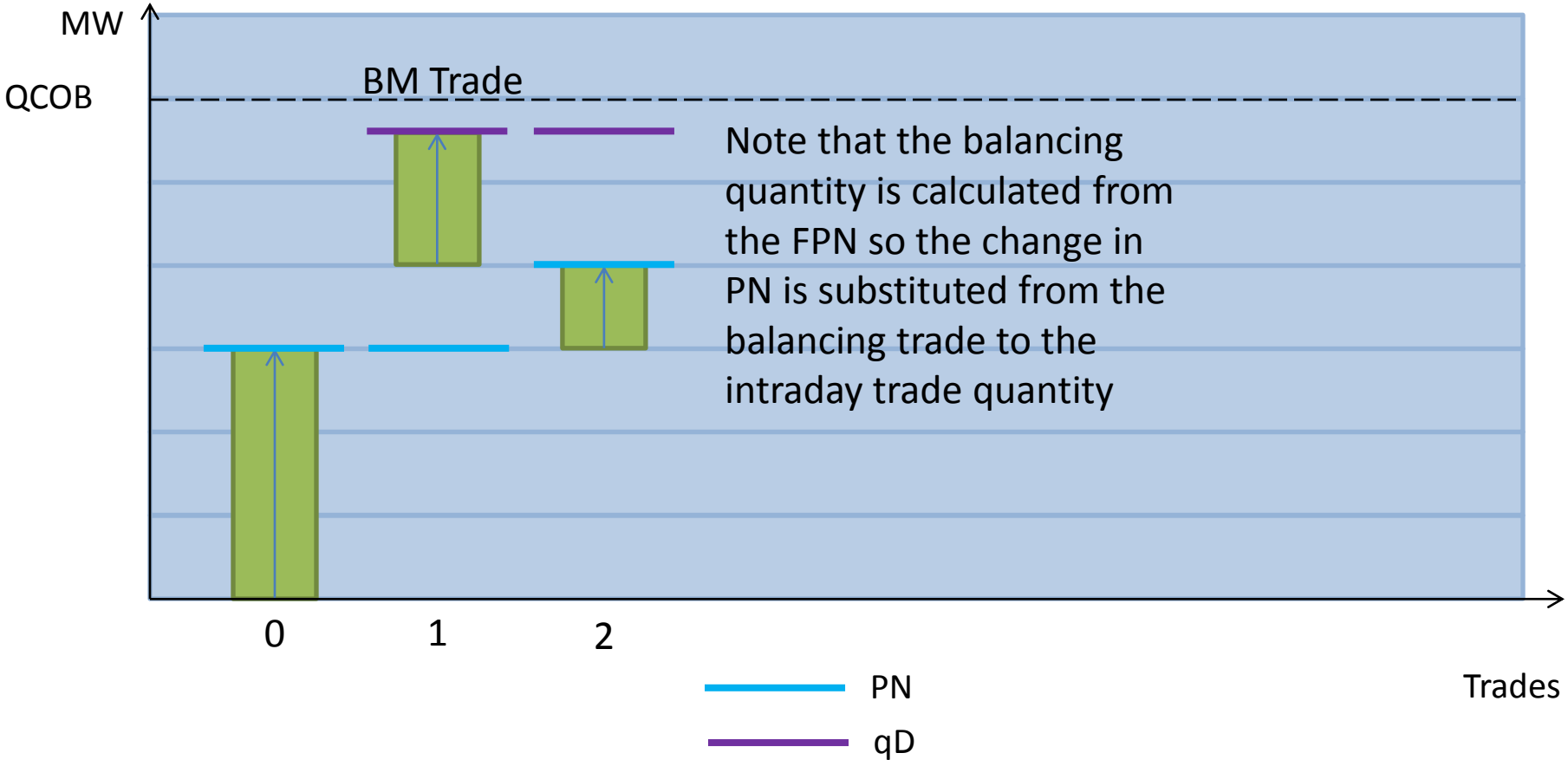


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	60	60	60	60	60	60	N/A	N/A
Volume of this Trade	30	10	-20	5	25	0	N/A	N/A
QEX Ex-ante Quantity	25	25	25	25	25	25	N/A	N/A
Total Ex-Ante Traded Position After This Step	30	40	20	25	25	25	N/A	N/A
Total Traded Position After This Step	30	40	20	25	50	50	N/A	N/A
QDIFFDA Day-ahead Difference Quantity	25	25	25	25	25	25	N/A	N/A
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	0	0	0	25	0	N/A	N/A
Sum of the Volumes Eligible for Market Difference Charges After This Step	25	25	25	25	50	50	N/A	N/A
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	25	25	25	25	25	25	N/A	N/A
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	25	25	25	25	50	50	N/A	N/A
qAA Actual Availability Quantity	70	70	70	70	70	70	N/A	N/A
qD Dispatch Quantity	50	50	50	50	50	50	N/A	N/A
QDIFFCSS System Service Difference Quantity	0	0	0	0	0	0	N/A	N/A
QDIFFCNP Non-Performance Difference Quantity	0	0	0	0	0	10	N/A	N/A

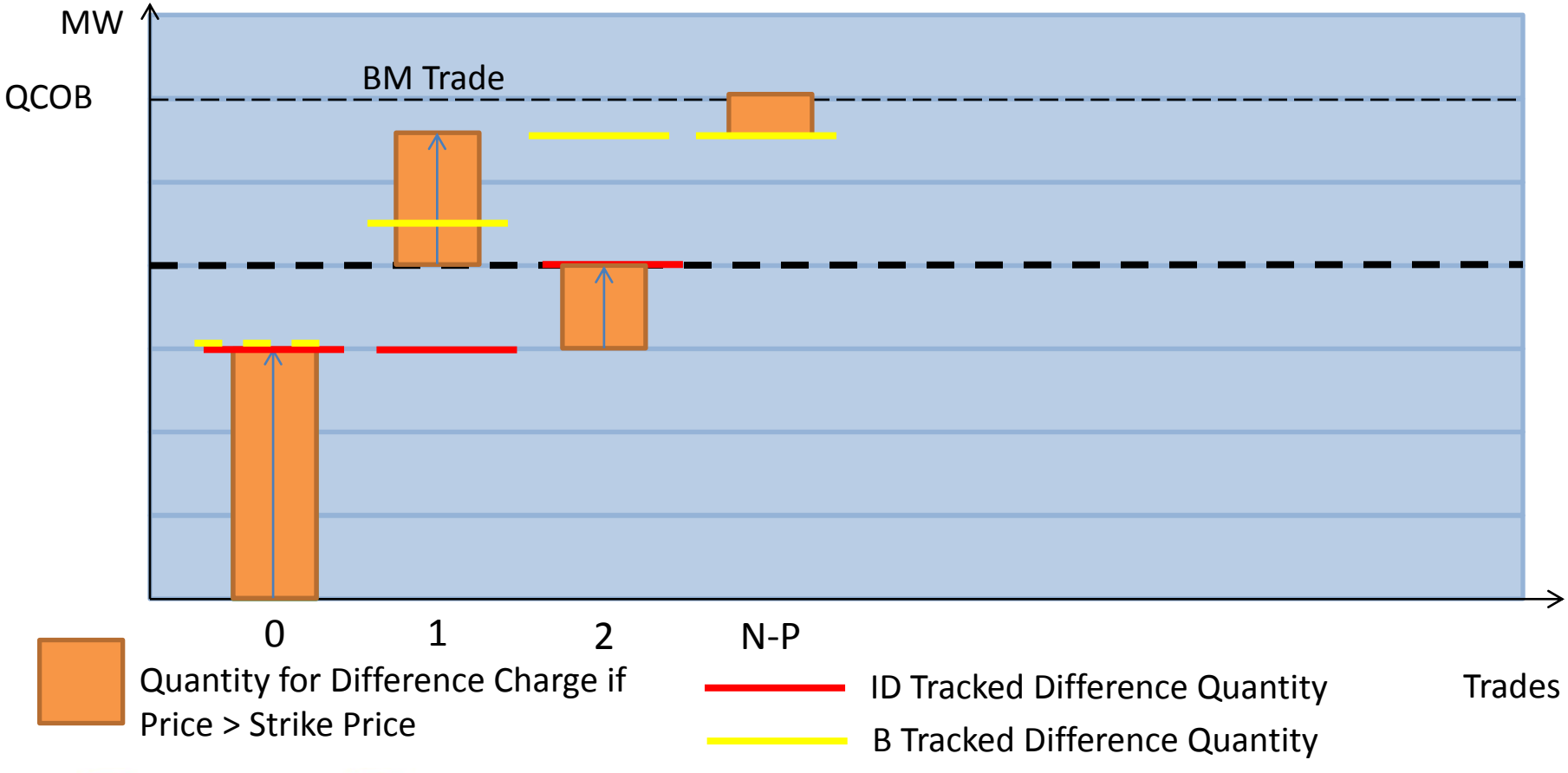
Difference Charges and Difference Payments Examples

- Difference Charge Example 5 – Day-ahead, Intraday, Balancing trade before Intraday Trade, and Non-performance:



Difference Charges and Difference Payments Examples

- Difference Charge Example 5 – Day-ahead, Intraday, Balancing trade before Intraday Trade, and Non-performance:

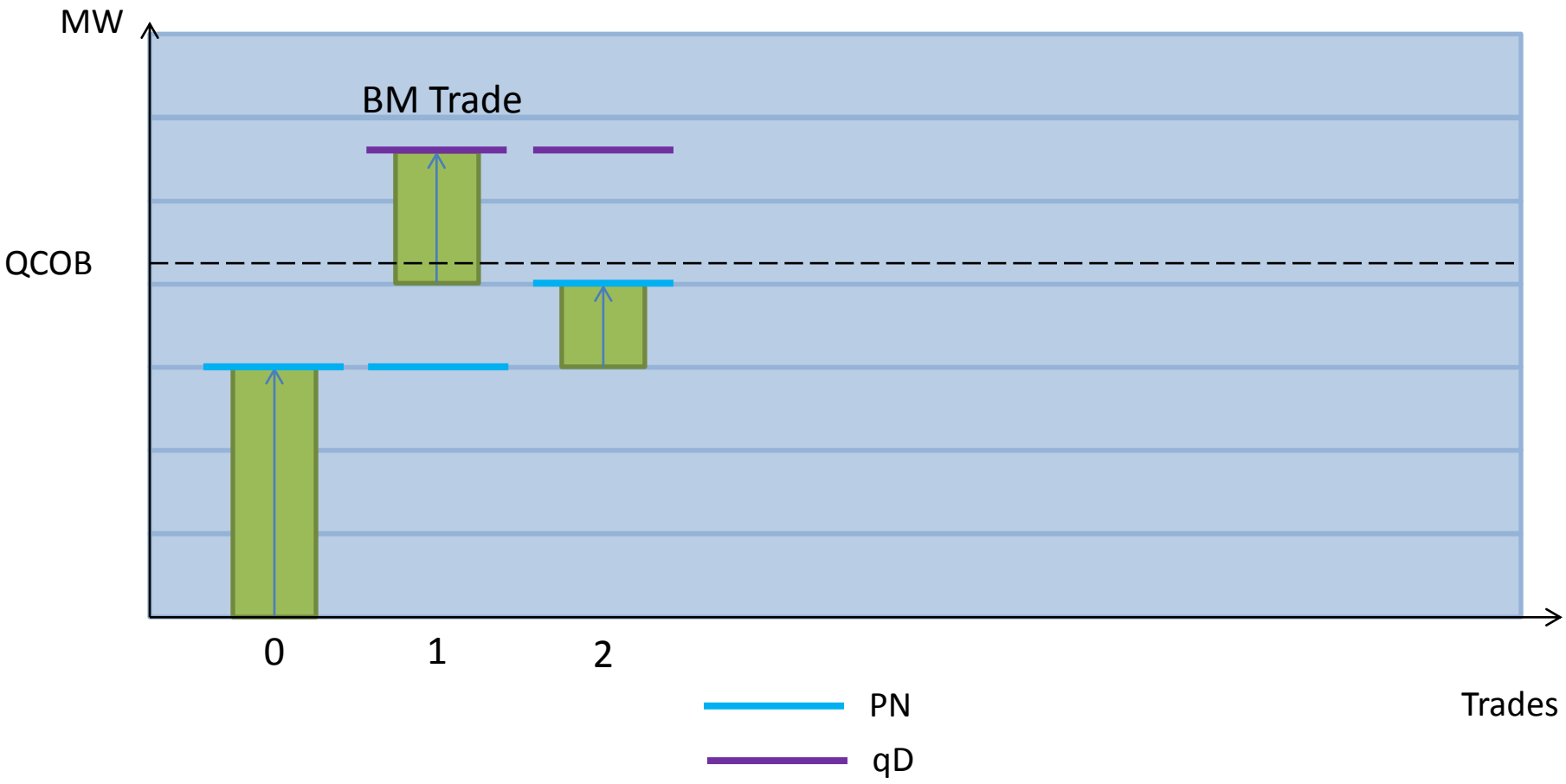


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	60	60	60	60	N/A	N/A	N/A	N/A
Volume of this Trade	30	15	10	0	N/A	N/A	N/A	N/A
QEX Ex-ante Quantity	40	40	40	40	N/A	N/A	N/A	N/A
Total Ex-Ante Traded Position After This Step	30	30	40	40	N/A	N/A	N/A	N/A
Total Traded Position After This Step	30	45	55	55	N/A	N/A	N/A	N/A
QDIFFDA Day-ahead Difference Quantity	30	30	30	30	N/A	N/A	N/A	N/A
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	15	10	0	N/A	N/A	N/A	N/A
Sum of the Volumes Eligible for Market Difference Charges After This Step	30	45	55	55	N/A	N/A	N/A	N/A
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	30	30	40	40	N/A	N/A	N/A	N/A
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	30	45	45	55	N/A	N/A	N/A	N/A
qAA Actual Availability Quantity	70	70	70	70	N/A	N/A	N/A	N/A
qD Dispatch Quantity	55	55	55	55	N/A	N/A	N/A	N/A
QDIFFCSS System Service Difference Quantity	0	0	0	0	N/A	N/A	N/A	N/A
QDIFFCNP Non-Performance Difference Quantity	0	0	0	5	N/A	N/A	N/A	N/A

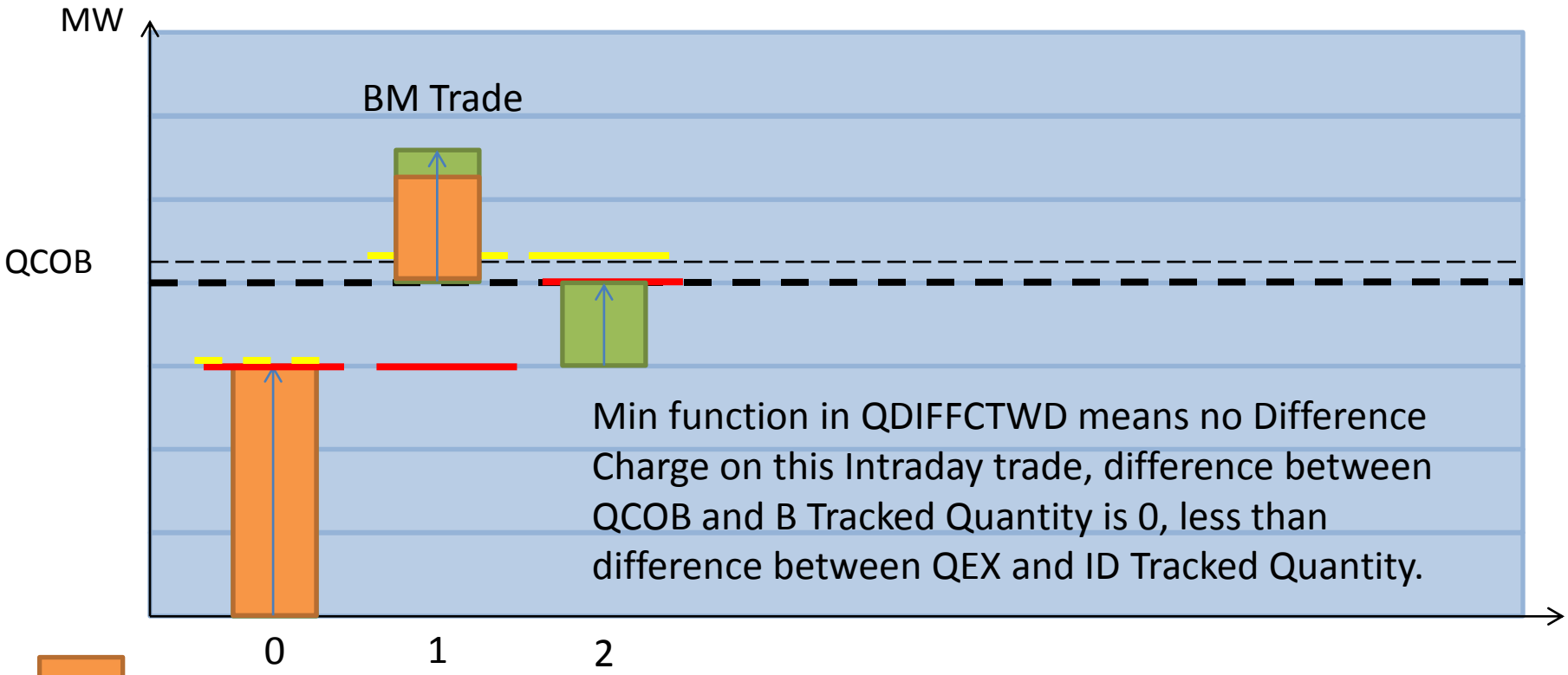
Difference Charges and Difference Payments Examples

