I-SEM Training
Capacity Market Settlement

September 2017

Capacity Market Settlement Modules

- Introduction and Overview
- Process and Data Inputs
- Capacity Payments and Charges
- Strike Price
- Load Following Obligated Capacity Quantity
- Stop-Loss Limits
- Market Difference Charges and Difference Payments
- Non-Performance Difference Charges and Imbalance Difference Payments
- Difference Payment Socialisation Charge and Socialisation Fund

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

The intention is for the Self Learning Training materials to help with understanding the concepts of what is happening in each aspect of the Capacity Market settlement, while the Instructor Led Training materials will cover the details of the settlement calculations, looking at how the settlement equations work and considering a number of examples.

Chapter 1: Introduction and Overview

Introduction and Overview – 1/13

- While in the current arrangements generators receive capacity payments based on their availability, in the new arrangements they receive capacity payments on the basis of auction results, which give participants awarded capacity. Essentially, the market pays the generators for capacity and the cost of that is recovered from suppliers.

- In the energy market, the generators are paid for their generation at the energy price, and likewise suppliers pay for their consumption. Apart from an auction being used, the Capacity Market and Energy Market cash flows more or less match how the market works today.

- A new feature that comes with this capacity market is that there is a strike price associated with the awarded capacity. If the energy price is above the strike price then generators will earn that high price in the energy market if they generate. Those holding awarded capacity will have to pay back the difference between the energy price and the strike price to the market. Depending on the energy market price to which this happens, this payment may need to be done only if the generator has traded in that energy market, or the payment would have to be made irrespective of whether they actually generate in that period. This gives the generators with awarded capacity an incentive to be generating in the market when prices are high.

Introduction and Overview – 2/13

- The money collected by the market when energy market prices exceed the strike price is paid back to suppliers who get the difference between the energy price and the strike price on their consumption. In this way, the suppliers are effectively hedged and do not have to pay more than the strike price in the energy markets, a source of benefit for funding the capacity in the first instance.

- The energy market prices could rise above the strike price due to the bids submitted by participants, or through another feature of the market called the administered scarcity price (ASP). This relates to when the market is running short of reserve capacity. Reserve capacity is generation held in reserve in case other generators breakdown or there are transmission failures etc.

- As reserves fall below the standard requirements, the ASP rises. If that becomes higher than the calculated energy price then it replaces the calculated energy price. This means that participants with awarded capacity could be very exposed if they are not generating.

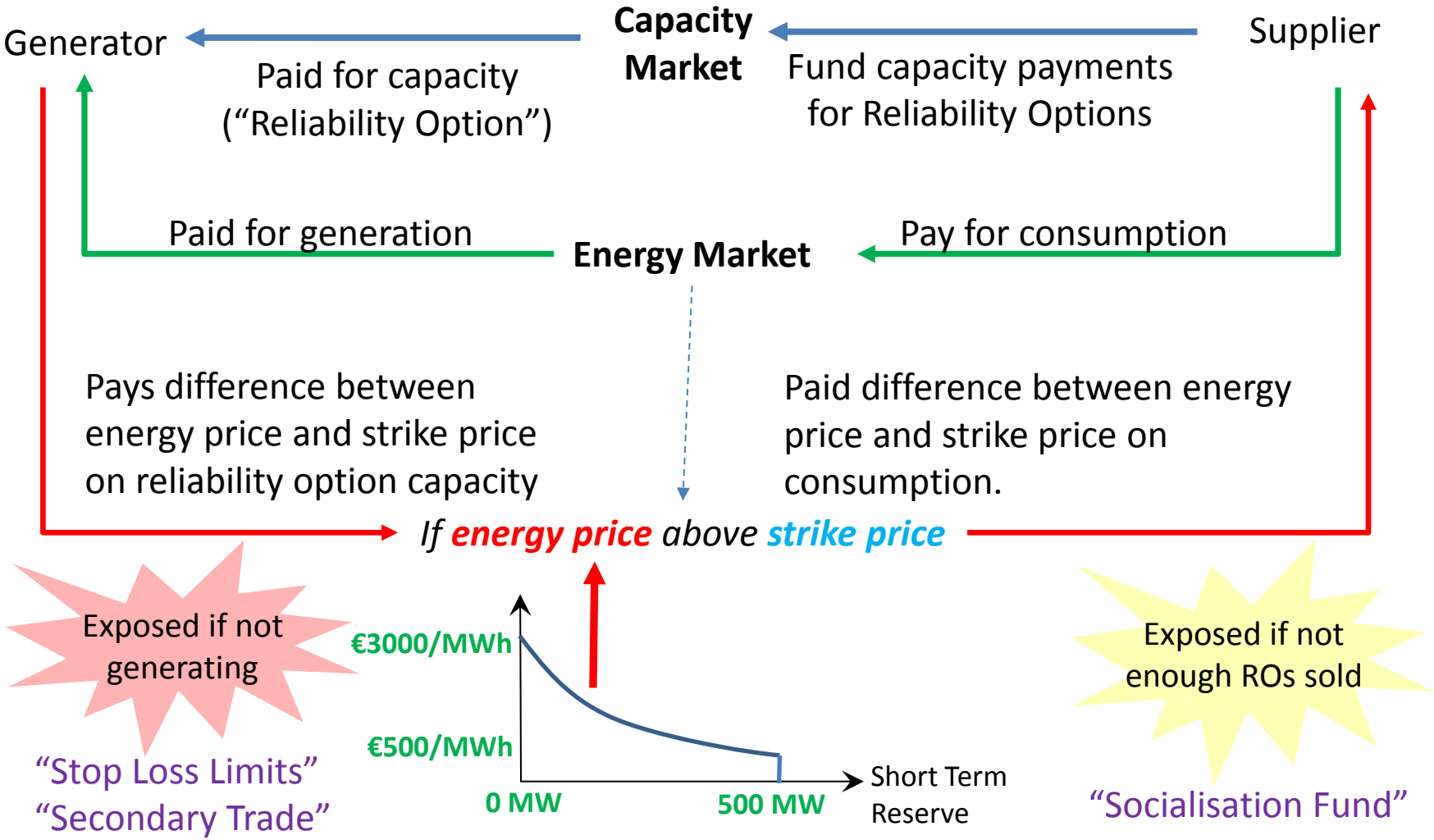
Introduction and Overview – 3/13

- There are protections for generators. One way they are protected is through "stop loss limits". These are applied in settlement which limits the amount generators have to pay out in these difference charges over a billing period and over a year. Another protection is via secondary trading which allows a generator to trade out of its obligations to generate at times of high market prices.

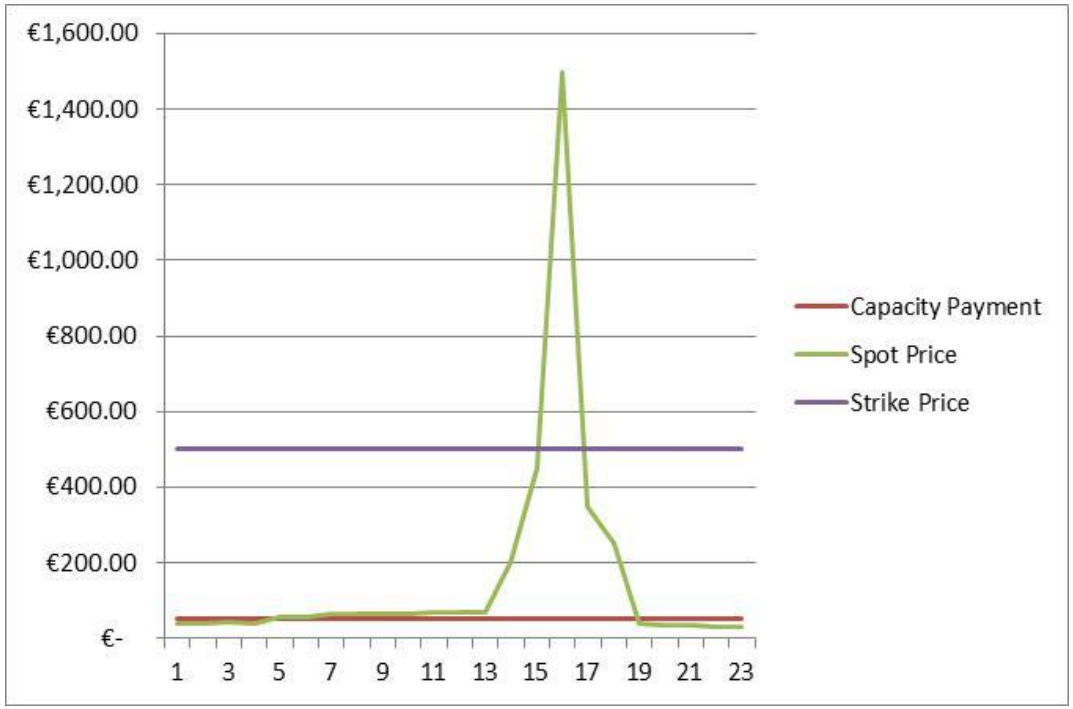
- On the supplier side, suppliers are only hedged to the level of aggregate awarded capacity. For example if not all generators participate in the capacity market, the generators that don't participate keep the high energy price and therefore would not contribute to the cash flow used for difference payments to enact the hedge for suppliers. Also if generators are frequently protected by stop loss limits, there will not be sufficient funds enact the hedge for suppliers. This is addressed by collecting additional amounts from suppliers, using this as part of a "socialisation fund", to cover the shortfall.

- The following diagrams summarise these points, showing the flows between Suppliers and Generators in the Capacity and Energy Markets.