- Difference Charge Example 6 – Day-ahead, Intraday, Balancing trade before Intraday Trade:



Difference Charges and Difference Payments Examples

- Difference Charge Example 6 – Day-ahead, Intraday, Balancing trade before Intraday Trade, :

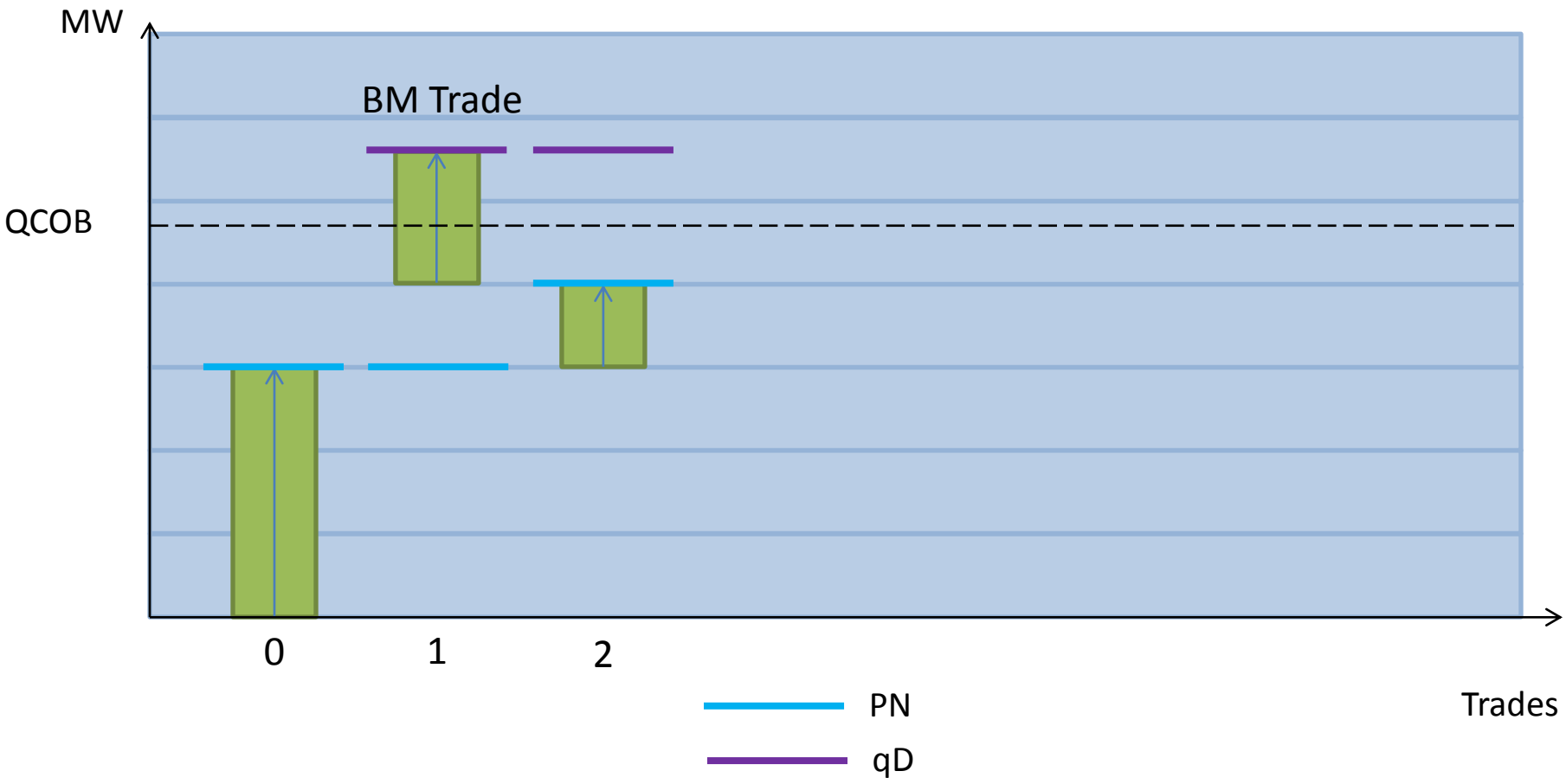


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	42	42	42	N/A	N/A	N/A	N/A	N/A
Volume of this Trade	30	15	10	N/A	N/A	N/A	N/A	N/A
QEX Ex-ante Quantity	40	40	40	N/A	N/A	N/A	N/A	N/A
Total Ex-Ante Traded Position After This Step	30	30	40	N/A	N/A	N/A	N/A	N/A
Total Traded Position After This Step	30	45	55	N/A	N/A	N/A	N/A	N/A
QDIFFDA Day-ahead Difference Quantity	30	30	30	N/A	N/A	N/A	N/A	N/A
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	12	0	N/A	N/A	N/A	N/A	N/A
Sum of the Volumes Eligible for Market Difference Charges After This Step	30	42	42	N/A	N/A	N/A	N/A	N/A
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	30	30	40	N/A	N/A	N/A	N/A	N/A
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	30	42	42	N/A	N/A	N/A	N/A	N/A
qAA Actual Availability Quantity	70	70	70	N/A	N/A	N/A	N/A	N/A
qD Dispatch Quantity	55	55	55	N/A	N/A	N/A	N/A	N/A
QDIFFCSS System Service Difference Quantity	0	0	0	N/A	N/A	N/A	N/A	N/A
QDIFFCNP Non-Performance Difference Quantity	0	0	0	N/A	N/A	N/A	N/A	N/A

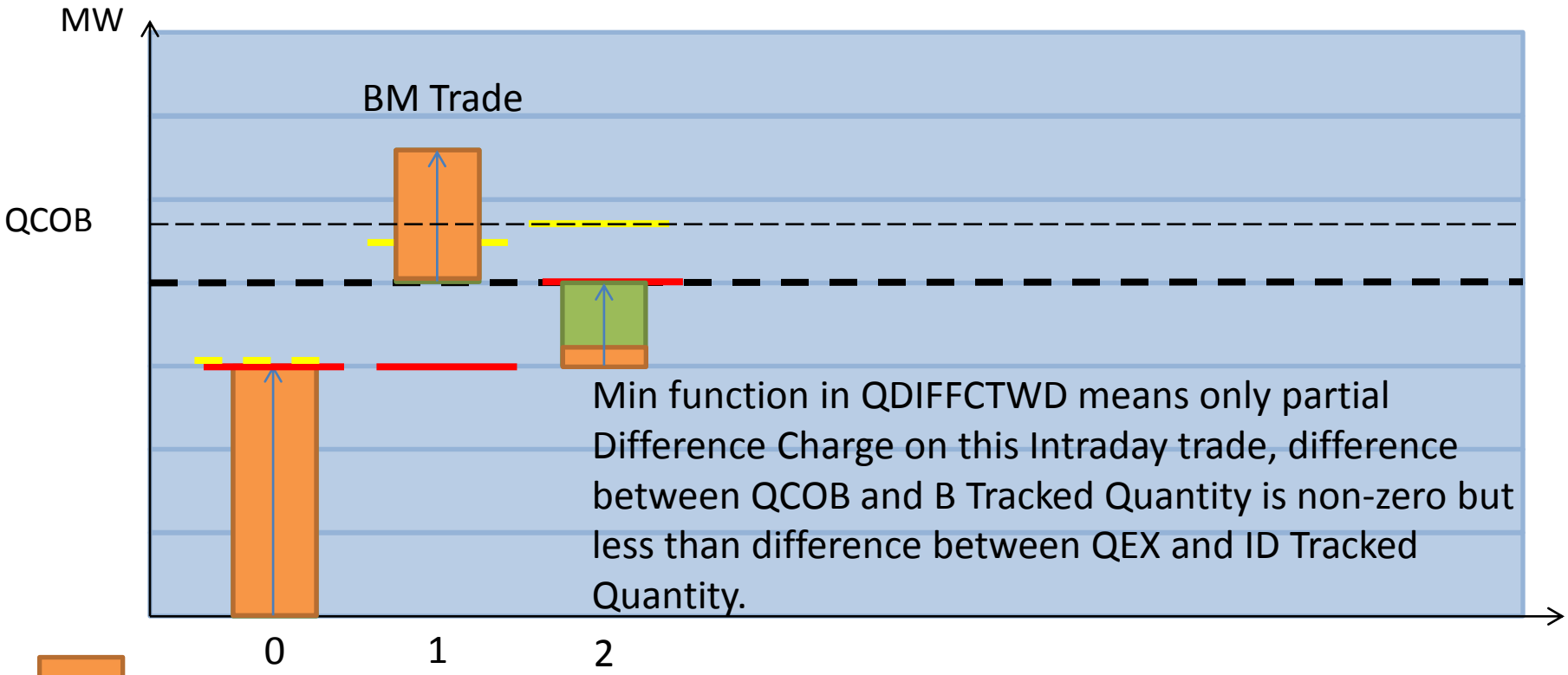
Difference Charges and Difference Payments Examples

- Difference Charge Example 7 – Day-ahead, Intraday, Balancing trade before Intraday Trade:



Difference Charges and Difference Payments Examples

- Difference Charge Example 7 – Day-ahead, Intraday, Balancing trade before Intraday Trade:

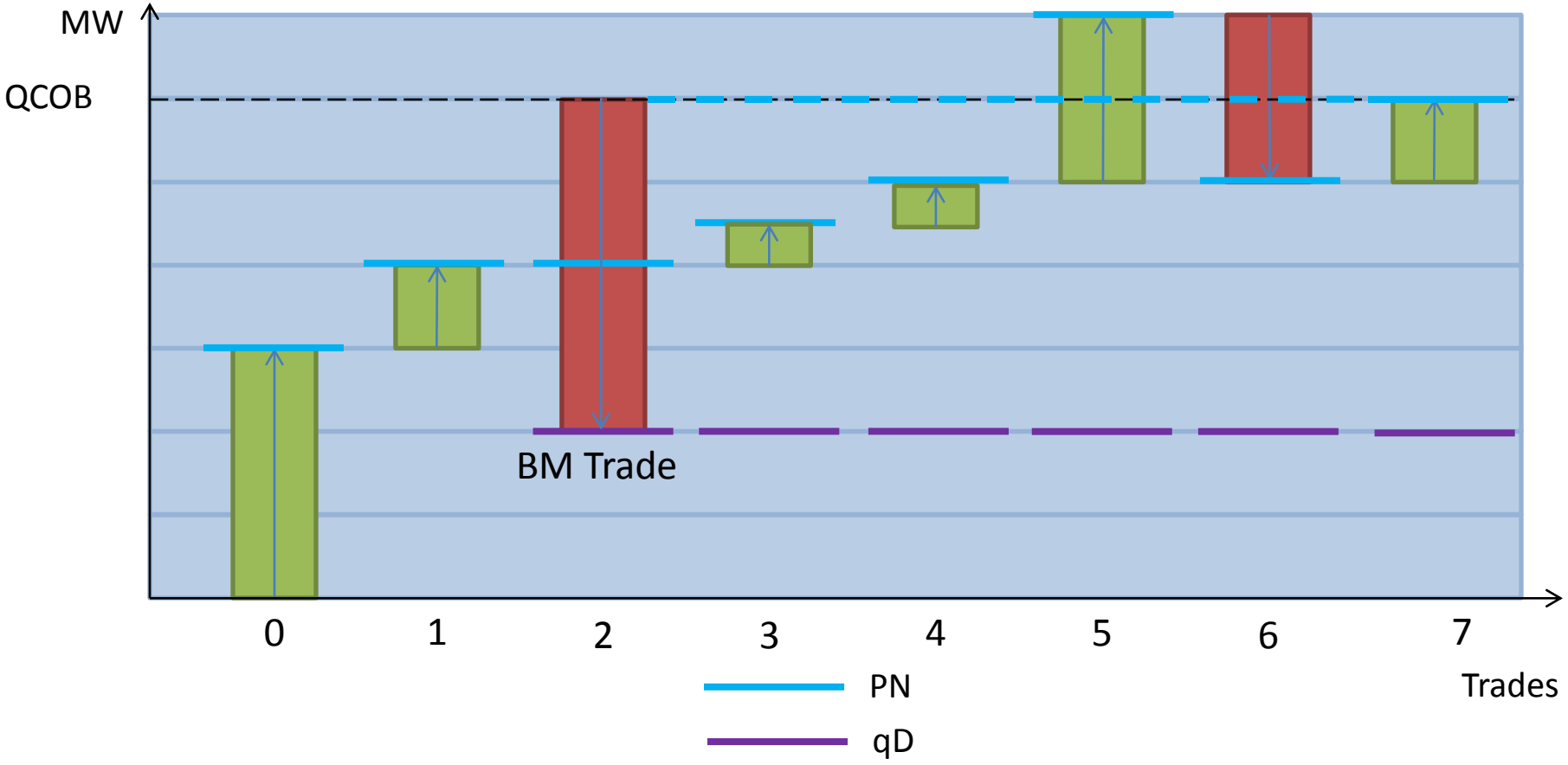


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	42	42	42	N/A	N/A	N/A	N/A	N/A
Volume of this Trade	30	15	10	N/A	N/A	N/A	N/A	N/A
QEX Ex-ante Quantity	40	40	40	N/A	N/A	N/A	N/A	N/A
Total Ex-Ante Traded Position After This Step	30	30	40	N/A	N/A	N/A	N/A	N/A
Total Traded Position After This Step	30	45	55	N/A	N/A	N/A	N/A	N/A
QDIFFDA Day-ahead Difference Quantity	30	30	30	N/A	N/A	N/A	N/A	N/A
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	12	0	N/A	N/A	N/A	N/A	N/A
Sum of the Volumes Eligible for Market Difference Charges After This Step	30	42	42	N/A	N/A	N/A	N/A	N/A
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	30	30	40	N/A	N/A	N/A	N/A	N/A
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	30	42	42	N/A	N/A	N/A	N/A	N/A
qAA Actual Availability Quantity	70	70	70	N/A	N/A	N/A	N/A	N/A
qD Dispatch Quantity	55	55	55	N/A	N/A	N/A	N/A	N/A
QDIFFCSS System Service Difference Quantity	0	0	0	N/A	N/A	N/A	N/A	N/A
QDIFFCNP Non-Performance Difference Quantity	0	0	0	N/A	N/A	N/A	N/A	N/A

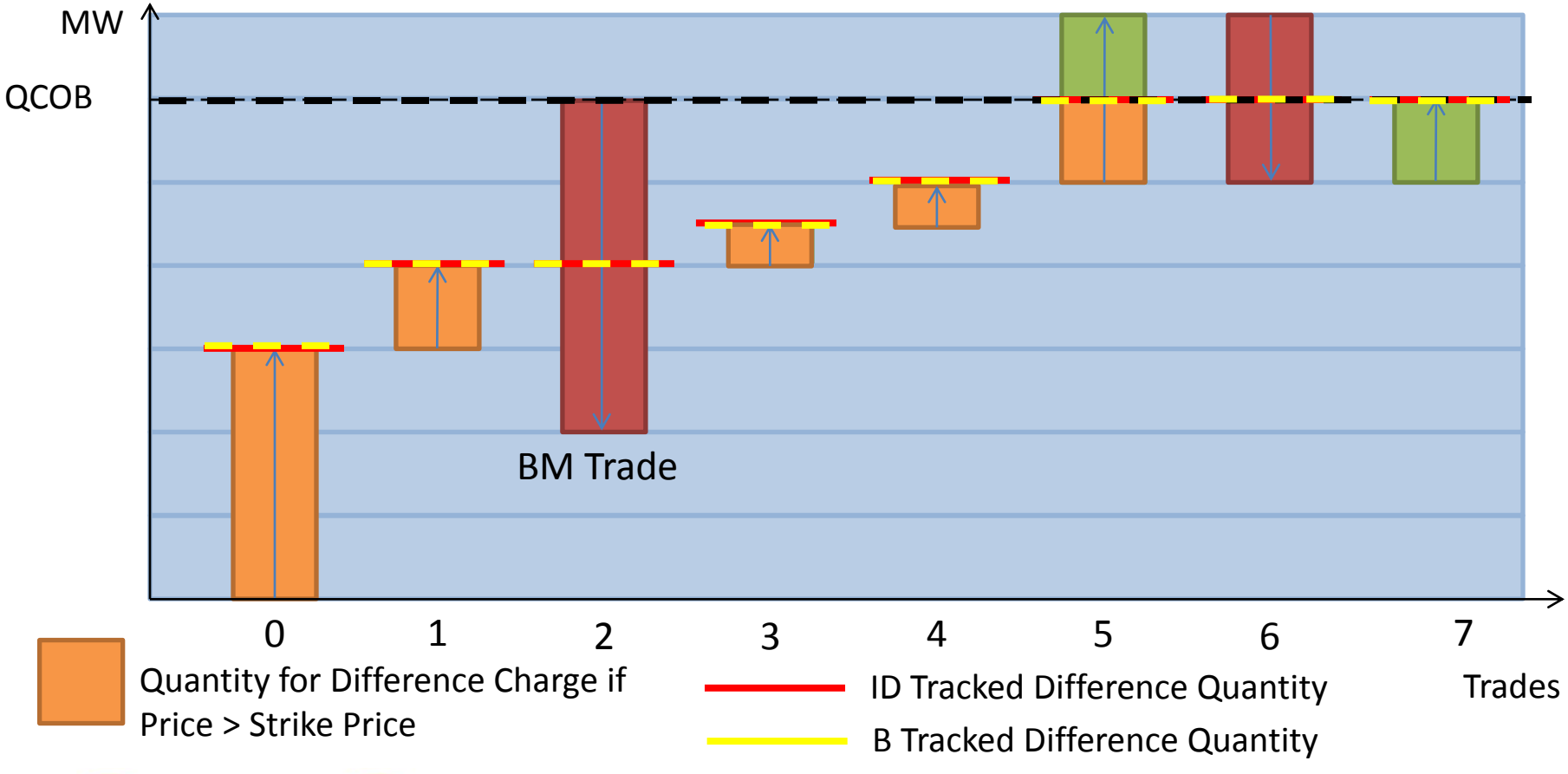
Difference Charges and Difference Payments Examples

- Difference Charge Example 8 – Day-ahead, Intraday, Balancing Trade before Intraday Trade, with Trade Opposite TSO not turned on:



Difference Charges and Difference Payments Examples

- Difference Charge Example 8 – Day-ahead, Intraday, Balancing Trade before Intraday Trade, with Trade Opposite TSO not turned on:

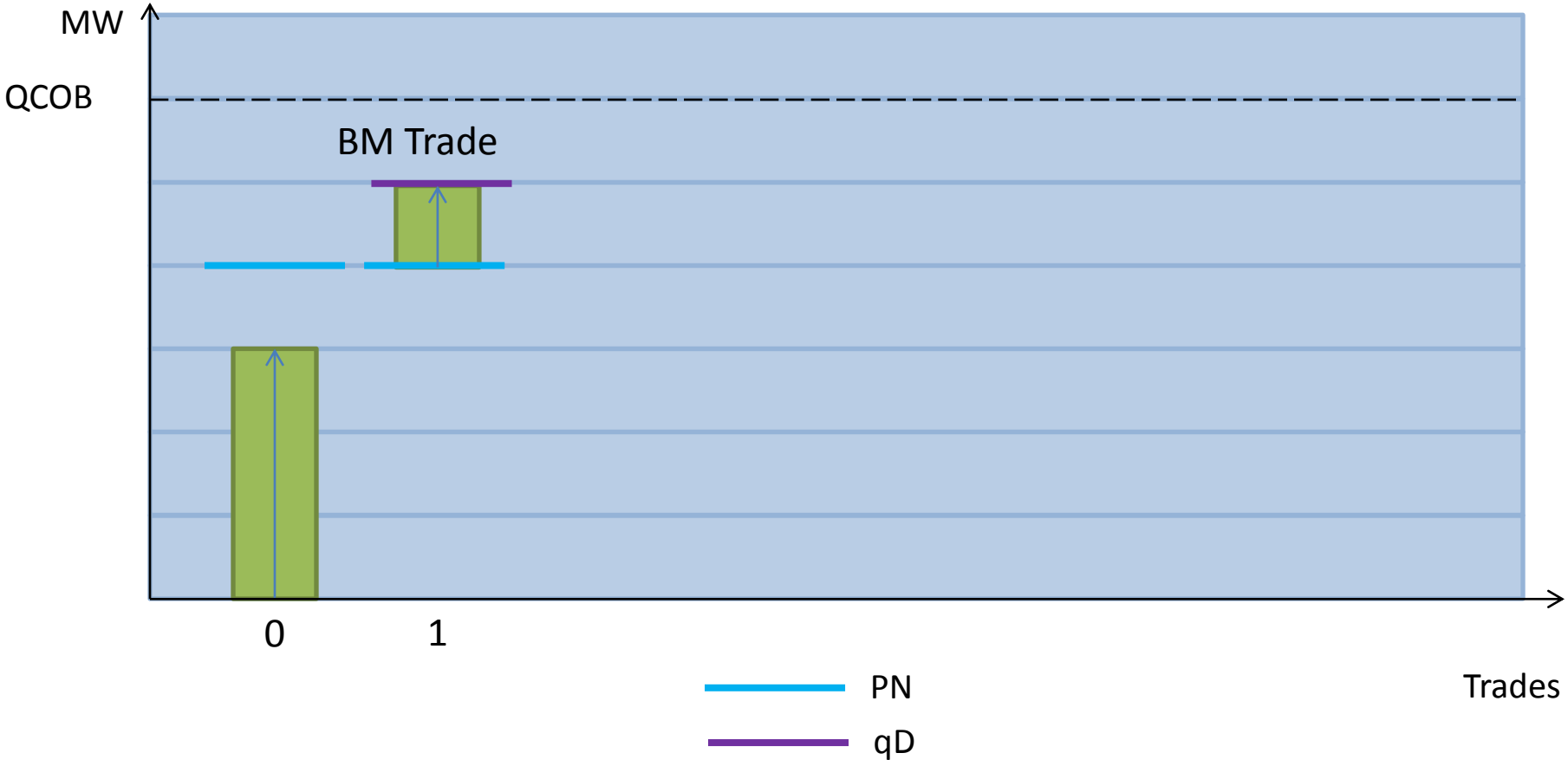


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	60	60	60	60	60	60	60	60
Volume of this Trade	30	10	-40	5	5	20	-20	10
QEX Ex-ante Quantity	60	60	60	60	60	60	60	60
Total Ex-Ante Traded Position After This Step	30	40	40	45	50	70	50	60
Total Traded Position After This Step	30	40	0	5	10	30	10	20
QDIFFDA Day-ahead Difference Quantity	30	30	30	30	30	30	30	30
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	10	0	5	5	10	0	0
Sum of the Volumes Eligible for Market Difference Charges After This Step	30	40	40	45	50	60	60	60
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	30	40	40	45	50	60	60	60
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	30	40	40	45	50	60	60	60
qAA Actual Availability Quantity	70	70	70	70	70	70	70	70
qD Dispatch Quantity	20	20	20	20	20	20	20	20
QDIFFCSS System Service Difference Quantity	0	0	0	0	0	0	0	0
QDIFFCNP Non-Performance Difference Quantity	0	0	0	0	0	0	0	0

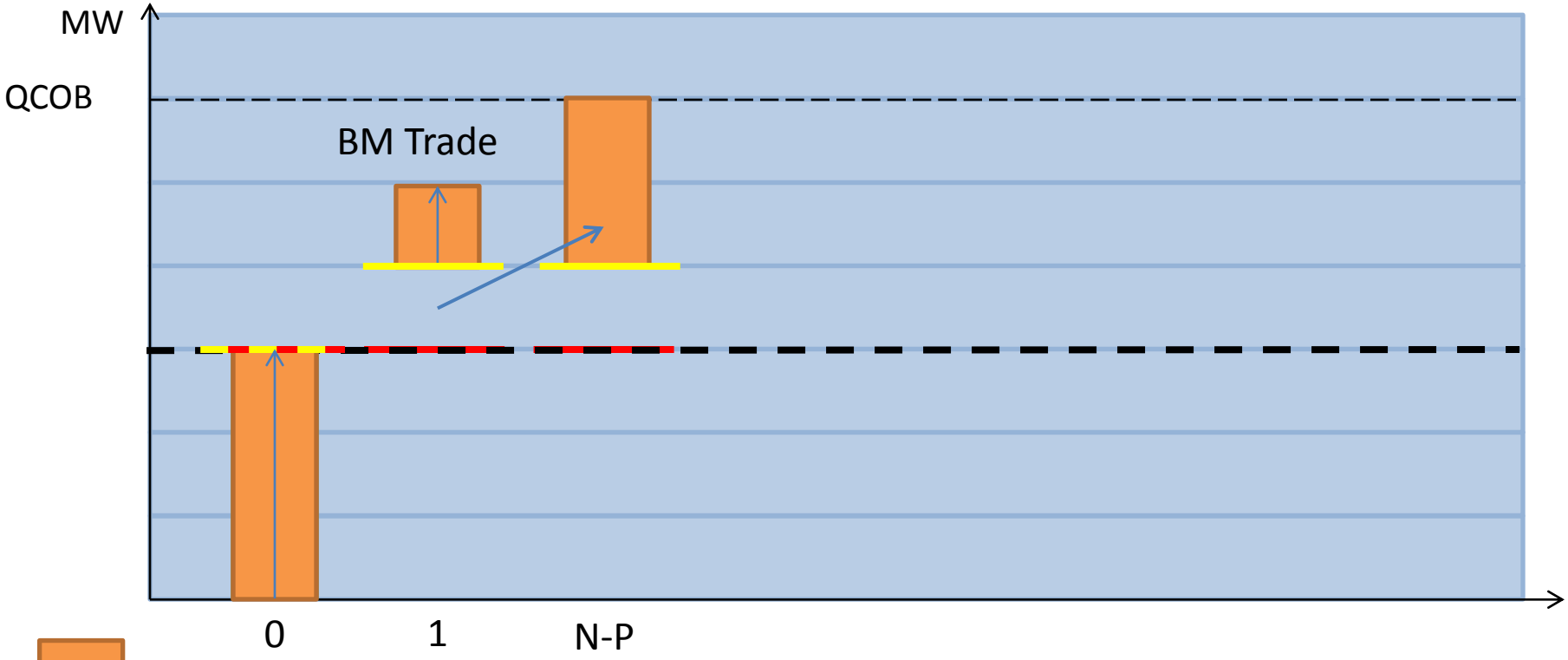
Difference Charges and Difference Payments Examples

- Difference Charge Example 9 – Day-ahead and Balancing with Notified Imbalance and Non-Performance:



Difference Charges and Difference Payments Examples

- Difference Charge Example 9 – Day-ahead and Balancing with Notified Imbalance and Non-Performance:

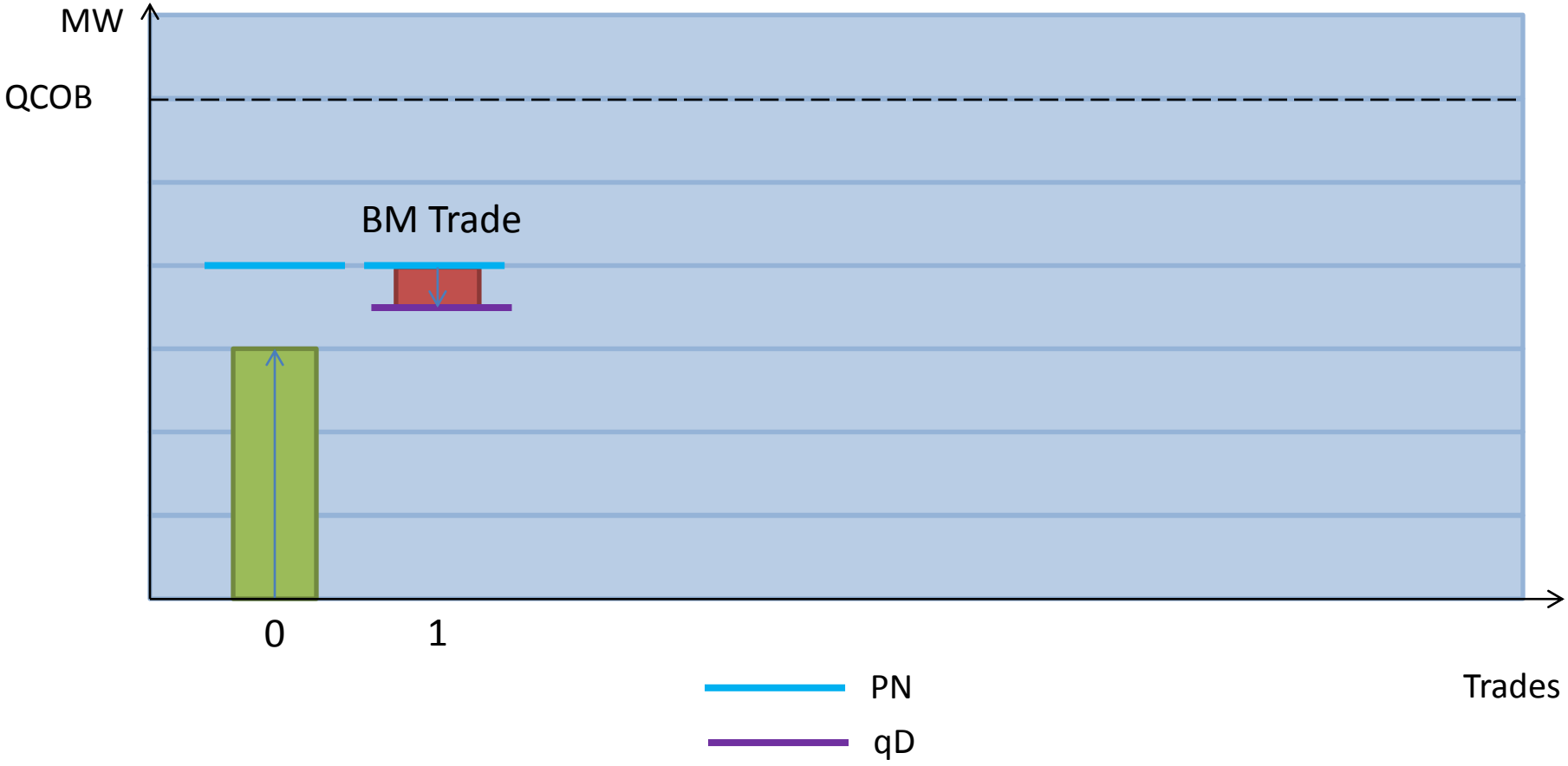


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	60	60	60	N/A	N/A	N/A	N/A	N/A
Volume of this Trade	30	10	0	N/A	N/A	N/A	N/A	N/A
QEX Ex-ante Quantity	30	30	30	N/A	N/A	N/A	N/A	N/A
Total Ex-Ante Traded Position After This Step	30	30	30	N/A	N/A	N/A	N/A	N/A
Total Traded Position After This Step	30	40	40	N/A	N/A	N/A	N/A	N/A
QDIFFDA Day-ahead Difference Quantity	30	30	30	N/A	N/A	N/A	N/A	N/A
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	10	0	N/A	N/A	N/A	N/A	N/A
Sum of the Volumes Eligible for Market Difference Charges After This Step	30	40	40	N/A	N/A	N/A	N/A	N/A
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	30	30	30	N/A	N/A	N/A	N/A	N/A
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	30	40	40	N/A	N/A	N/A	N/A	N/A
qAA Actual Availability Quantity	70	70	70	N/A	N/A	N/A	N/A	N/A
qD Dispatch Quantity	50	50	50	N/A	N/A	N/A	N/A	N/A
QDIFFCSS System Service Difference Quantity	0	0	0	N/A	N/A	N/A	N/A	N/A
QDIFFCNP Non-Performance Difference Quantity	0	0	20	N/A	N/A	N/A	N/A	N/A