Introduction and Overview – 4/13



Introduction and Overview – 5/13



1. Generator gets option payment so does not need spikey prices to cover “missing money”.

2. Supplier funding of regular capacity payments hedges against spikey energy prices.

3. Generator pays back when spot price exceeds strike price. Strong incentive to be ON.

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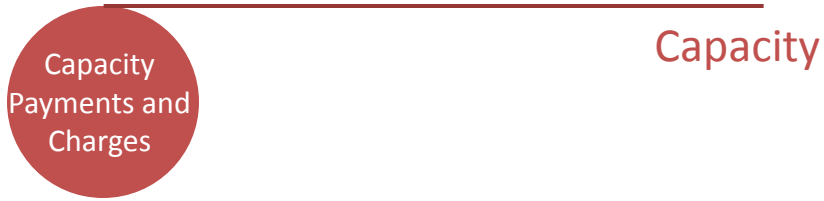
Introduction and Overview – 6/13

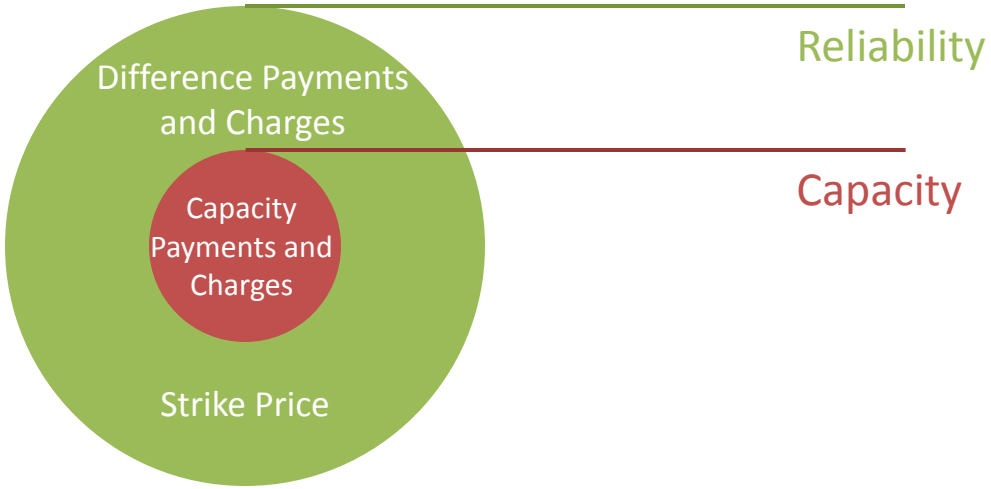


Introduction and Overview – 7/13

- At its core the settlement of the capacity market is quite simple – it focusses on how Capacity Market Units are paid and charged, creating the incentives which enact the policy objectives around energy security. However various layers have been added in order to fine tune these incentives. We start with an overview of these layers, before each layer is discussed in more detail.

- The capacity market exists to ensure that Capacity Market Units get paid to help cover costs (for example, their Long Run Marginal Costs) which may not be covered in their energy market revenue (which is based on Short Run Marginal Cost principles, and due to the fact that price caps and floors apply in the energy markets). In this way the capacity market incentivises energy security – Capacity Market Units are paid to reliably ensure that the capacity is there when demand requires that they are called to generate. As the beneficiary of this increased security, Suppliers are charged to cover these Capacity Payments.

Introduction and Overview – 8/13



Introduction and Overview – 9/13

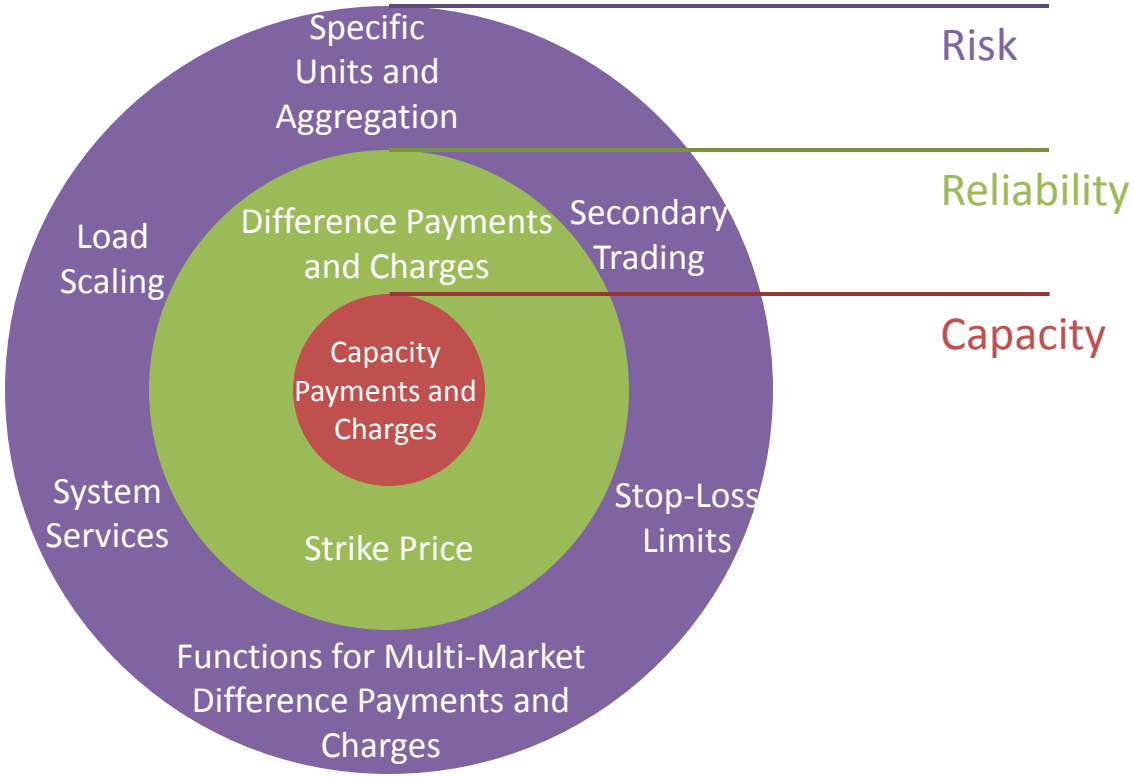
- In order to ensure this energy security is linked more to the physical reality of meeting demand in real-time and that reliability is incentivised, an obligation for Capacity Market Units to trade in the energy markets is incentivised through Difference Charges. These use information from Capacity Payments and from energy market trades as inputs to calculate charges which incentivise behaviour to reliably provide energy when it is most needed.

- These Difference Charges are used to fund the Suppliers who pay for this capacity in the form of Difference Payments. These payments act as a hedge in the energy markets, ensuring that consumers are not charged above the Strike Price.

- Difference Payments and Charges work in a similar way to a one-sided Contract for Difference: If a market price is above the Strike Price, Capacity Market Units must pay back the difference, while Suppliers must be paid the difference.

- All Capacity Payments and Charges, and Difference Payments and Charges, appear on the same settlement documents.

Introduction and Overview – 10/13



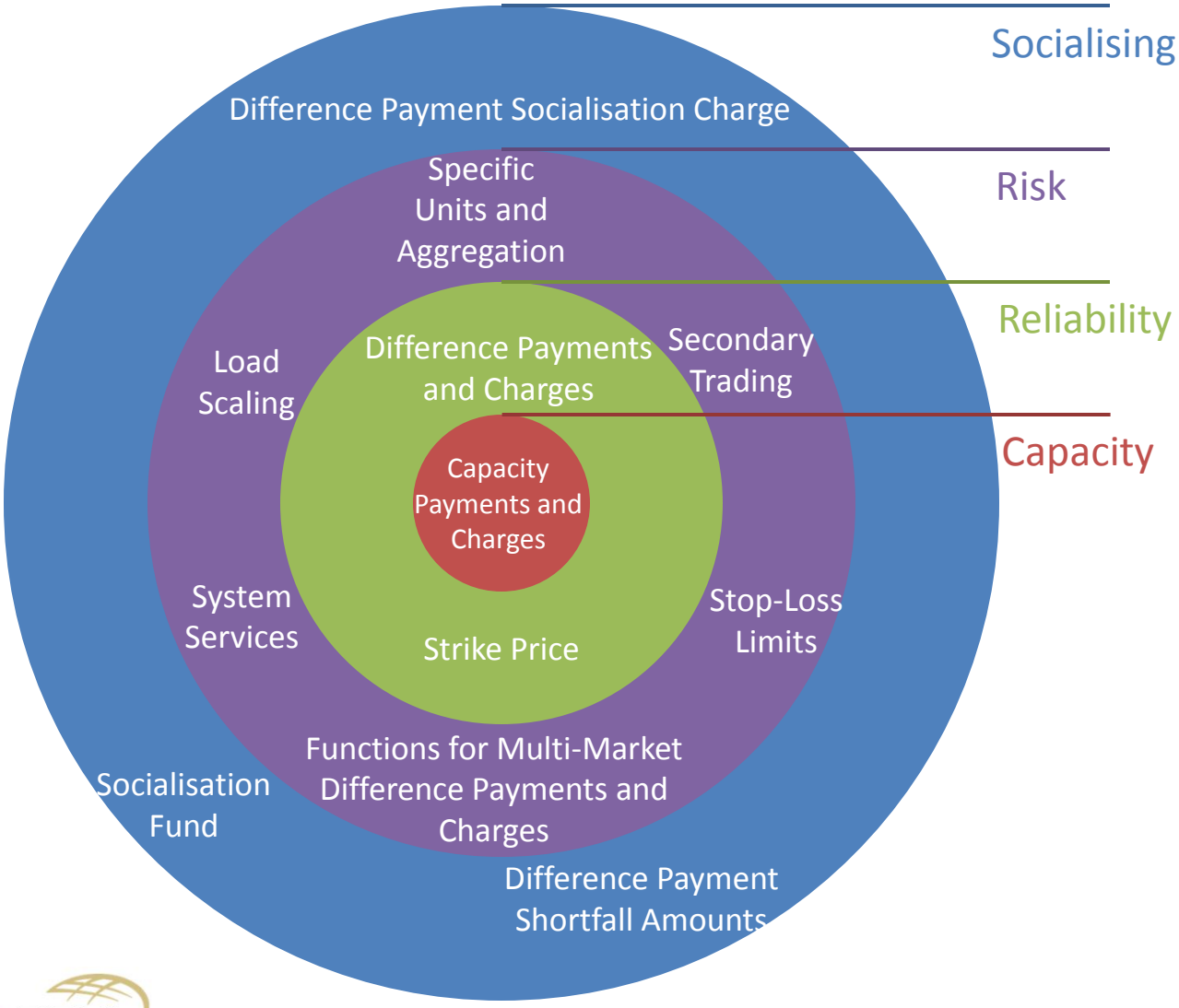
Introduction and Overview – 11/13

- This mechanism has risks associated with it. Therefore, another layer of complexity is added to reduce the potential for excessive exposure or losses, and gaming.