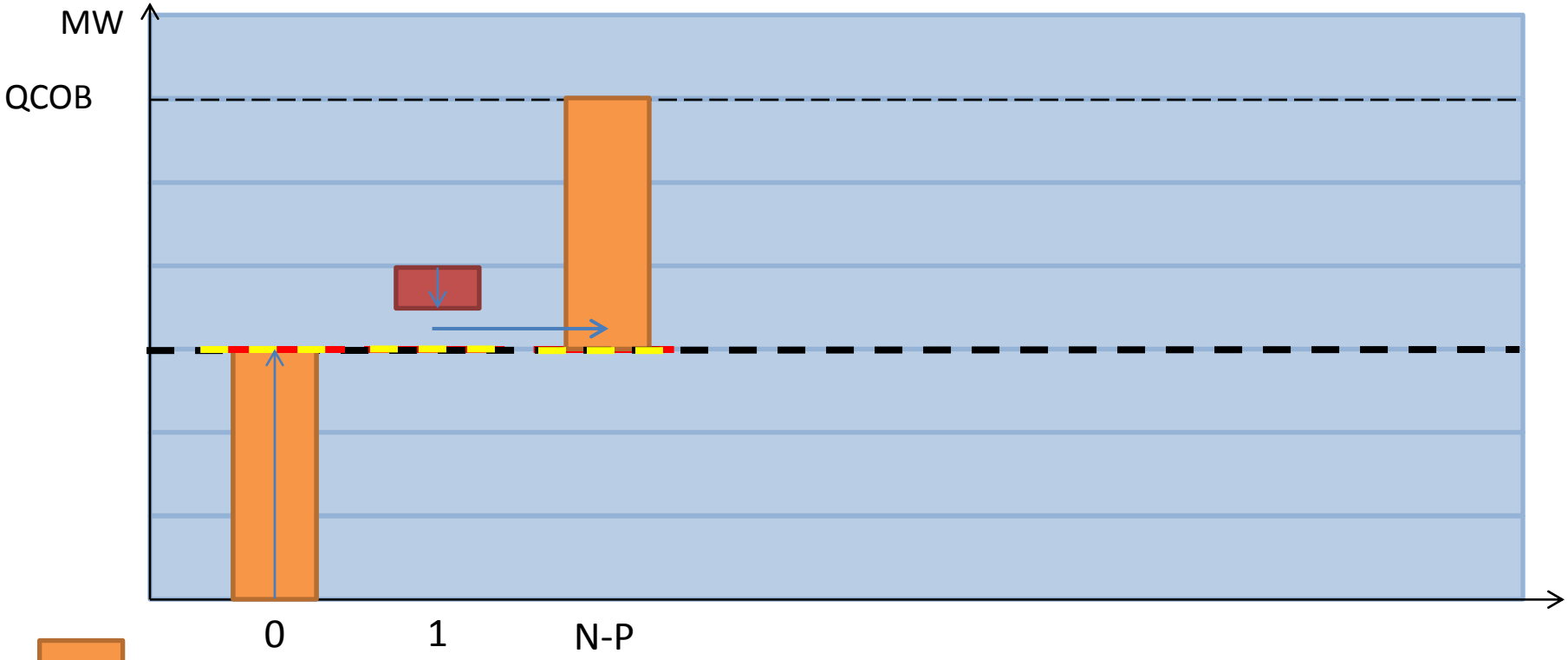
Difference Charges and Difference Payments Examples

- Difference Charge Example 10 – Day-ahead and Balancing with Notified Imbalance and Non-Performance:



Difference Charges and Difference Payments Examples

- Difference Charge Example 10 – Day-ahead and Balancing with Notified Imbalance and Non-Performance:

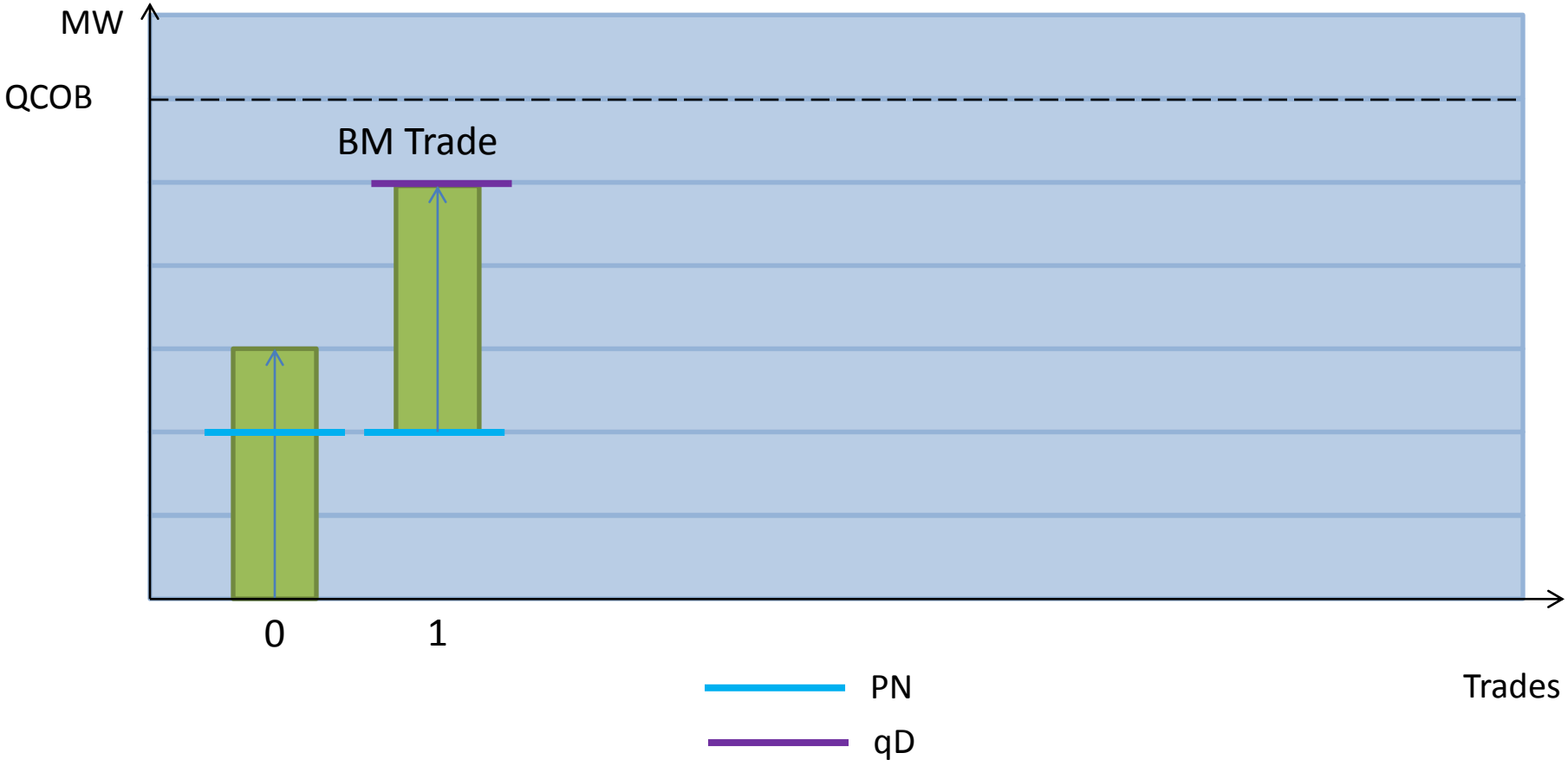


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	60	60	60	N/A	N/A	N/A	N/A	N/A
Volume of this Trade	30	-5	0	N/A	N/A	N/A	N/A	N/A
QEX Ex-ante Quantity	30	30	30	N/A	N/A	N/A	N/A	N/A
Total Ex-Ante Traded Position After This Step	30	30	30	N/A	N/A	N/A	N/A	N/A
Total Traded Position After This Step	30	25	25	N/A	N/A	N/A	N/A	N/A
QDIFFDA Day-ahead Difference Quantity	30	30	30	N/A	N/A	N/A	N/A	N/A
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	0	0	N/A	N/A	N/A	N/A	N/A
Sum of the Volumes Eligible for Market Difference Charges After This Step	30	30	30	N/A	N/A	N/A	N/A	N/A
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	30	30	30	N/A	N/A	N/A	N/A	N/A
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	30	30	30	N/A	N/A	N/A	N/A	N/A
qAA Actual Availability Quantity	70	70	70	N/A	N/A	N/A	N/A	N/A
qD Dispatch Quantity	35	35	35	N/A	N/A	N/A	N/A	N/A
QDIFFCSS System Service Difference Quantity	0	0	0	N/A	N/A	N/A	N/A	N/A
QDIFFCNP Non-Performance Difference Quantity	0	0	30	N/A	N/A	N/A	N/A	N/A

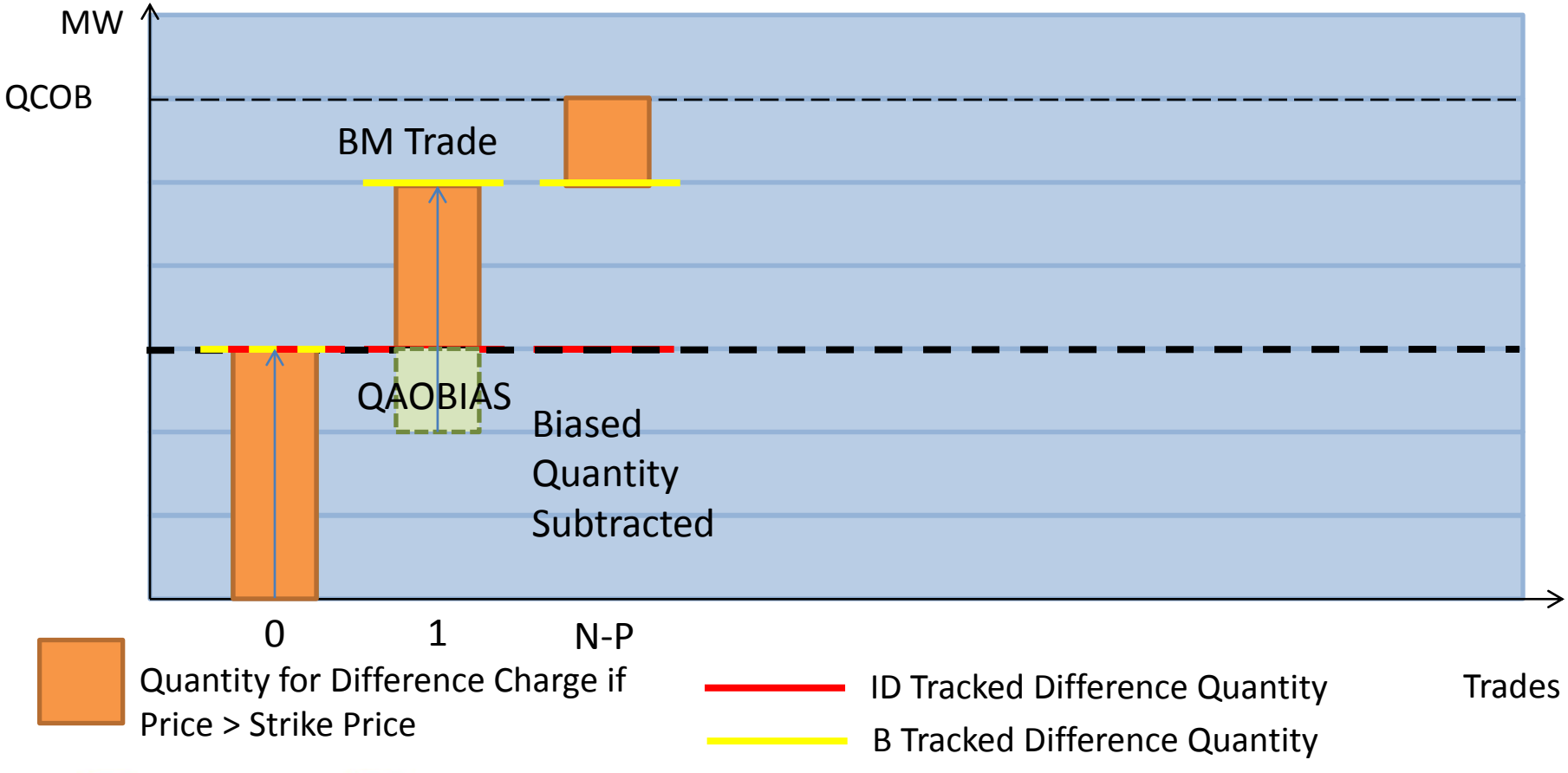
Difference Charges and Difference Payments Examples

- Difference Charge Example 11 – Day-ahead and Balancing with Biased PN and Non-Performance:



Difference Charges and Difference Payments Examples

- Difference Charge Example 11 – Day-ahead and Balancing with Biased PN and Non-Performance:

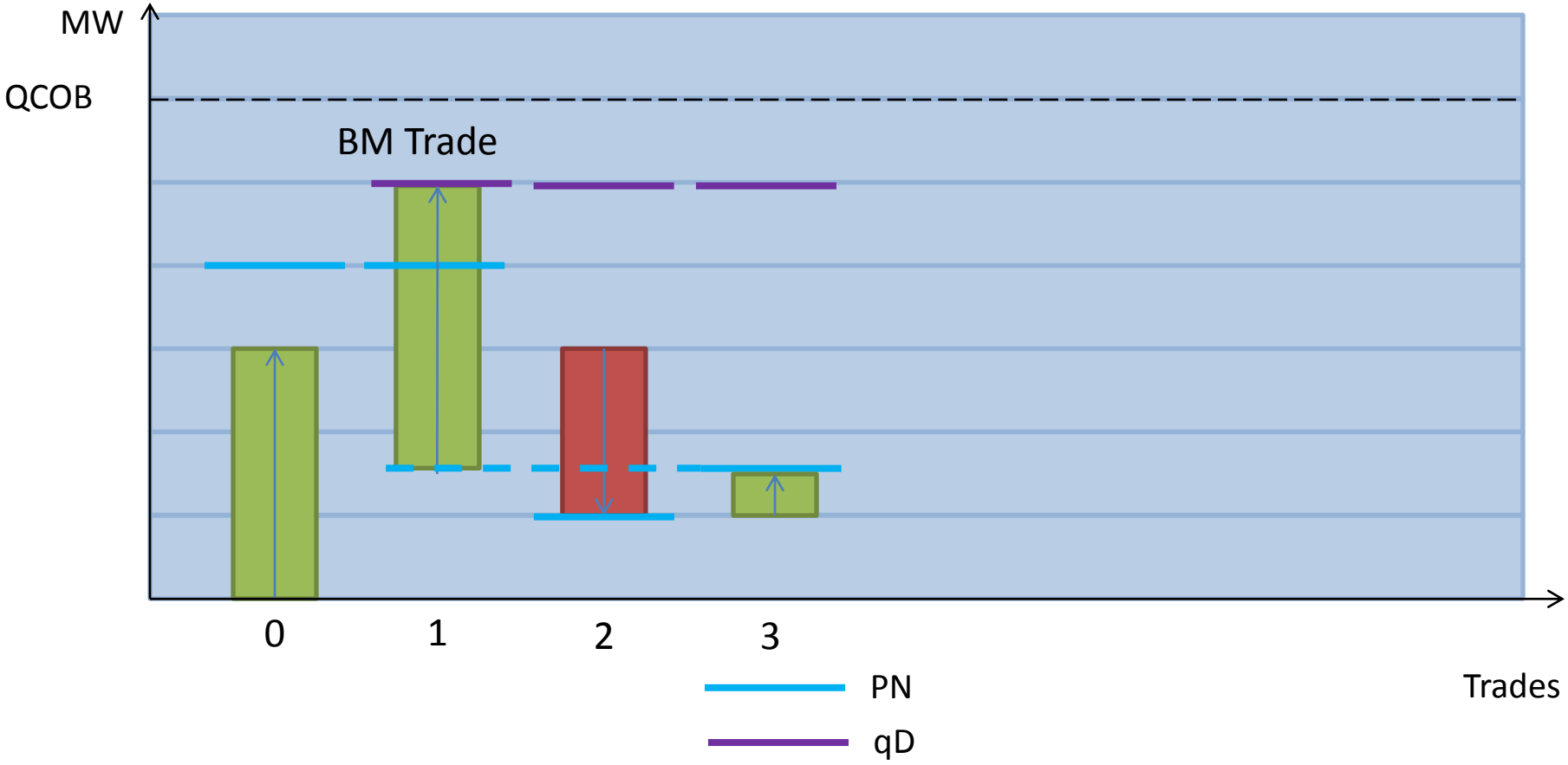


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	60	60	60	N/A	N/A	N/A	N/A	N/A
Volume of this Trade	30	30	0	N/A	N/A	N/A	N/A	N/A
QEX Ex-ante Quantity	30	30	30	N/A	N/A	N/A	N/A	N/A
Total Ex-Ante Traded Position After This Step	30	30	30	N/A	N/A	N/A	N/A	N/A
Total Traded Position After This Step	30	60	60	N/A	N/A	N/A	N/A	N/A
QDIFFDA Day-ahead Difference Quantity	30	30	30	N/A	N/A	N/A	N/A	N/A
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	20	0	N/A	N/A	N/A	N/A	N/A
Sum of the Volumes Eligible for Market Difference Charges After This Step	30	50	50	N/A	N/A	N/A	N/A	N/A
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	30	30	30	N/A	N/A	N/A	N/A	N/A
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	30	50	50	N/A	N/A	N/A	N/A	N/A
qAA Actual Availability Quantity	70	70	70	N/A	N/A	N/A	N/A	N/A
qD Dispatch Quantity	50	50	50	N/A	N/A	N/A	N/A	N/A
QDIFFCSS System Service Difference Quantity	0	0	0	N/A	N/A	N/A	N/A	N/A
QDIFFCNP Non-Performance Difference Quantity	0	0	10	N/A	N/A	N/A	N/A	N/A

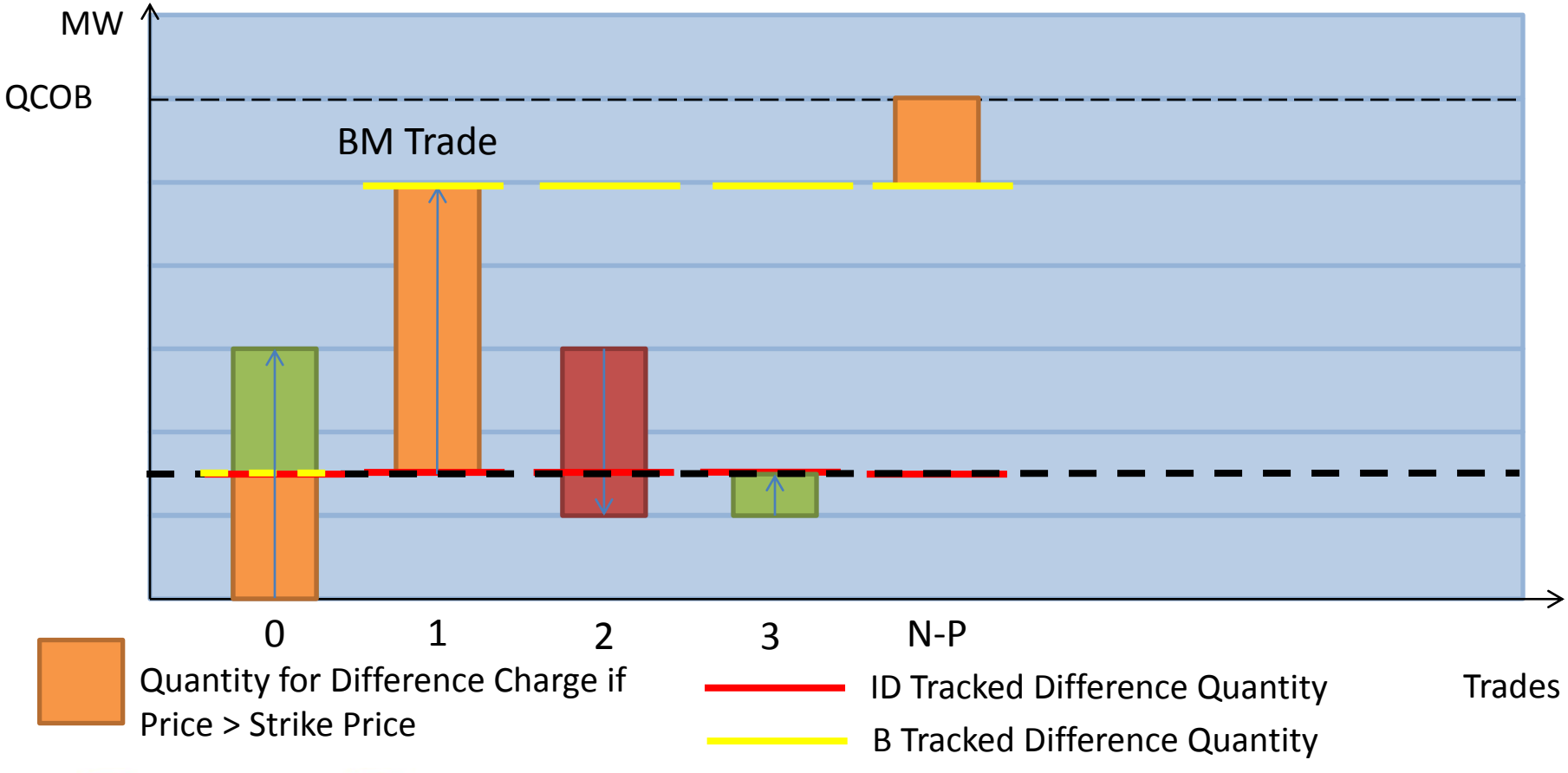
Difference Charges and Difference Payments Examples

- Difference Charge Example 12 – Day-ahead, Intraday, Balancing Trade before Intraday Trade, Notified Imbalance and Non-Performance with Trade Opposite TSO not turned on:



Difference Charges and Difference Payments Examples

- Difference Charge Example 12 – Day-ahead, Intraday, Balancing Trade before Intraday Trade, Notified Imbalance and Non-Performance with Trade Opposite TSO not turned on:

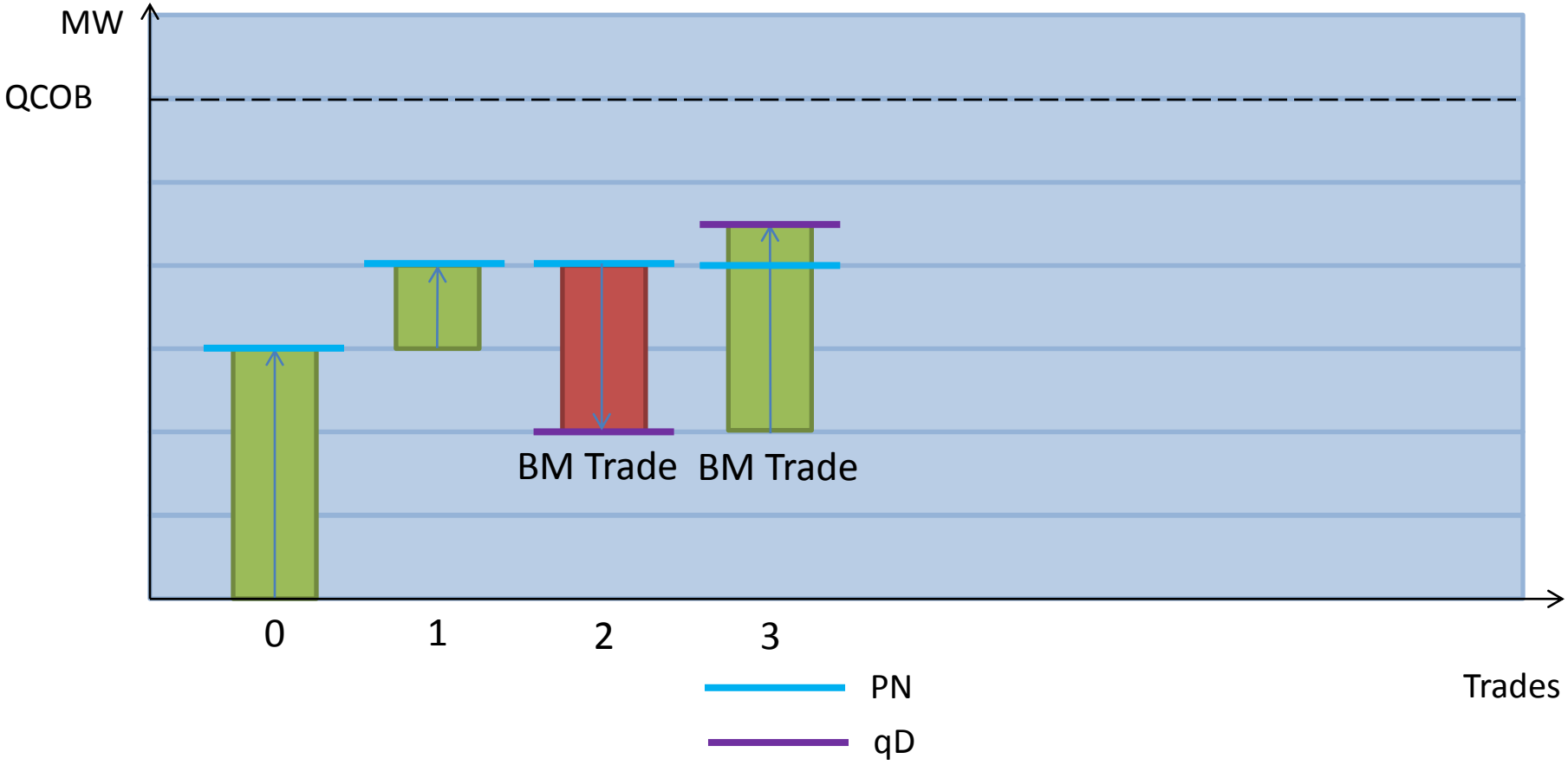


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	60	60	60	60	60	N/A	N/A	N/A
Volume of this Trade	30	35	-20	5	0	N/A	N/A	N/A
QEX Ex-ante Quantity	15	15	15	15	15	N/A	N/A	N/A
Total Ex-Ante Traded Position After This Step	30	30	10	15	15	N/A	N/A	N/A
Total Traded Position After This Step	30	65	45	50	50	N/A	N/A	N/A
QDIFFDA Day-ahead Difference Quantity	15	15	15	15	15	N/A	N/A	N/A
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	35	0	0	0	N/A	N/A	N/A
Sum of the Volumes Eligible for Market Difference Charges After This Step	15	50	50	50	50	N/A	N/A	N/A
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	15	15	15	15	15	N/A	N/A	N/A
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	15	50	50	50	50	N/A	N/A	N/A
qAA Actual Availability Quantity	70	70	70	70	70	N/A	N/A	N/A
qD Dispatch Quantity	50	50	50	50	50	N/A	N/A	N/A
QDIFFCSS System Service Difference Quantity	0	0	0	0	0	N/A	N/A	N/A
QDIFFCNP Non-Performance Difference Quantity	0	0	0	0	10	N/A	N/A	N/A

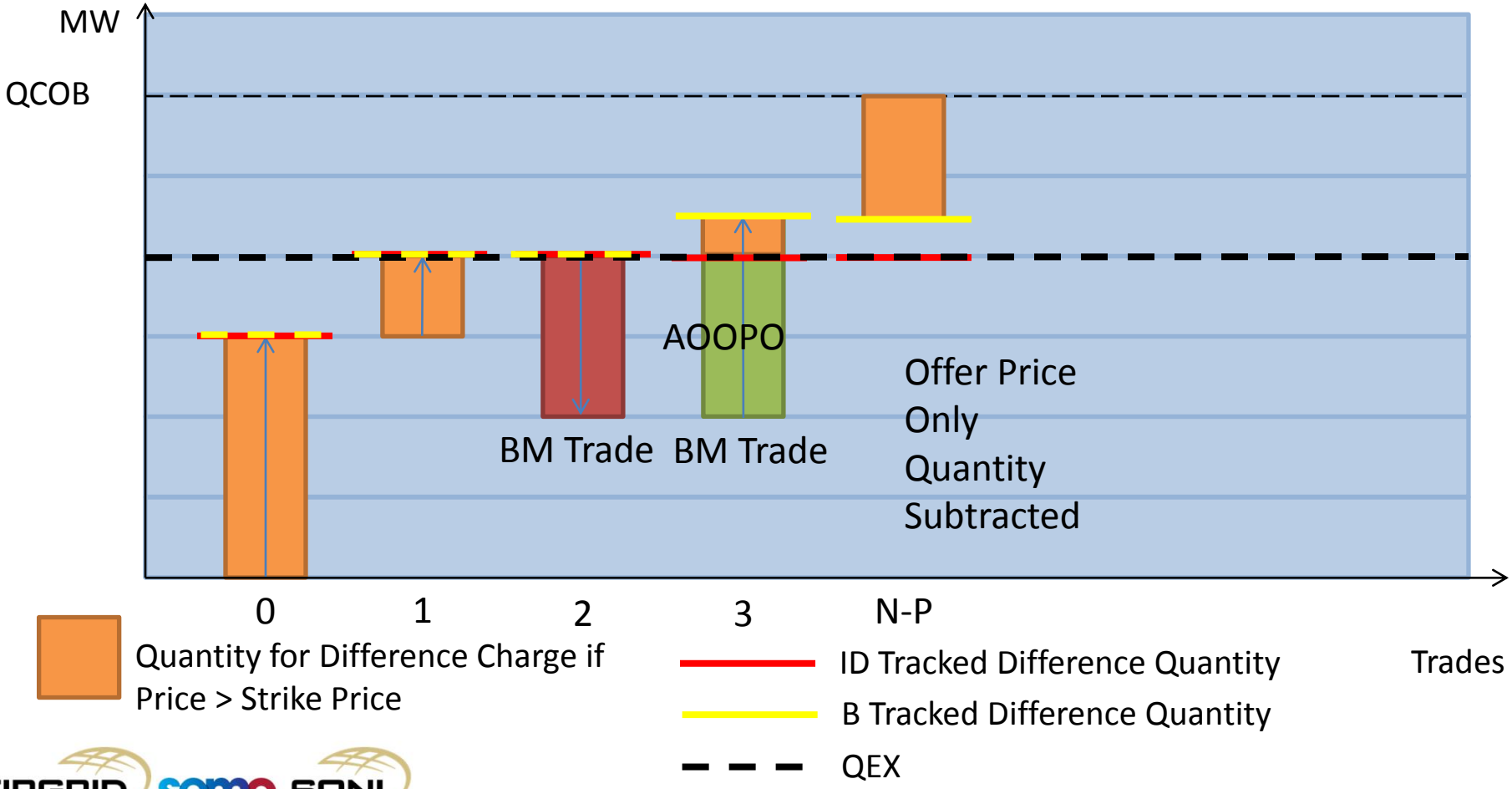
Difference Charges and Difference Payments Examples