- These risks are twofold. For a Capacity Market Unit for example, there is the risk of potential losses if a CMU's Difference Charges out are more than their Capacity Payments coming in. To mitigate against this, there is the option of secondary trading, where if a participant is unable to provide the promised capacity in the energy markets it can trade out of its position so that it is no longer exposed to the charges. The obligation to provide energy is also load-scaled where a CMU is required to provide less of its capacity through the energy markets when demand is lower. Specific units, such as Demand Side Units and Interconnectors, are treated in a specific different way to ensure that they aren't overly exposed due to differences in how they operate. The provision of some system services are also counted towards meeting the obligation to provide capacity. There is also a Stop-Loss Limit related to how much a Capacity Market Unit can be charged for the elements of the incentive scheme which can result in a loss.

- Then on the other side are the risks to energy security and the hedge for Suppliers, which could be caused by "gaming", where Capacity Market Units are still getting paid while finding ways out of their obligation to provide their capacity in ways that are not intended. This is a risk for Suppliers because it means the capacity may not be physically available to meet demand, but the charges which help fund their Difference Payments to enact the hedge in the energy markets are also reduced. To mitigate against this, there is a multiple market approach to Difference Payments and Charges to ensure that the risk of having to pay excessive price in any energy market is hedged and covered. The approaches to limit to risks on Capacity Market Units also have elements which limit the potential for gaming.

Introduction and Overview – 12/13



Introduction and Overview – 13/13

- The layer which reduces the risks in the Capacity Market can cause situations where the cash flow in from charges is not enough to meet the cash flow out for payments. Therefore the final socialising layer is included to ensure that payments and charges are matched. Included in this layer there is a fund with an additional charge for Suppliers, and an approach for calculating, tracking and reimbursing shortfalls in Difference Payments if required, intended to ensure the mechanism is revenue neutral.

Chapter 2: Process and Data Inputs

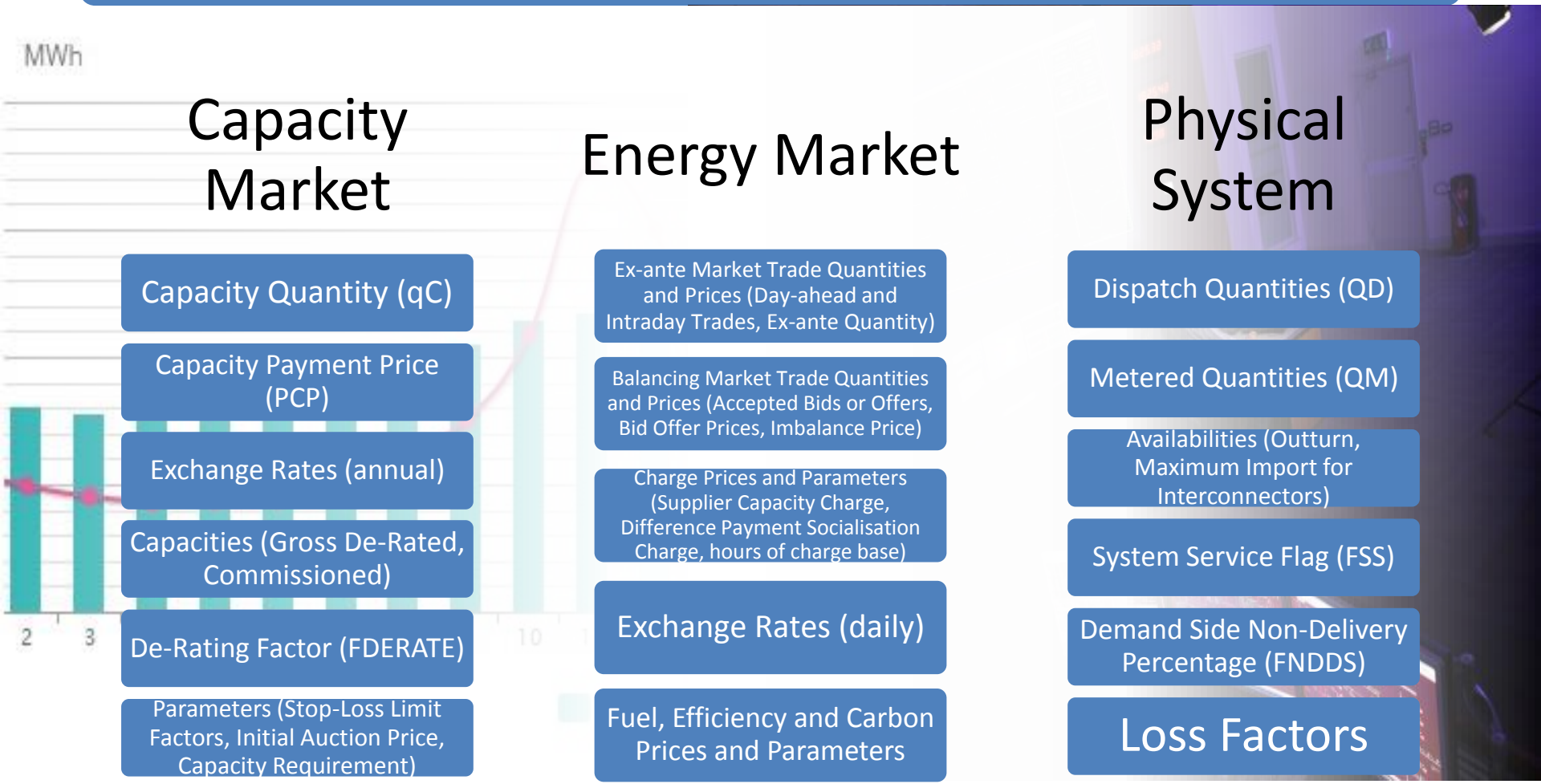
Process and Data Inputs – 1/7

- 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.

- 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 – 2/7



Capacity Market

- Capacity Quantity (qC)
- Capacity Payment Price (PCP)
- Exchange Rates (annual)
- Capacities (Gross De-Rated, Commissioned)
- De-Rating Factor (FDERATE)
- Parameters (Stop-Loss Limit Factors, Initial Auction Price, Capacity Requirement)

Energy Market

- Ex-ante Market Trade Quantities and Prices (Day-ahead and Intraday Trades, Ex-ante Quantity)
- Balancing Market Trade Quantities and Prices (Accepted Bids or Offers, Bid Offer Prices, Imbalance Price)
- Charge Prices and Parameters (Supplier Capacity Charge, Difference Payment Socialisation Charge, hours of charge base)
- Exchange Rates (daily)
- Fuel, Efficiency and Carbon Prices and Parameters

Physical System

- Dispatch Quantities (QD)
- Metered Quantities (QM)
- Availabilities (Outturn, Maximum Import for Interconnectors)
- System Service Flag (FSS)
- Demand Side Non-Delivery Percentage (FNDDS)
- Loss Factors

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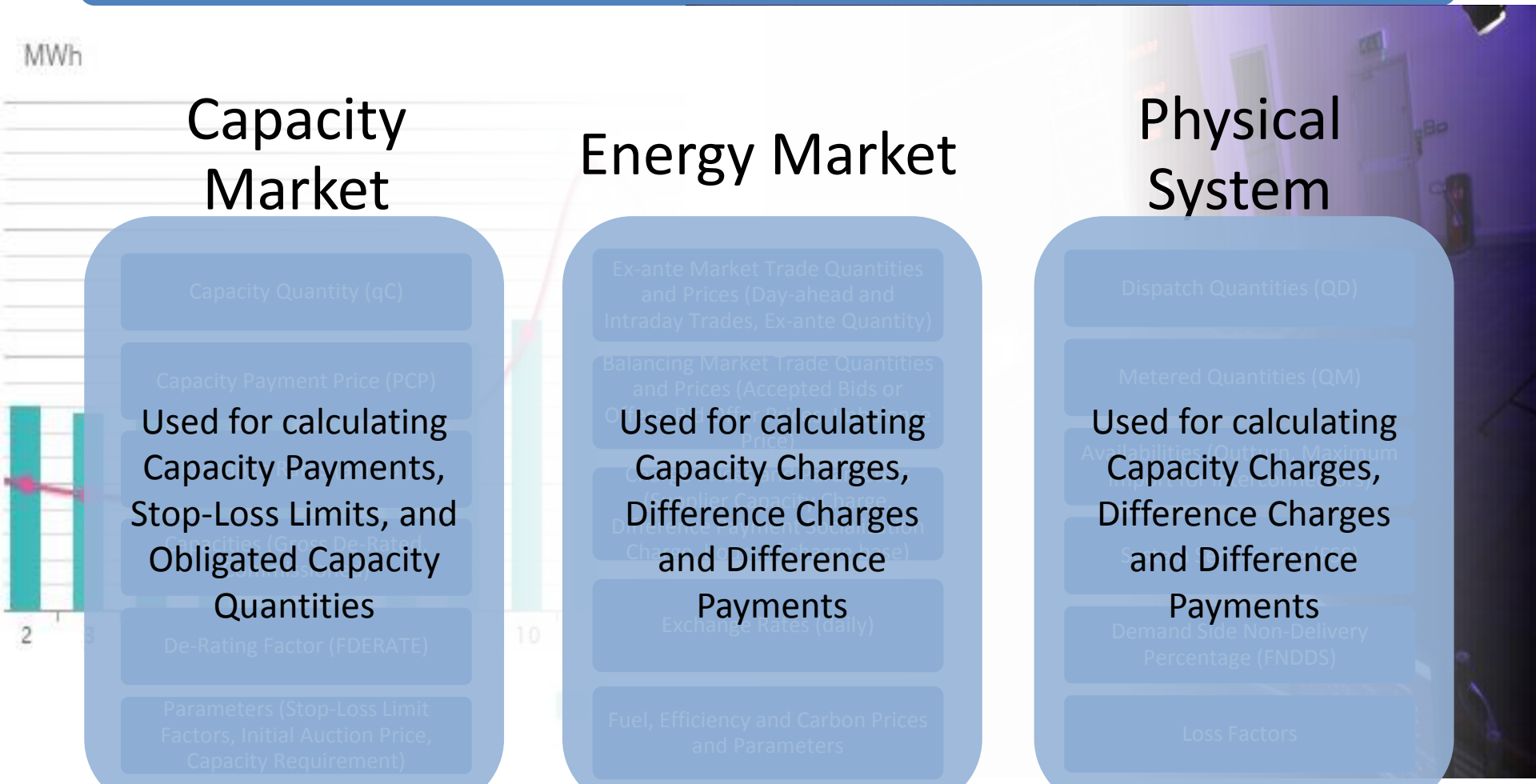
Process and Data Inputs – 3/7



Capacity Market

Used for calculating Capacity Payments, Stop-Loss Limits, and Obligated Capacity Quantities

Energy Market

Used for calculating Capacity Charges, Difference Charges and Difference Payments

Physical System

Used for calculating Capacity Charges, Difference Charges and Difference Payments

Process and Data Inputs – 4/7

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

These are the different variable names for 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
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
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

Total Difference Charge

Achievable Difference Payment

Process and Data Inputs – 5/7

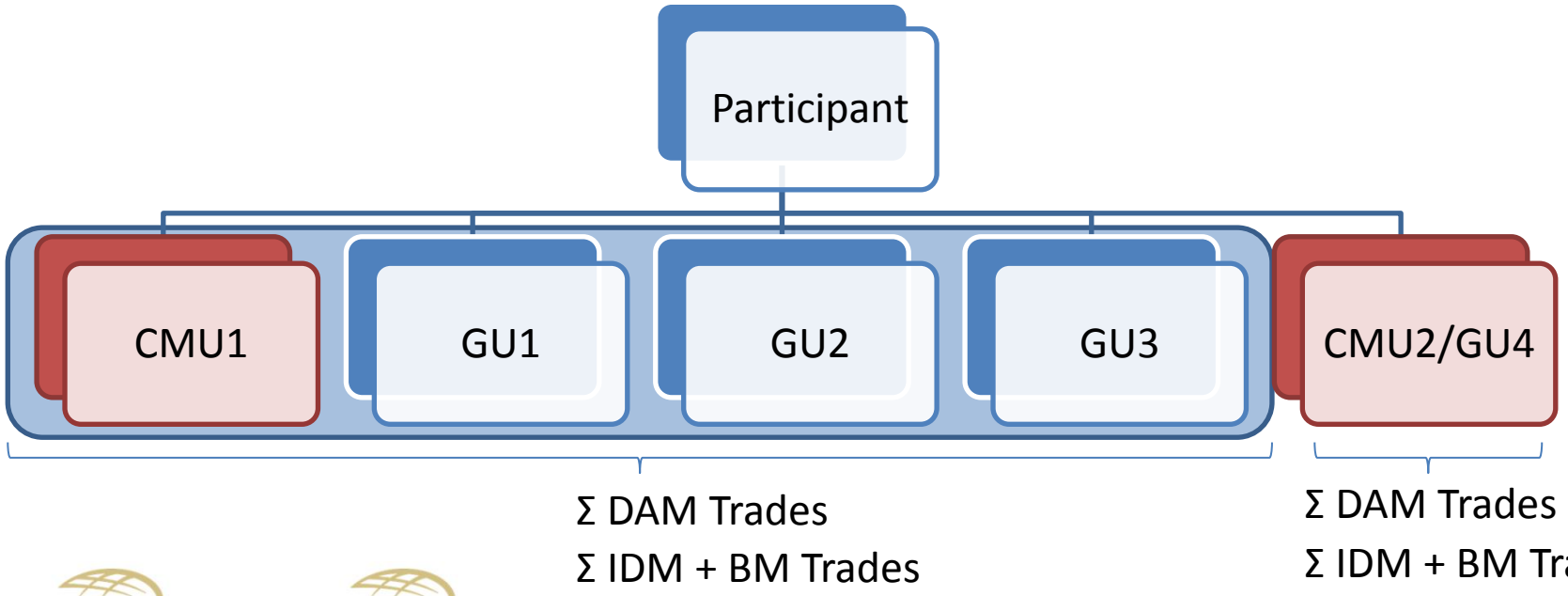
Applies | Sometimes Applies | Does Not Apply | Applies in Specific Way

These are the different variable names for 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	
$CCP_{\Omega\gamma}$	●	●	●	●	●	●	
$CCC_{v\gamma}$	●	●	●	●	●	●	
$CSOCDIFFP_{v\gamma}$	●	●	●	●	●	●	
$CDIFFCDA_{\Omega\gamma}$	●	●	●	●	●	●	$CDIFFCTOT_{\Omega\gamma}$
$CDIFFCWD_{\Omega\gamma}$	●	●	●	●	●	●	
$CDIFFCNP_{\Omega\gamma}$	●	●	●	●	●	●	
$CDIFFPDA_{vd}$	●	●	●	●	●	●	$CDIFFPACHIEVE_{v\gamma}$
$CDIFFPID_{vd}$	●	●	●	●	●	●	
$CDIFFPIMB_{vd}$	●	●	●	●	●	●	
$CSHORTDIFFP_{vd}$	●	●	●	●	●	●	
$CREIMDIFFP_{vd}$	●	●	●	●	●	●	

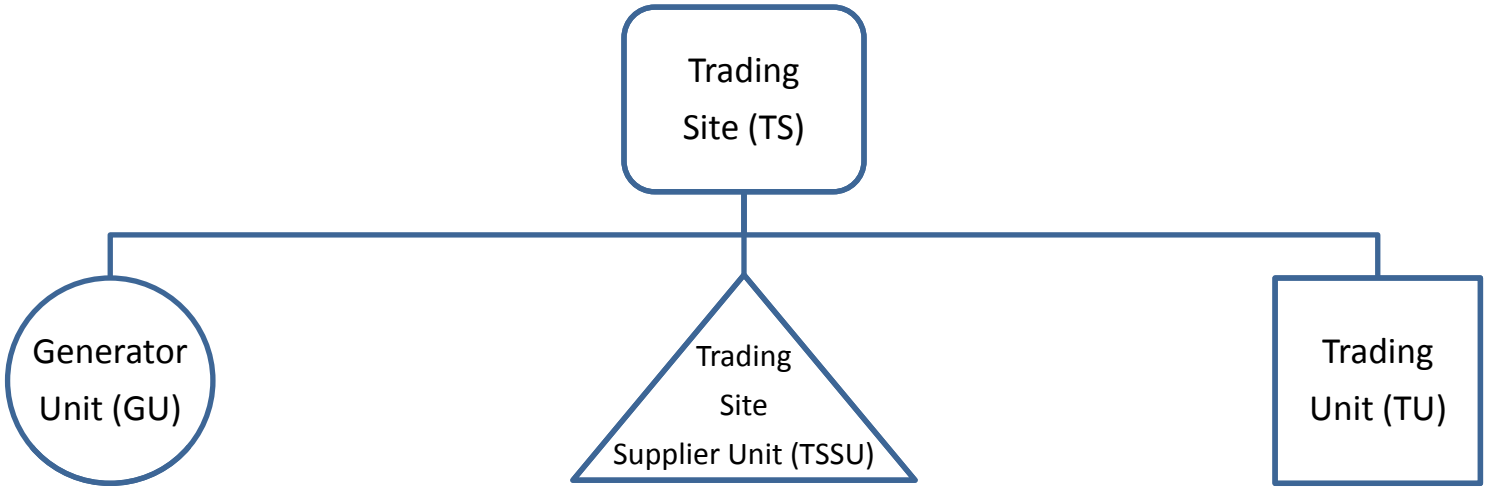
Process and Data Inputs – 6/7

- Capacity Auction and Payments:
  - A CMU can be a Generator Unit representing itself, or can be a “parent” unit to a number of “child” Generator Units.
  - Only CMUs enter auction and receive Capacity Payments.
- Difference Charges:
  - Only CMUs are subject to Difference Charges;
  - CMUs are not active in the energy markets – the sum of the trades of the child Generator Units represented by CMU are taken.



Process and Data Inputs – 7/7

- 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:
  - 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.



Chapter 3: Capacity Payments and Charges

Capacity Payments and Charges – 1/13

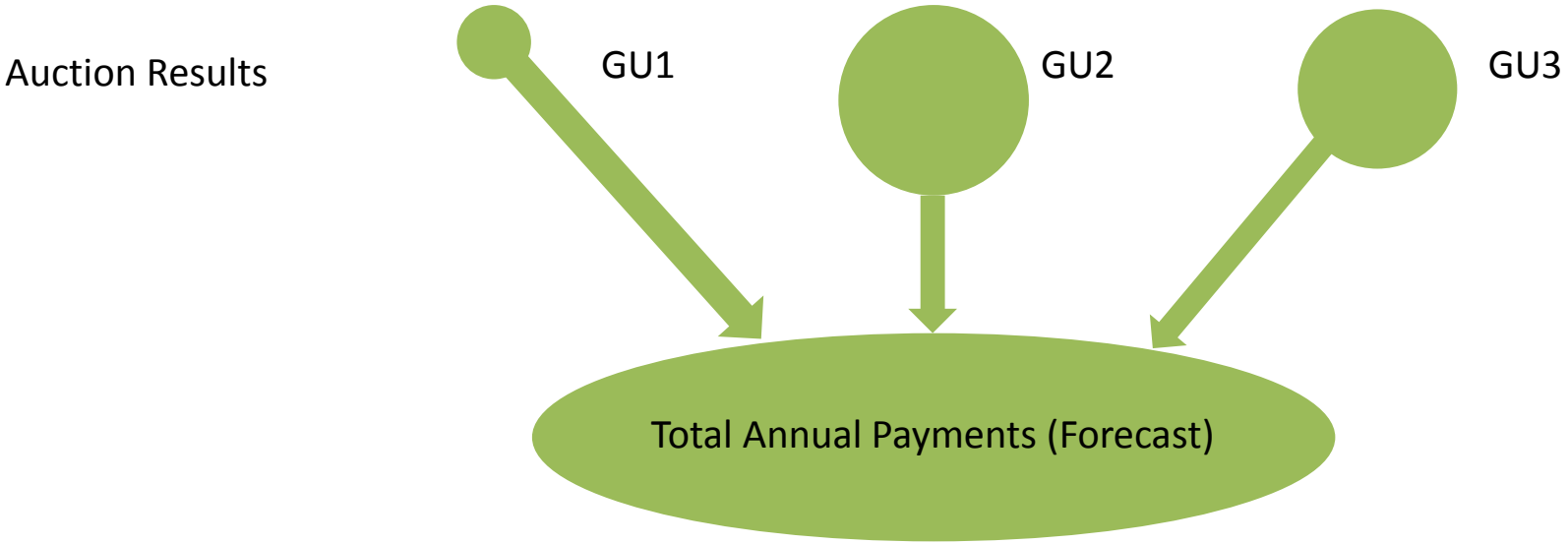
- Capacity Payment:
  - This is the payment to a Capacity Market Unit for being successful in a Capacity Auction or Secondary Trade;
  - Each successful auction or secondary trade has an individual Contract Register Entry with Capacity Quantity and Capacity Payment Price;
  - Payment is simply:
    - Quantity times Price;
    - Calculated in every Imbalance Settlement Period in which the Contract Register Entry is active;
    - Summed for all Contract Register Entries relevant to the Capacity Market Unit; and
    - Summed for all Imbalance Settlement Periods over which the entry is active (e.g. if a secondary trade is to cover 1 week) within the Capacity Period (i.e. a month).
- 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 – 2/13

- 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 if 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.