- Difference Charge Example 13 – Day-ahead, Intraday, Balancing with Offer Price Only quantity from undo:



Difference Charges and Difference Payments Examples

- Difference Charge Example 13 – Day-ahead, Intraday, Balancing with Offer Price Only quantity from undo:

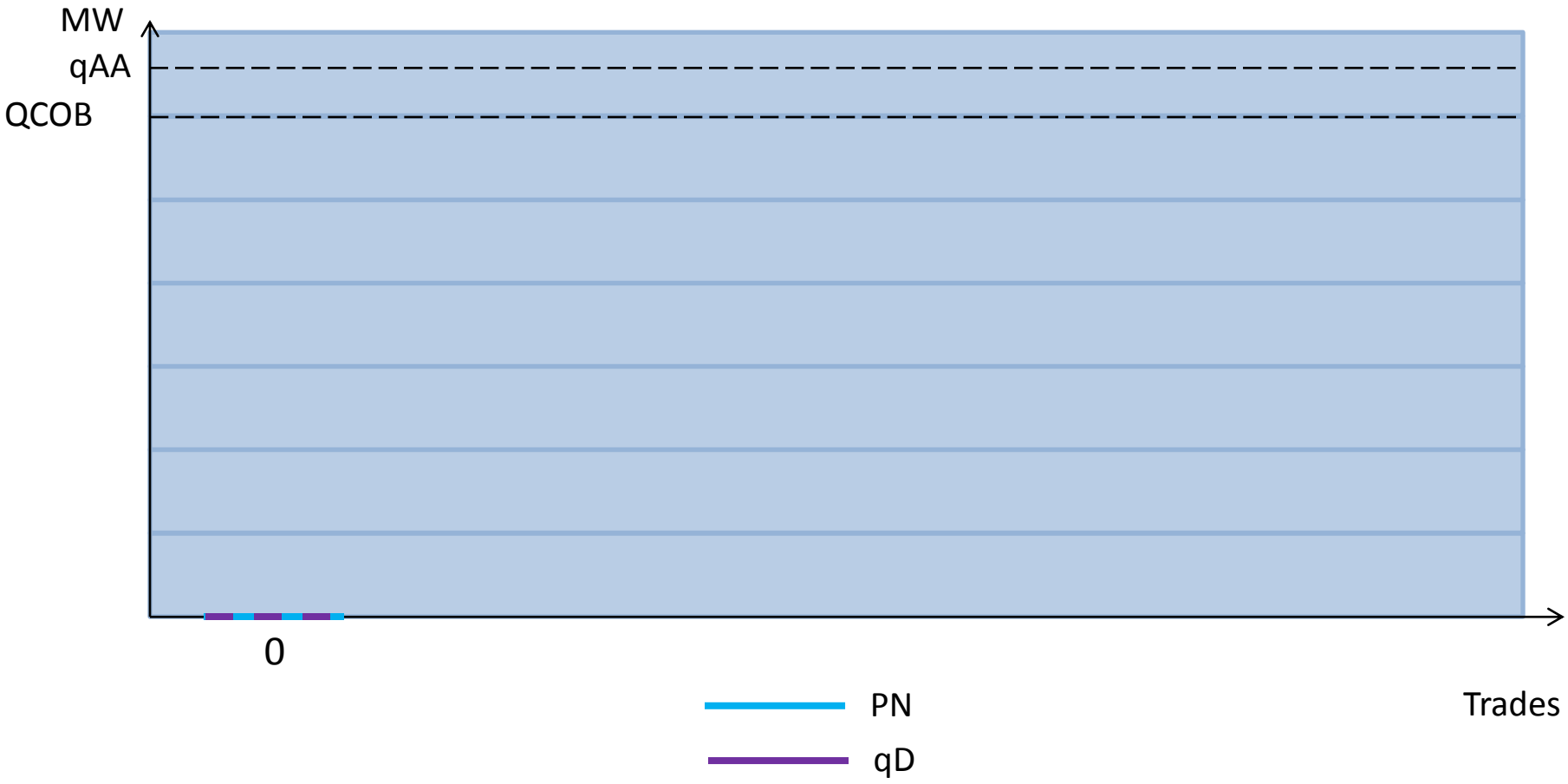


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	60	60	60	60	60	N/A	N/A	N/A
Volume of this Trade	30	10	-20	25	0	N/A	N/A	N/A
QEX Ex-ante Quantity	40	40	40	40	40	N/A	N/A	N/A
Total Ex-Ante Traded Position After This Step	30	40	40	40	40	N/A	N/A	N/A
Total Traded Position After This Step	30	40	20	45	45	N/A	N/A	N/A
QDIFFDA Day-ahead Difference Quantity	30	30	30	30	30	N/A	N/A	N/A
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	10	0	5	0	N/A	N/A	N/A
Sum of the Volumes Eligible for Market Difference Charges After This Step	30	40	40	45	45	N/A	N/A	N/A
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	30	40	40	40	40	N/A	N/A	N/A
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	30	40	40	45	45	N/A	N/A	N/A
qAA Actual Availability Quantity	70	70	70	70	70	N/A	N/A	N/A
qD Dispatch Quantity	45	45	45	45	45	N/A	N/A	N/A
QDIFFCSS System Service Difference Quantity	0	0	0	0	0	N/A	N/A	N/A
QDIFFCNP Non-Performance Difference Quantity	0	0	0	0	15	N/A	N/A	N/A

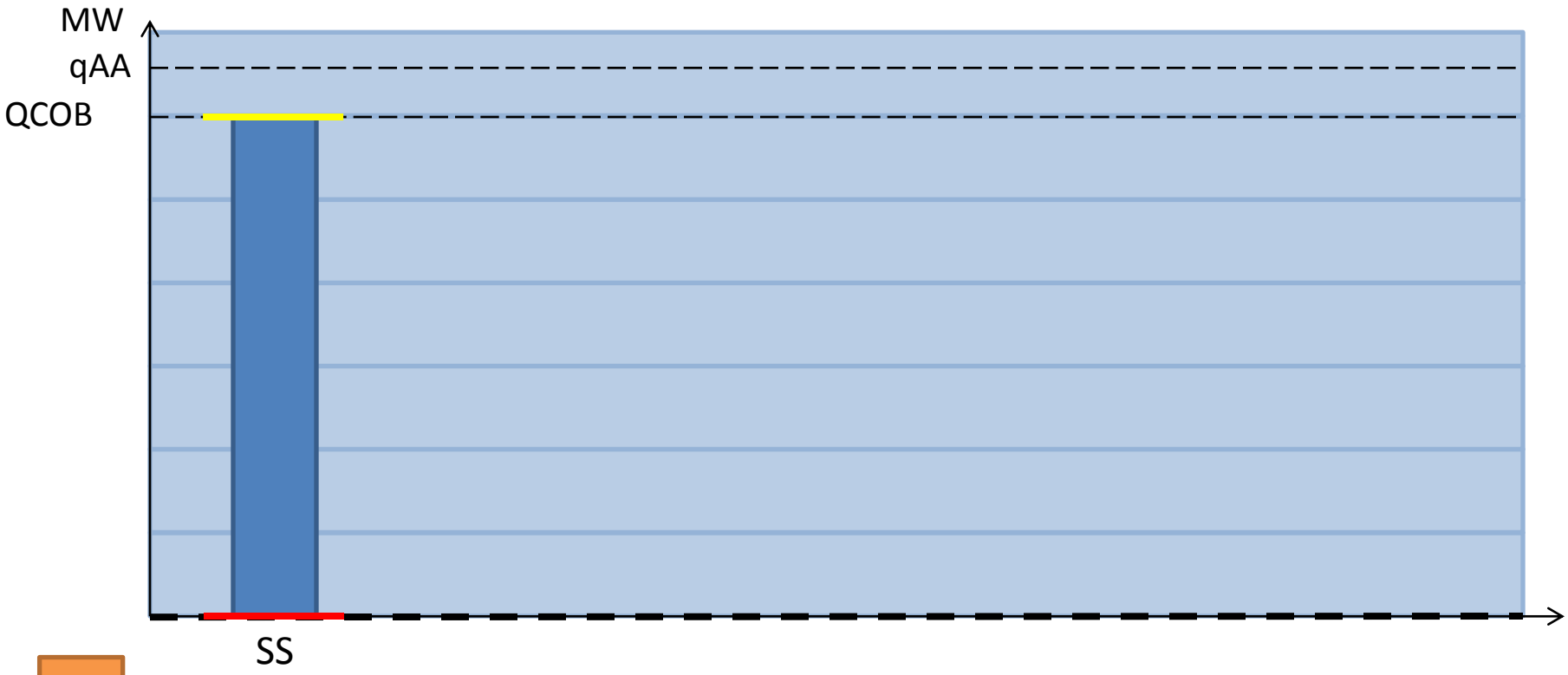
Difference Charges and Difference Payments Examples

- Difference Charge Example 14 – No trade, unit is kept off (FSS binding, qAAxDISP > QCOB):



Difference Charges and Difference Payments Examples

- Difference Charge Example 14 – No trade, unit is kept off (FSS binding, qAAxDISP > QCOB):

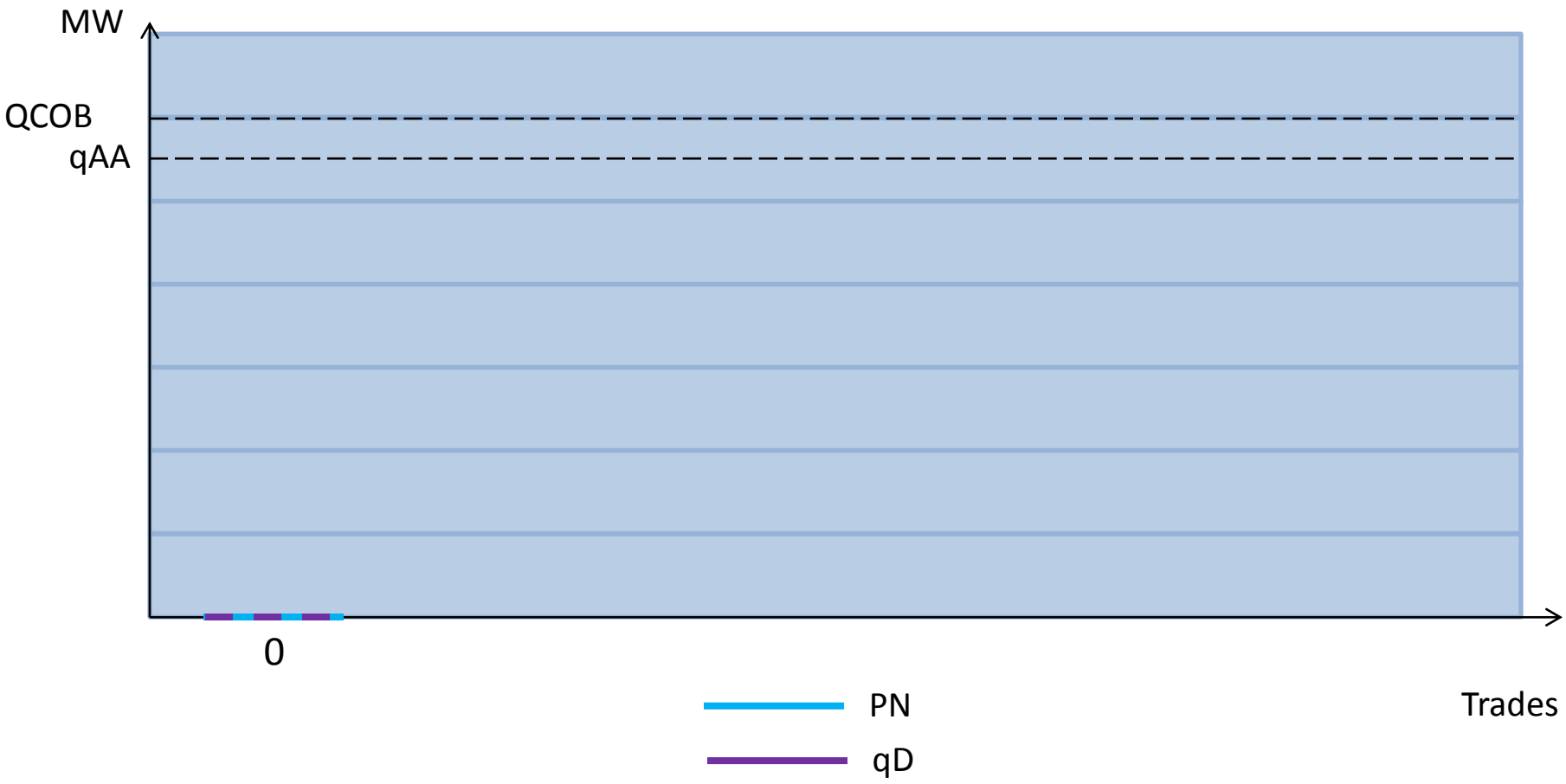


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Volume of this Trade	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QEX Ex-ante Quantity	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Ex-Ante Traded Position After This Step	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Traded Position After This Step	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QDIFFDA Day-ahead Difference Quantity	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sum of the Volumes Eligible for Market Difference Charges After This Step	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A
qAA Actual Availability Quantity	65	N/A	N/A	N/A	N/A	N/A	N/A	N/A
qD Dispatch Quantity	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QDIFFCSS System Service Difference Quantity	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QDIFFCNP Non-Performance Difference Quantity	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A

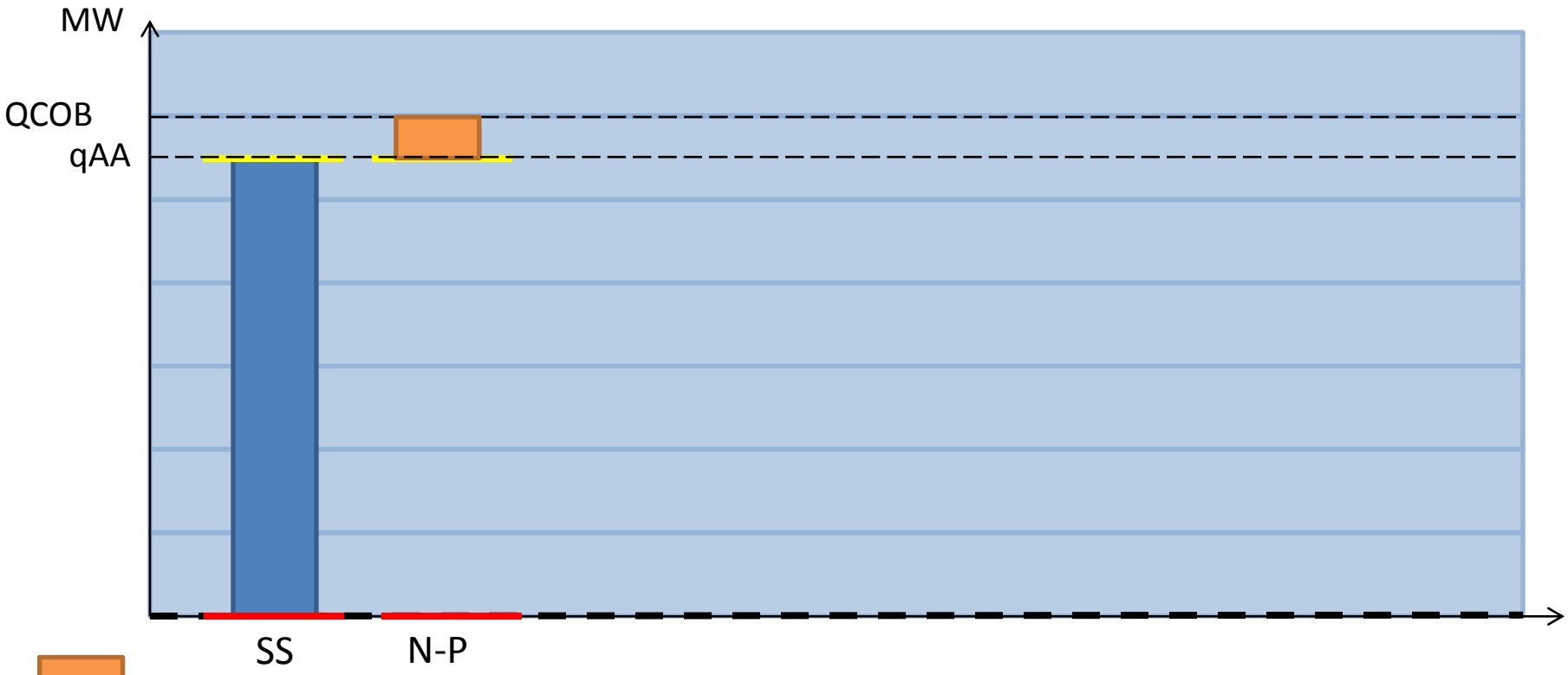
Difference Charges and Difference Payments Examples