- The following slides illustrate the features of, and relationship between, capacity payments and charges.

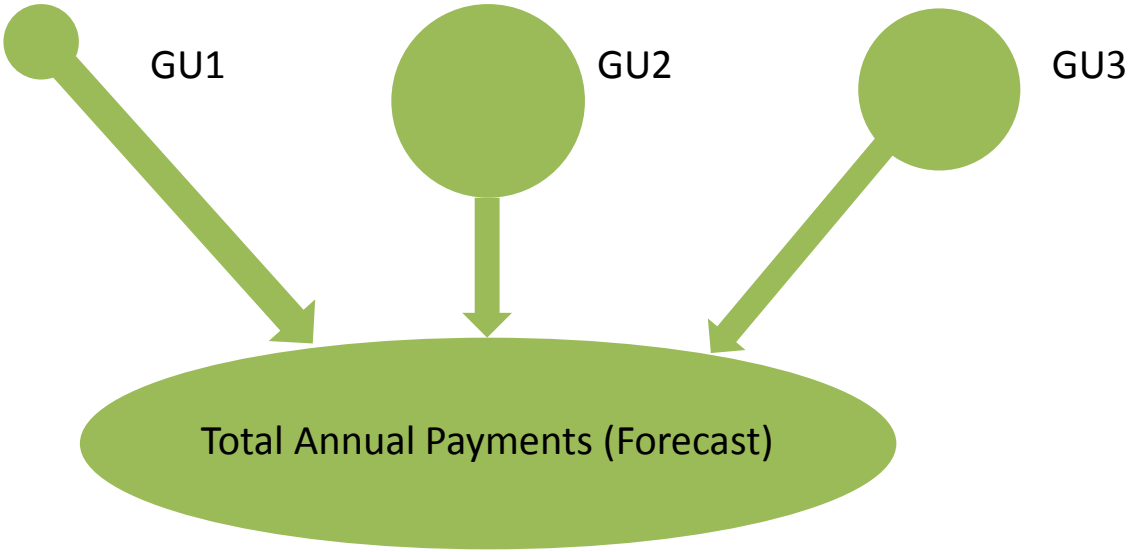
Capacity Payments and Charges – 3/13



- Starting off in the simplest level, Capacity Payments are based on the Capacity Quantity and Capacity Payment Prices awarded to Capacity Market Units from auctions and secondary trades. Once these have been awarded and the physical assets are commissioned, the CMU will receive a regular payment every month.
- After all the primary capacity auctions have been run and the Capacity Requirement awarded to Capacity Market Units for a year, it is possible to use the results of the auctions to calculate the total amount that all Capacity Market Units are going to be paid for the year. This can be used to calculate what Suppliers need to be charged in order to meet these payments.

Capacity Payments and Charges – 4/13

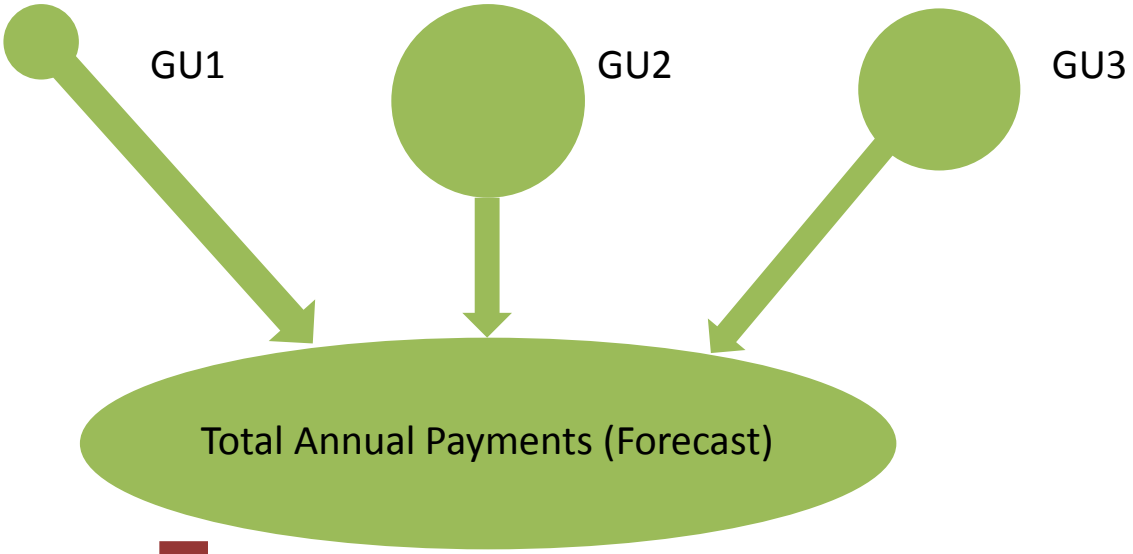
Auction Results



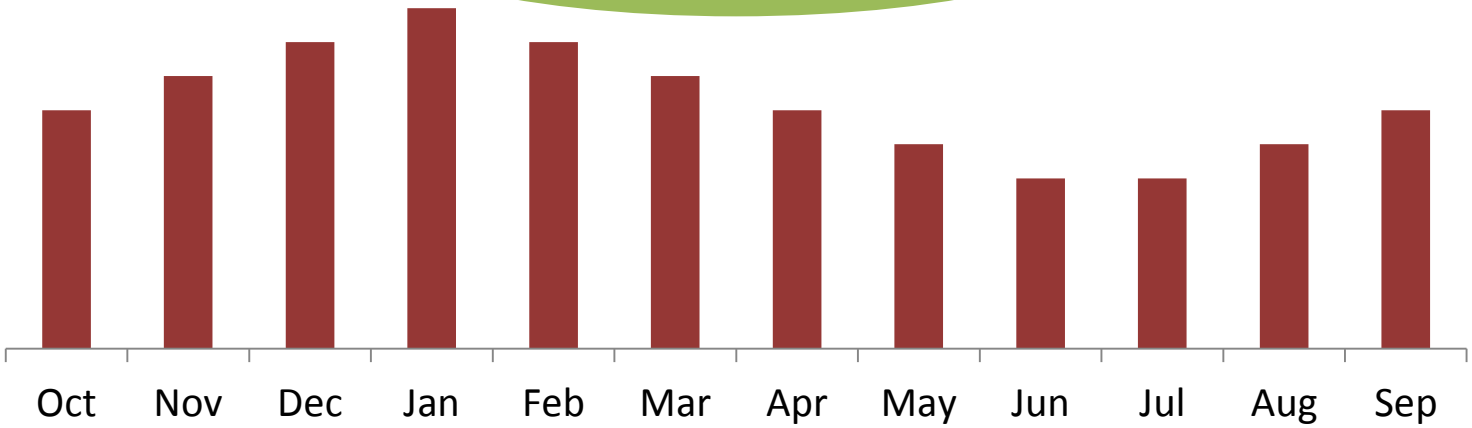
- As well as the total amount to be paid, the level of Supplier demand which will need to make this payment needs to be forecasted. As the payments to be met are over a year, and the charge to meet these payments is levied in particular chosen half hours over the year, the demand in those periods needs to be forecasted and summed over the year.

Capacity Payments and Charges – 5/13

Auction Results



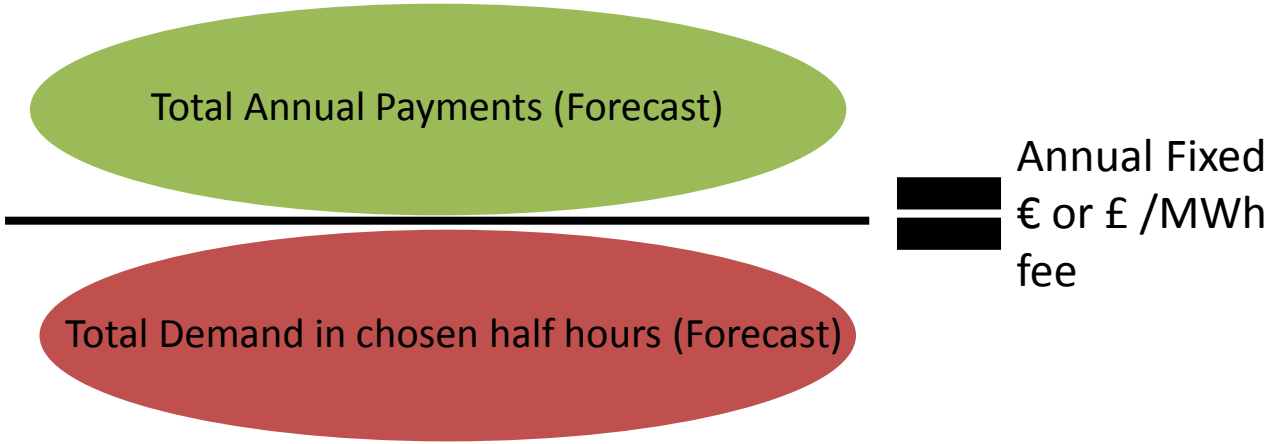
Demand in chosen half hours (Forecast)



Capacity Payments and Charges – 6/13

- Once forecasted, the total forecast payments over the year can be divided by the total forecast demand which forms the Suppliers' charging base to calculate a fixed price for the year.

- This fixed price allows demand customers to know exactly what they are paying for capacity every time they are consuming.



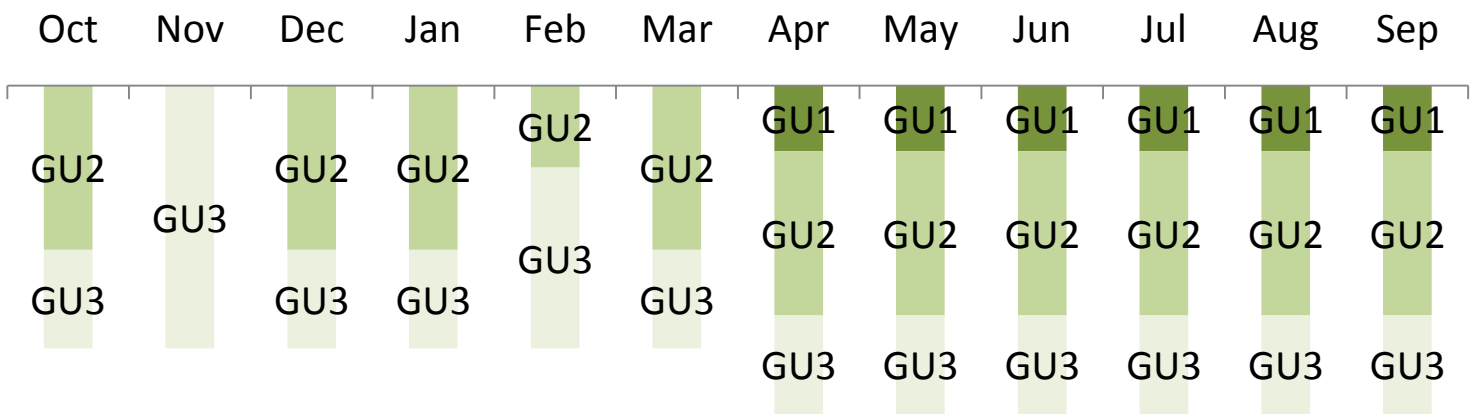
Capacity Payments and Charges – 7/13

- Now all the information required in order to start making these payments and taking in these charges throughout the Capacity Year (from October to October) is available.

- The Capacity Payments are based on monthly Capacity Periods and are a flat payment based on the Capacity Quantity and corresponding Capacity Payment Price awarded to the unit. The payment made is based on the awards relevant to the unit for the Capacity Period just past. The awarded capacity can be for the whole year (as in the case of the primary capacity auctions), in which case the payment would be for one month's worth of that yearly product. However secondary trading can cover smaller periods, such as a single Capacity Period, single week, or a smaller subset of days or hours, depending on the products traded. The calculation of Capacity Payments will take into account the relative length of these products within the Capacity Period for which the payments are being calculated. Therefore differences in the amounts paid to individual units can be caused by secondary trading between the units – however the net payment required to all commissioned Capacity Market Units should remain the same.

- In this example, between October and November GU2 has sold his capacity to GU3 through secondary trading. GU3 are now receiving all of the payments but on the other side GU2 is no longer exposed to difference charges in that period, for example if GU2 is on an outage in the month. Also, despite having an awarded Capacity Quantity for the Capacity Year, GU1 will only start getting paid from April onwards as that is when it has been commissioned.

Capacity Payments and Charges – 8/13



Monthly Capacity Payments based on:

- Primary and Secondary Trades in period;
- Actual Commissioning in period.

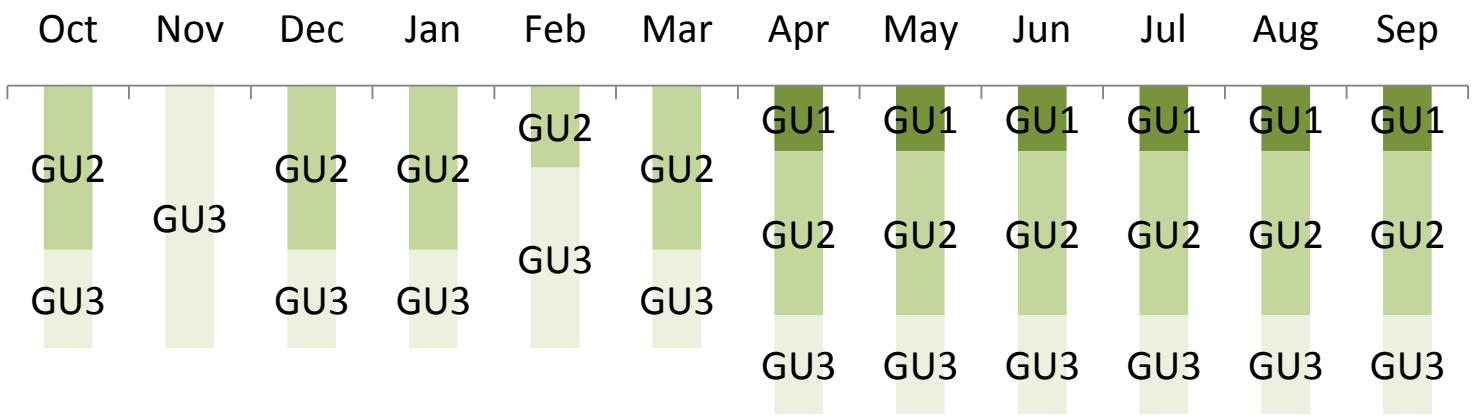
Capacity Payments and Charges – 9/13

- On the other side charges are coming in, based on an annual fixed tariff and on the actual Metered Quantity showing the energy Supplier Units consumed in the Capacity Period – focusing on particular half hours chosen by the RAs. These charges are also monthly.

- This fee is charged to Suppliers in specific half-hours of each Settlement Day decided by the RAs. This is done in order to create an incentive on these suppliers to reduce their demand in those periods, moving the demand instead to periods where there is no charge.

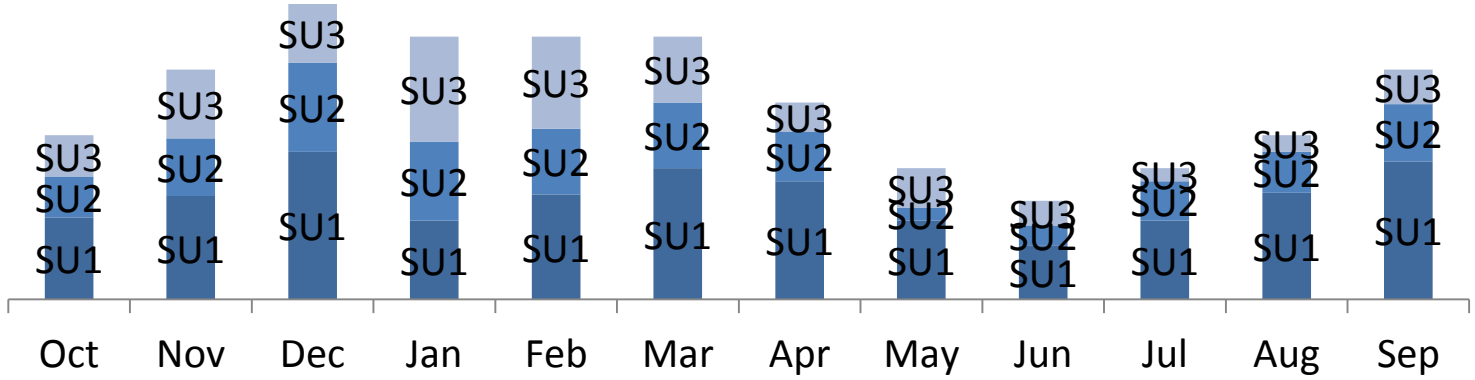
- The reason for this is to incentivise demand to go into other periods in order to bring down peak demand. Because the Capacity Requirement is driven by peak demand, the more the peak is brought down the less capacity is required to be procured, which overall can result in a more efficient outcome.

Capacity Payments and Charges – 10/13



Monthly Capacity Payments based on:
- Primary and Secondary Trades in period;
- Actual Commissioning in period.

Monthly Capacity Charges based on:
- Actual Consumption in pre-defined periods;
- Annual Fixed € or £ /MWh tariff.

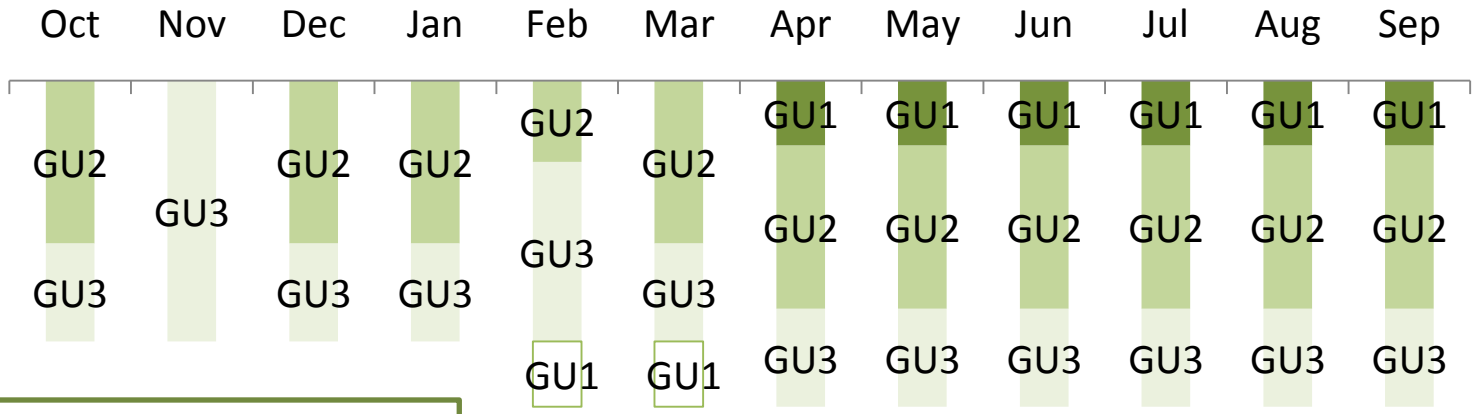


Capacity Payments and Charges – 11/13

- The tariff for Capacity Charges is based on forecasts of demand, therefore some differences can arise where a different amount was consumed to that which was forecast. As Suppliers are incentivised not to consume in those half hours where the charge applies, this could result in under-recovery if they consume less than was forecast.