- Difference Charge Example 15 – No trade, unit is kept off (FSS binding, qAAxDISP < QCOB):



Difference Charges and Difference Payments Examples

- Difference Charge Example 15 – No trade, unit is kept off (FSS binding, qAAxDISP < QCOB):

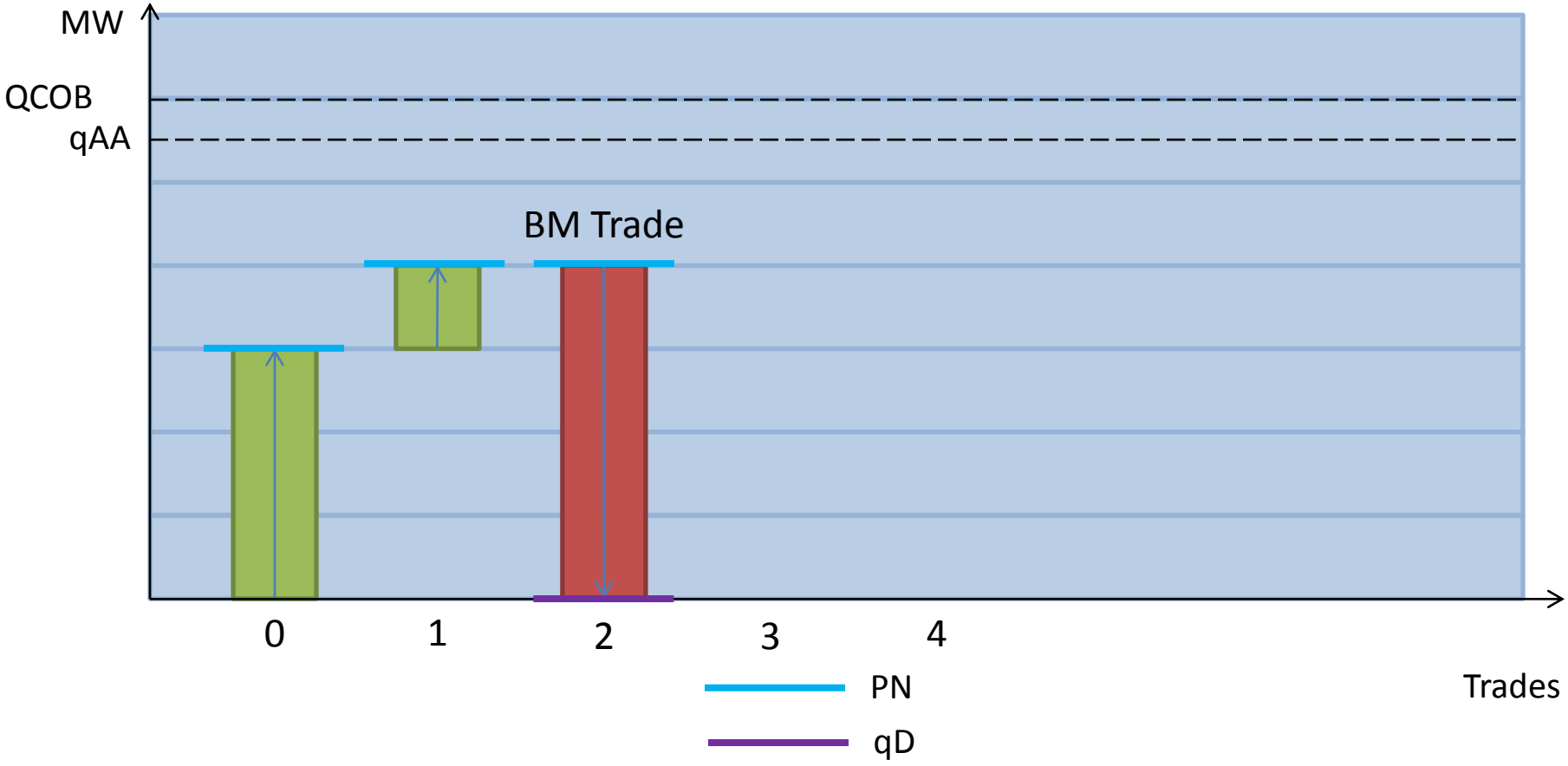


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	60	60	N/A	N/A	N/A	N/A	N/A	N/A
Volume of this Trade	0	0	N/A	N/A	N/A	N/A	N/A	N/A
QEX Ex-ante Quantity	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Total Ex-Ante Traded Position After This Step	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Total Traded Position After This Step	0	0	N/A	N/A	N/A	N/A	N/A	N/A
QDIFFDA Day-ahead Difference Quantity	0	0	N/A	N/A	N/A	N/A	N/A	N/A
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Sum of the Volumes Eligible for Market Difference Charges After This Step	0	0	N/A	N/A	N/A	N/A	N/A	N/A
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	0	0	N/A	N/A	N/A	N/A	N/A	N/A
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	55	55	N/A	N/A	N/A	N/A	N/A	N/A
qAA Actual Availability Quantity	55	70	N/A	N/A	N/A	N/A	N/A	N/A
qD Dispatch Quantity	0	0	N/A	N/A	N/A	N/A	N/A	N/A
QDIFFCSS System Service Difference Quantity	55	55	N/A	N/A	N/A	N/A	N/A	N/A
QDIFFCNP Non-Performance Difference Quantity	0	5	N/A	N/A	N/A	N/A	N/A	N/A

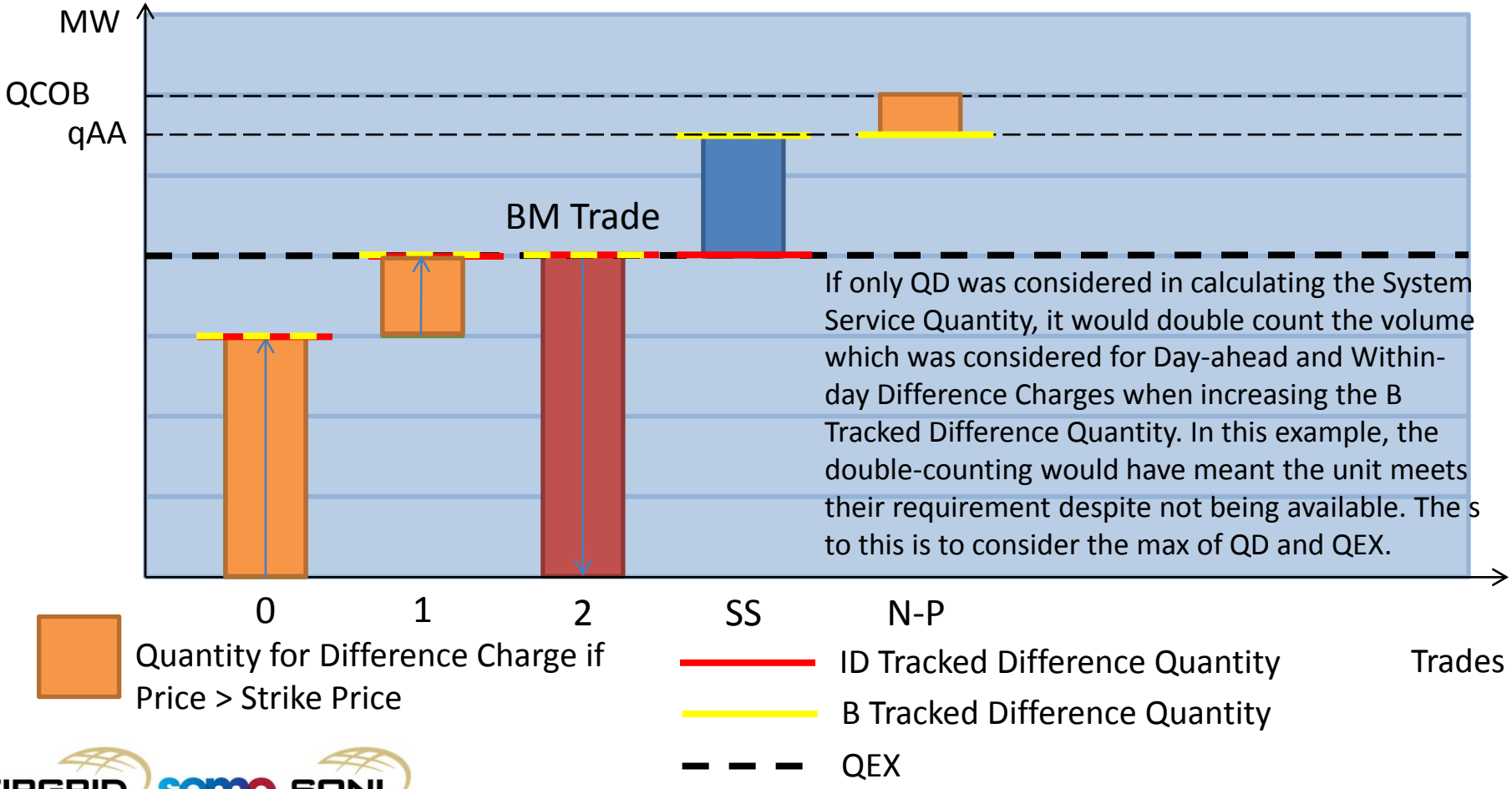
Difference Charges and Difference Payments Examples

- Difference Charge Example 16 – Day-ahead and Intraday trade, unit is kept off (FSS binding, qAAxDISP < QCOB):



Difference Charges and Difference Payments Examples

- Difference Charge Example 16 – Day-ahead and Intraday trade, unit is kept off (FSS binding, qAAxDISP < QCOB):

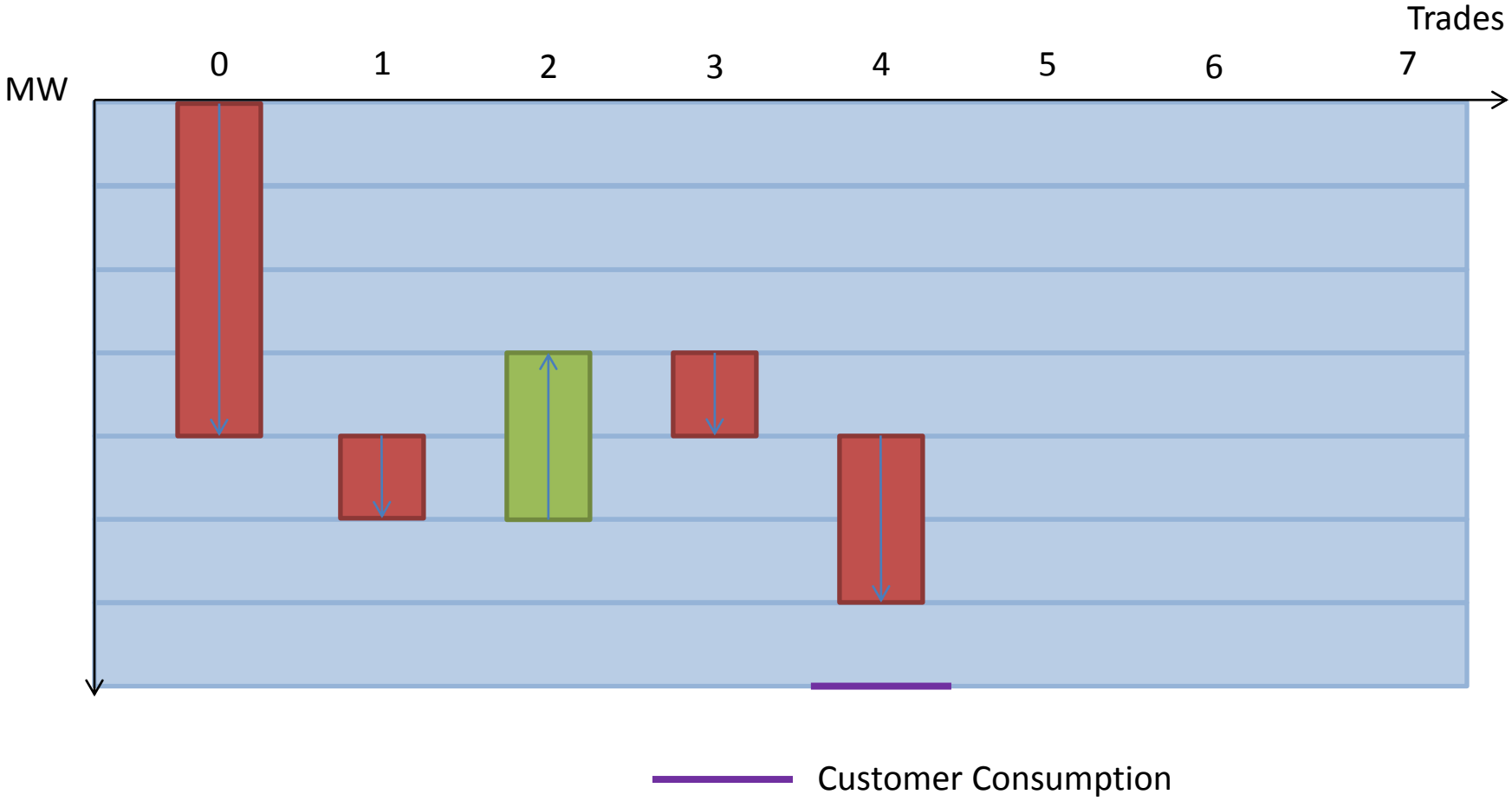


Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
QCOB Obligated Capacity Quantity	60	60	60	60	60	N/A	N/A	N/A
Volume of this Trade	30	10	-30	0	0	N/A	N/A	N/A
QEX Ex-ante Quantity	40	40	40	40	40	N/A	N/A	N/A
Total Ex-Ante Traded Position After This Step	30	40	40	40	40	N/A	N/A	N/A
Total Traded Position After This Step	30	40	0	0	0	N/A	N/A	N/A
QDIFFDA Day-ahead Difference Quantity	30	30	30	30	30	N/A	N/A	N/A
QDIFFCTWD Within-day Trade Difference Quantity Arising in This Step	0	10	0	0	0	N/A	N/A	N/A
Sum of the Volumes Eligible for Market Difference Charges After This Step	30	40	40	40	40	N/A	N/A	N/A
QDIFFTRACKID Intraday Tracked Difference Quantity After This Step	30	40	40	40	40	N/A	N/A	N/A
QDIFFTRACKB Balancing Tracked Difference Quantity After This Step	30	40	40	55	55	N/A	N/A	N/A
qAA Actual Availability Quantity	55	55	55	55	55	N/A	N/A	N/A
qD Dispatch Quantity	0	0	0	0	0	N/A	N/A	N/A
QDIFFCSS System Service Difference Quantity	0	0	0	15	0	N/A	N/A	N/A
QDIFFCNP Non-Performance Difference Quantity	0	0	0	0	5	N/A	N/A	N/A