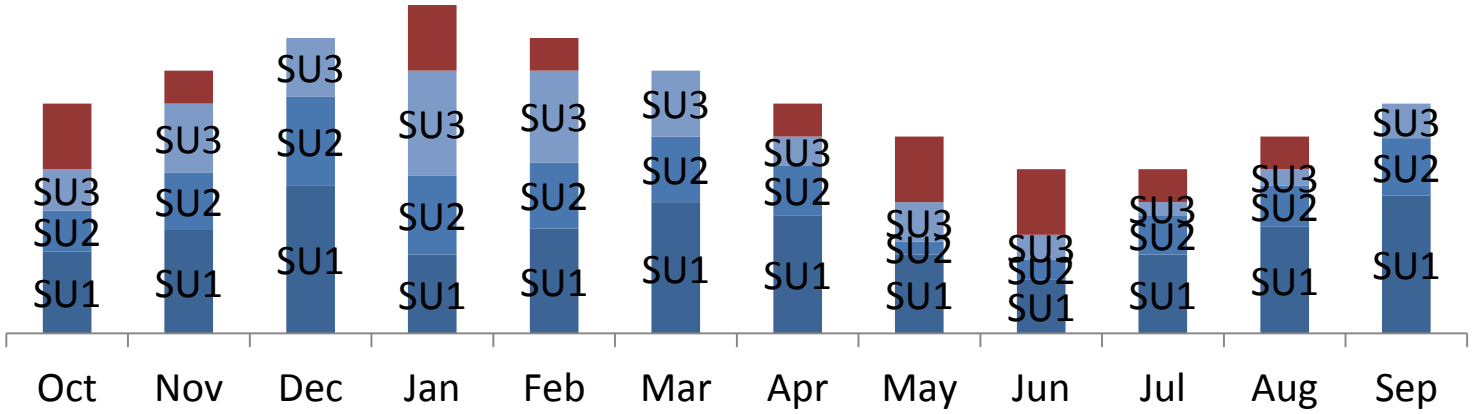
- In addition, the tariff for the Capacity Charges is based on a forecast of Capacity Payments which could be slightly different to actual final payments. For instance, in this example it was thought in the forecast that the Capacity Market Unit GU1 was going to be commissioned in, and therefore going to be paid from, February, but in reality they commissioned late and are only paid from April.

Capacity Payments and Charges – 12/13



Differences driven by:
- Late unit commissioning;
- One-sided secondary trade.

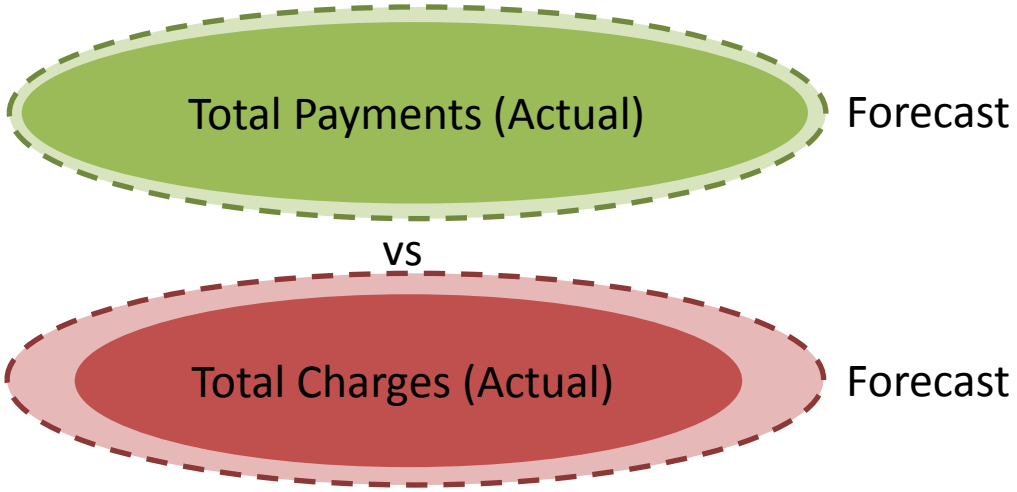
Differences driven by:
- Actual vs forecast consumption in pre-defined periods.



Capacity Payments and Charges – 13/13

- This means that there can be a mismatch between what is forecasted in terms of charges coming in, and what actually happened. This difference has to be managed on a short term cash flow basis, and on a longer term sufficiency of funds basis.

- On a cash flow basis a shortfall in the charges received relative to the amount needed to make payments can be managed through accessing both a socialization fund (covered later) and any surplus available from other market charges including energy market charges. From a funds sufficiency basis a shortfall or surplus in the charge shall be included in the following year's tariff through a K factor adjustment.



Chapter 4: Strike Price

Strike Price – 1/3

- There are a number of inputs to the Difference Charge and Payment element of the Capacity Market.

- The fist input, the Strike Price, is extremely important as it is the price which triggers the reliability incentives, and the Supplier hedge, through Difference Payments and Difference Charges. It is like the price for a one-way Contract for Difference: if the reference market price goes above the Strike Price then the option is called, i.e. these payments and charges are triggered, if it doesn't people are paid as normal. Difference Charges and Payments are calculated from the volume of the energy trade or non-delivery / imbalance in the relevant market, and the difference between the price received for that trade (the Market Reference Price) and the Strike Price.

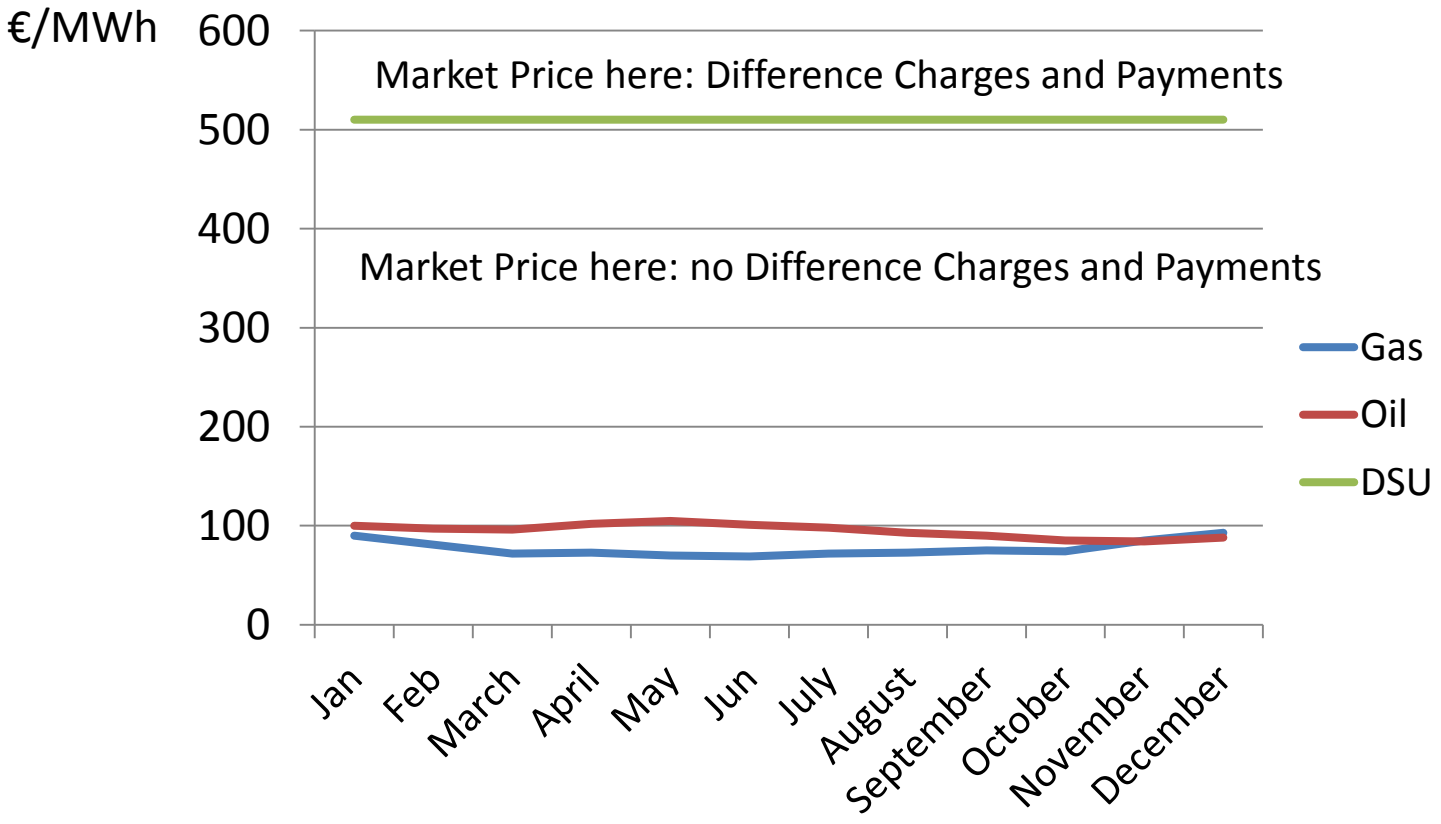
- The Strike Price must not be so low that it is lower than the running costs of most Capacity Market Units or too high that it is never going to be triggered, blunting the incentive to be reliable. The price is based on an inefficient unit's actual fuel costs. A number of different unit types, and therefore fuel or unit costs, are considered including gas, oil, Demand Side Units, and adjustments for carbon and efficiency. The maximum of the resulting input prices is taken to be the Strike Price. Therefore the Strike Price can change over time, representing the least efficient and most expensive of these units.

Strike Price – 2/3

- This is to ensure that no unit is disadvantaged through a strike price lower than the price it would reasonably expect to offer into the market to recover their costs. If this were to happen, it could trigger difference charges on the unit, incentivising it to trade its power in that period, but the unit would not be able to recover their costs through their net revenue because their net revenue would be at the strike price, which is below the price which reflects their costs. To prevent the strike price requiring inefficient or high cost units to run at a loss in order to meet their capacity requirement, the Strike Price tracks the core costs of those units.

- The values for the oil, gas and carbon elements are taken from standard industry fuel price indices, being updated with a single value every month. There are a number of parameters determined by the RAs which feed into this price also, including transport adders and carbon intensity factors. The most important ones are the DSU Floor Price, and the thermal efficiency of the reference conventional unit. The values decided for these for I-SEM go-live are 500€/MWh and 15% respectively.