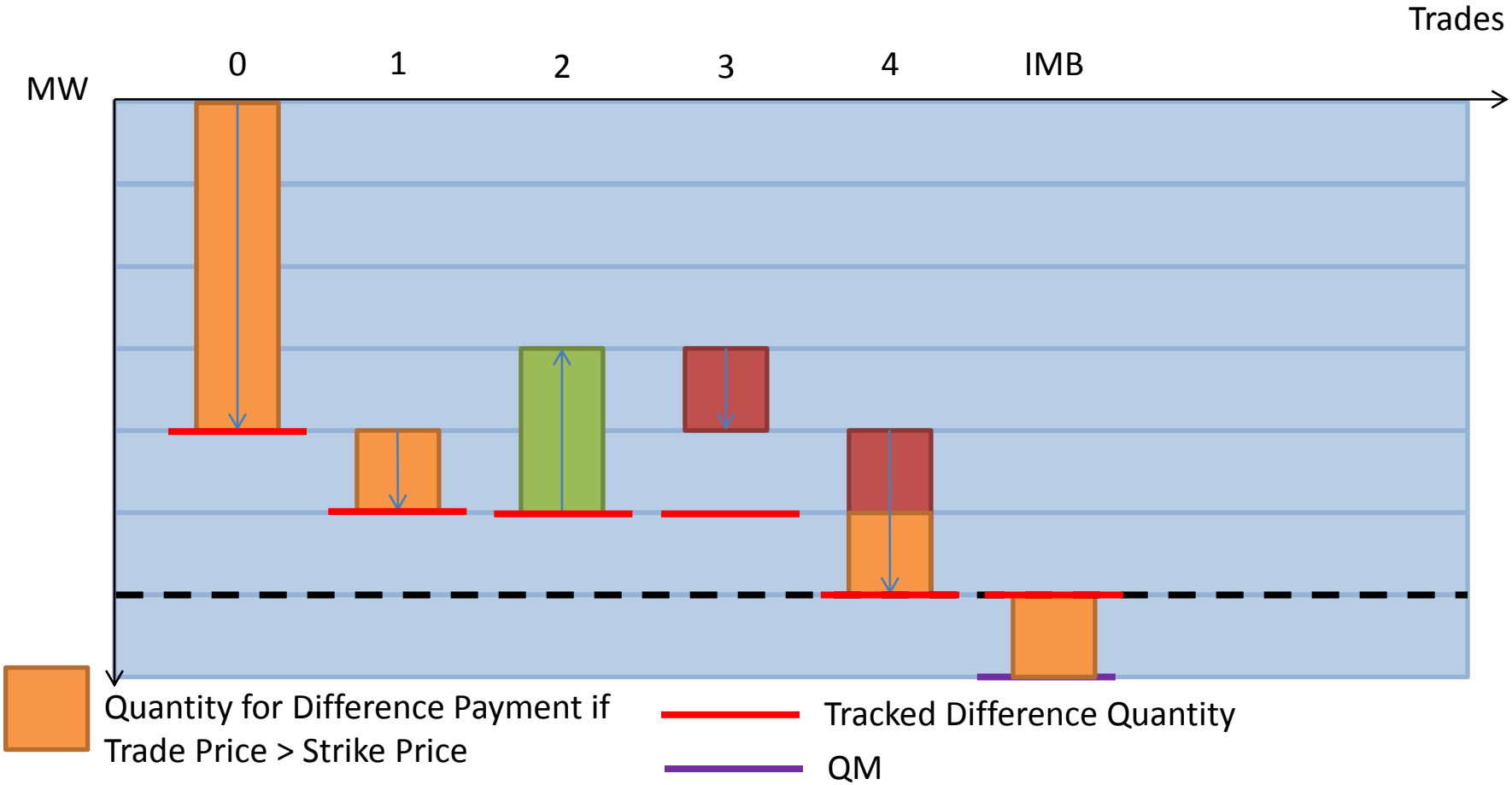
Difference Charges and Difference Payments Examples

- Difference Payment Example:



Difference Charges and Difference Payments Examples

- Difference Payment Example:



Difference Charges and Difference Payments Examples

Step	0	1	2	3	4	5	6	7
Volume of this Trade	-40	-10	20	-10	-20	0	N/A	N/A
QEX Ex-ante Quantity	-60	-60	-60	-60	-60	-60	N/A	N/A
Total Traded Position After This Step	-40	-50	-30	-40	-60	-60	N/A	N/A
QDIFFDA Day-ahead Difference Quantity	-40	-40	-40	-40	-40	-40	N/A	N/A
QDIFFCTID Intraday Trade Difference Quantity Arising in This Step	0	-10	0	0	-10	0	N/A	N/A
Sum of the Volumes Eligible for Market Difference Charges After This Step	-40	-50	-50	-50	-60	-60	N/A	N/A
QDIFFTRACK Tracked Difference Quantity After This Step	-40	-50	-50	-50	-60	-60	N/A	N/A
QM Metered Quantity	-70	-70	-70	-70	-70	-70	N/A	N/A
QDIFFCIMB Imbalance Difference Quantity	0	0	0	0	0	-10	N/A	N/A

Topic 9: Difference Payment Socialisation Charge and Socialisation Fund

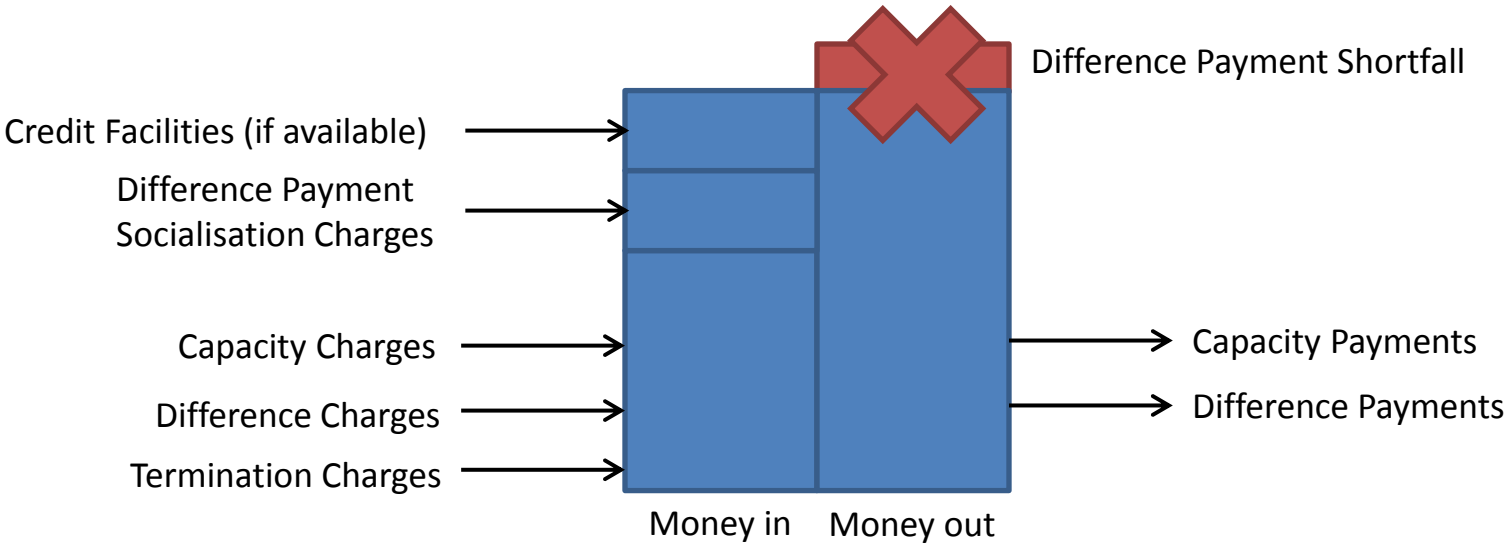
Difference Payment Socialisation Charge and Socialisation Fund

- The socialisation fund is intended to cover:
  - Shortfalls in Difference Payments to meet Difference Charges;
  - Seasonal variations in Capacity Payments and Supplier Capacity Charges;
  - Within-year surplus/shortfall in Supplier Capacity Charges.
- The fund considers all Capacity Market settlement together to allow the surplus in one area to cover the shortfall in another;
- There are provisions to allow for adjustments to the balance to account for other means of funding shortfalls;
- If there are insufficient funds from all of these sources, a “Suspend and Accrue” approach can apply to Difference Payments.

Difference Payment Socialisation Charge and Socialisation Fund

There are 4 stages of managing hole-in-the-hedge and seasonal differences in cash flow:

1. All cash flow in single “socialisation fund”.
2. If insufficient, plug gap with Difference Payment Socialisation Charge.
3. If insufficient, plug gap with credit facilities to extent possible.
4. If insufficient, short pay Difference Payments until funds available.



Difference Payment Socialisation Charge and Socialisation Fund

- Performance Bonds are required for new capacity under the CMC as an incentive to commission within the parameters required for the capacity market:
  - Required for new capacity that is awarded capacity until substantial completion is achieved;
  - The level of the bond increases over time according to a schedule set by RAs;
  - Acceptable forms include an irrevocable letter of credit or a cash deposit.
- The capacity not commissioning may mean that there is insufficient capacity for the amount of demand, which may make the events leading to a shortfall in Difference Charges to help meet Difference Payments more likely;
- Performance Bonds can be claimed as a Termination Fee if awarded capacity is terminated. This can be a partial claim if awarded capacity is partially terminated:
  - Intent is that Termination Fee can be used to offset costs of Capacity Market settlement, in a way that the unit which causes the situation at least partially covers the costs which result (e.g. the cost of procuring replacement capacity or funding a “hole in the hedge”).

Difference Payment Socialisation Charge and Socialisation Fund

- Difference Payment Socialisation Charge:
  - This is an additional charge where the shortfall in the Socialisation Fund is forecasted by the MO and spread among all Supplier Units as a charge, to ensure when the time comes to make Difference Payments there should be sufficient funds available;
  - It is enacted as a separate charge, which is a multiplier on the Capacity Charge for that unit:

$$CSOCDIFFP_{v\gamma} = QMLF_{v\gamma} \times FQMCC_{\gamma} \times PCCSUP_{y} \times FSOCDIFFP_{y}$$

  - TSSUs are subject to Capacity Charges if their site is net importing, they are subject to this charge also in that scenario.

Difference Payment Socialisation Charge and Socialisation Fund

- The previous calculations were for the base Difference Payment amounts that Supplier Units would receive if there are sufficient funds to meet the payments;
- There are a number of layers added before calculating the final amount which is actually paid to Supplier Units, to take into account shortfalls and reimbursement of past shortfalls as one of the stages of managing the “hole-in-the-hedge” (this is known in the market design as the “suspend and accrue” approach);
- There are two main functions in the “suspend and accrue” approach:
  - Tracking amounts:
    - Socialisation fund balance, considering Difference Charges and Payments, Socialisation Charges, Capacity Payments and Capacity Charges, and any other relevant sources of capacity market cash flow;
    - Reductions in Difference Payments incurred by each Supplier Unit that are yet to be reimbursed.
  - Determining the achievable difference payment:
    - If there is no fund shortfall:
      - Pay total payment due for period;
      - Reimburse to the extent possible the shortfall in payments from previous periods.
    - If there is a fund shortfall and functionality triggered:
      - Calculate reduction in payment due for period.

Difference Payment Socialisation Charge and Socialisation Fund

- If the need to short-pay Supplier Units for Difference Payments has been triggered, the shortfall is spread pro-rata according to the total across all Suppliers which are due a Difference Payment in the relevant period:

$$CSHORTDIFFP_{vd} = Min(CBSOC_d, 0) \times \left(\frac{CDIFFPTOT_{vd}}{CDIFFPTOTD_d} \right)$$

- The balance of Socialisation Fund needs to be at least zero to ensure that money in = money out. When the fund's balance negative prior to any adjustments, this negative quantity is distributed as a shortfall in Difference Payments to bring the net balance to zero for that day;
- The distribution is based on each Supplier Unit's proportion of the total Difference Payments for that day.

Difference Payment Socialisation Charge and Socialisation Fund

- Because the intention is to reimburse Supplier Unit's with their short payments when the funds become available, the shortfall amounts for each Supplier Unit are tracked as follows:

$$CSHORTDIFFPTRACK_{vd} = Min\left(CSHORTDIFFPTRACK_{v(d-1)} + CREIMDIFFP_{v(d-1)} + CSHORTDIFFP_{vd}, 0\right)$$

- This takes into account the remaining previous shortfalls for the Supplier Unit up to this day, whether any of that was reimbursed on the previous day, and whether a shortfall needs to be incurred on this day;
- There is also a Min of zero function to ensure that the tracked amount could not show that the unit is owing the market:
  - The negative value on this is seen as a "charge" on the unit representing the amount it has been short paid, a positive quantity would be seen as an overpayment.

Difference Payment Socialisation Charge and Socialisation Fund

- The Because the intention is to reimburse Supplier Unit's with their short payments once the funds become available, the reimbursement amounts for each Supplier Unit are calculated as follows:

$$CREIMDIFFP_{vd} = Min\left(Max(CBSOC_d, 0), \sum_v CSHORTDIFFPTRACK_{vd}\right) \times \frac{CSHORTDIFFPTRACK_{vd}}{\sum_v CSHORTDIFFPTRACK_{vd}}$$

- The amount which can be reimbursed to a Supplier Unit is the maximum of the funds available and the amount of shortfall that needs to be reimbursed;
- The reimbursement is also distributed pro-rata: those who have a greater proportion of the total Tracked Difference Payment Shortfall have a greater proportion of the reimbursement.

Difference Payment Socialisation Charge and Socialisation Fund

- The Because the intention is to reimburse Supplier Unit's with their short payments once the funds become available, the reimbursement amounts for each Supplier Unit are calculated as follows:

$$CREIMDIFFP_{vd} = Min\left(Max(CBSOC_d, 0), \sum_v CSHORTDIFFPTRACK_{vd}\right) \times \frac{CSHORTDIFFPTRACK_{vd}}{\sum_v CSHORTDIFFPTRACK_{vd}}$$

- The amount which can be reimbursed to a Supplier Unit is the maximum of the funds available and the amount of shortfall that needs to be reimbursed;
- The reimbursement is also distributed pro-rata: those who have a greater proportion of the total Tracked Difference Payment Shortfall have a greater proportion of the reimbursement.

Note, above is the version that is in the code, however there should be an edit to ensure that this value is always positive, i.e. a payment to a Supplier Unit.

Difference Payment Socialisation Charge and Socialisation Fund

- The tracked shortfall amounts are not reset at any time, but are not a Market Operator liability: it is for market participants to reimburse when sufficient funds have been made available by them to do so;
- Once the shortfalls / reimbursements that are needed / possible for a Settlement Day have been calculated, they can be added to the base Difference Payments due to the Supplier Unit to give the Achievable Difference Payment for that unit for that Settlement Day:

$$CDIFFPACHIEVE_{vd} = CDIFFPTOT_{vd} + CSHORTDIFFP_{vd} + CREIMDIFFP_{vd}$$

Topic 10: Course Summary

Review of Learning Objectives

At the end of this course, you should have an understanding of:

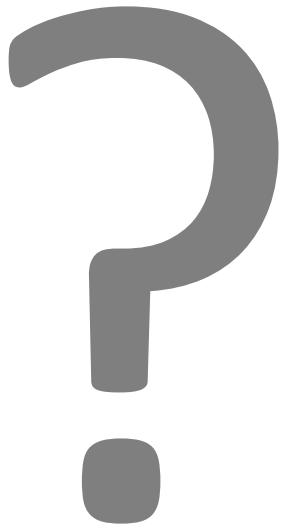
the timing and processes for Capacity Market Settlements 

the payment calculation for Capacity Market units 

the different payments and charges processes 

the supplier charging processes 

Questions



Thank You!

Thank you for your time and engagement during this session.

Please take the time to share your feedback with us by completing the short feedback survey before you leave.