Strike Price – 3/3



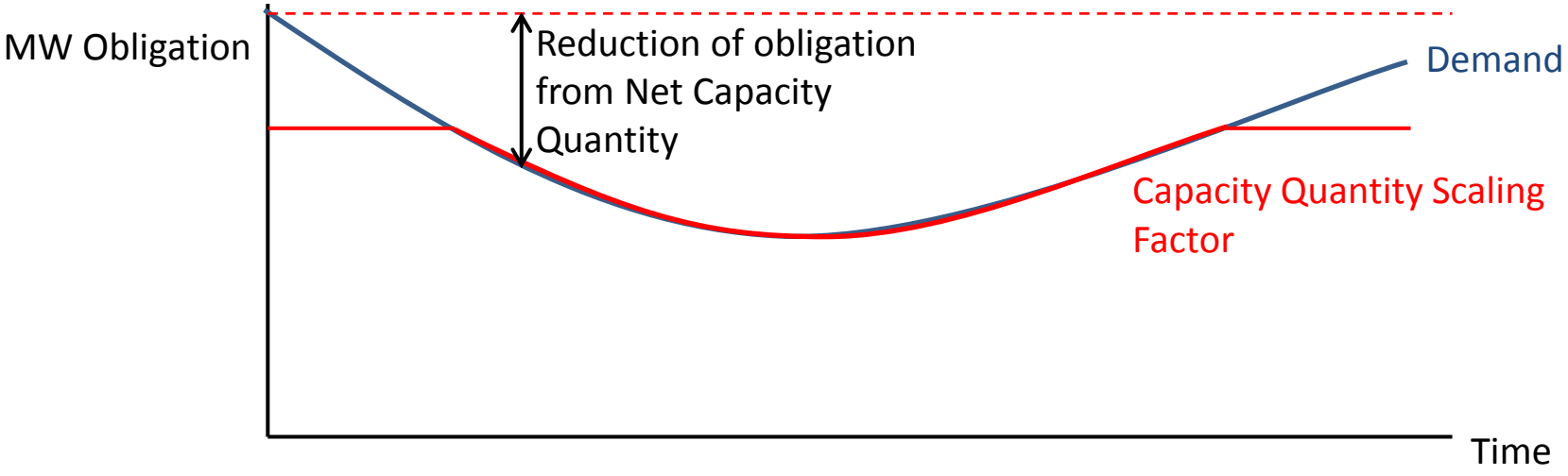
Chapter 5: Load Following Obligated Capacity Quantity

Load Following Obligated Capacity Quantity – 1/4

- 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 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 the 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.

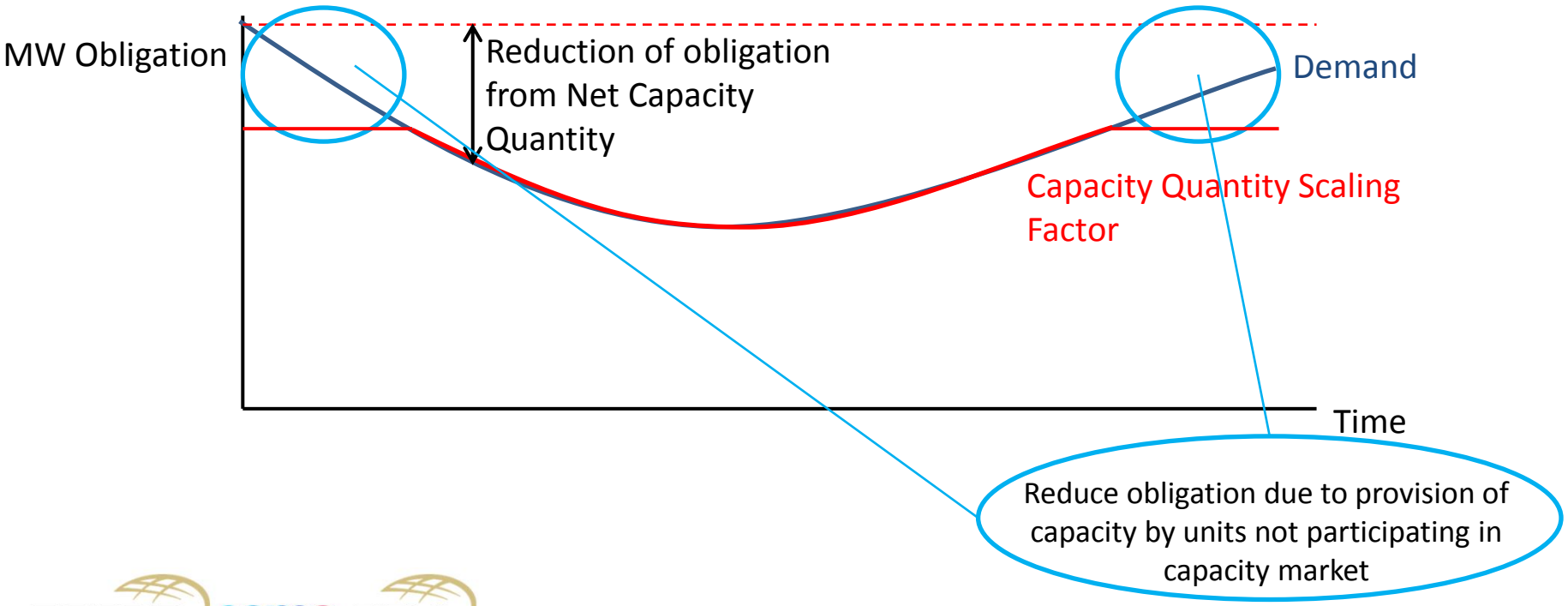
Load Following Obligated Capacity Quantity – 2/4

- The next input is the loading following element. Load-following refers to reducing the obligation on Capacity Market Units to trade in the energy markets. This is because the capacity auction is run so that enough capacity is awarded to cover the likely peak requirement. If demand is less than the peak, or there is other capacity available to provide the energy which didn't participate in the Capacity Market (to the extent allowed, such as for variable renewables), then the capacity required from Capacity Market Units to meet demand is less than the maximum amount of their awarded capacity quantities, and their obligation to trade is scaled down accordingly. This is done through the Capacity Quantity Scaling Factor.



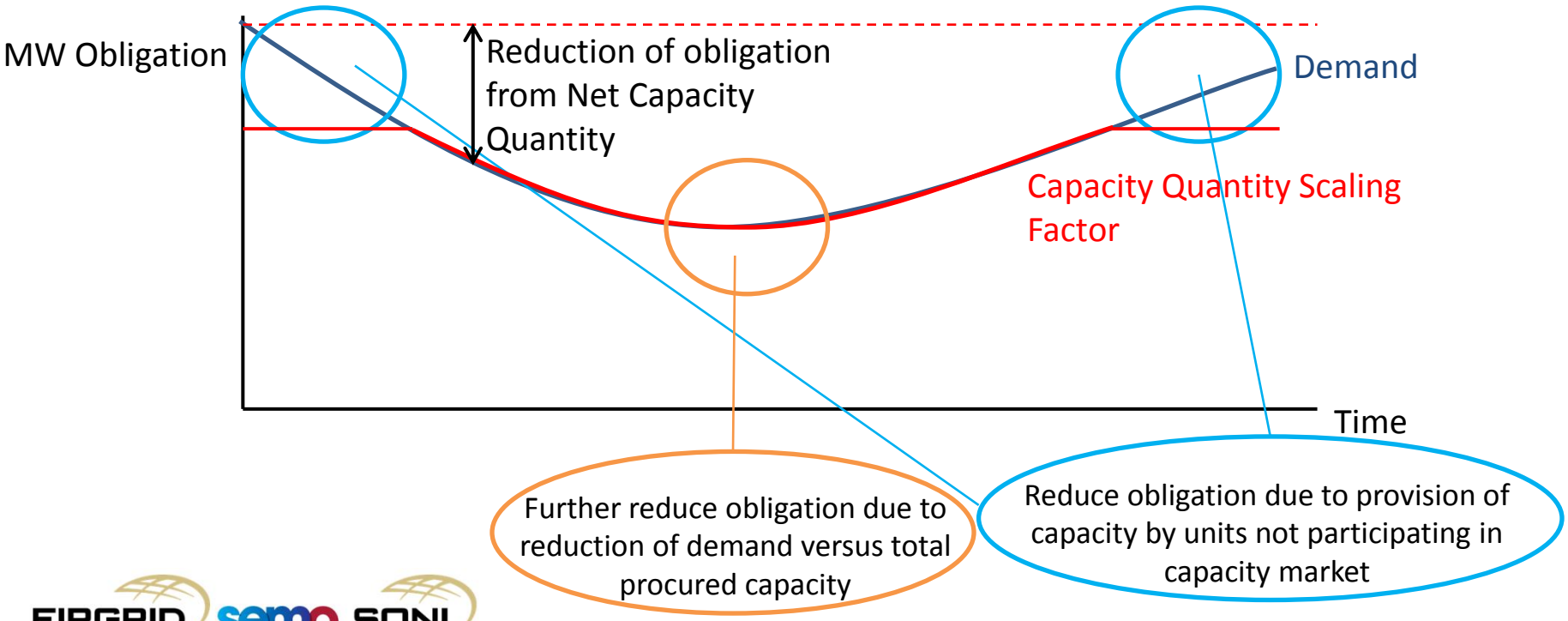
Load Following Obligated Capacity Quantity – 3/4

- For example, a unit with 400MW awarded capacity would normally need to provide 400MW in energy market trades in order to meet their obligation. Since a number of wind units did not participate in the Capacity Market auctions while still being available in the energy markets, this unit only needs to provide 300MW of this capacity through energy trades to make sure that demand is met. This amount is sufficient for a range of demand values closer to the peak Capacity Requirement value which was used to procure the capacity in the auctions. This is a fixed element of the Capacity Quantity Scaling Factor, reducing the obligation based on capacity which did not participate in the Capacity Market.



Load Following Obligated Capacity Quantity – 4/4

- As demand reduces further, the amount of demand buying the energy from the Capacity Market Units through the energy market starts to become insufficient to ensure the capacity obligations based on the full awarded capacity can be met. If Capacity Market Units were forced to continue providing the same amount they would be left exposed with no means of managing this exposure. Therefore the Capacity Quantity Scaling Factor includes an element which reduces the obligation, based on the reduction of demand.



Chapter 6: Stop-Loss Limits

Stop-Loss Limits – 1/5

- If a unit fails to meet an obligation to trade, this could result in large charges on the unit without any revenue to help cover the charge. This creates a strong incentive to provide energy reliably at the times of most need, but also a potential risk of the participant making a loss.

- Therefore an annual limit to how much Difference Charges can accrue on a Capacity Market Unit is imposed to limit the risk. The limit is based on a multiple of annual forecast and actual Capacity Payment revenue.

- The multiplier for the limit is determined through a parameter setting process, and for go-live its value will be 1.5, meaning that the Annual Stop-Loss Limit and maximum Non-Performance Difference Charge a Capacity Market Unit could incur in a year will be 1.5 times its Capacity Payment revenue.

- The limit only applies to the Difference Charges which can result in the Capacity Market Unit making a loss. In the day-ahead, intraday and balancing reference markets the Capacity Market Units receive revenue in the energy market for its trades which assist in paying the Difference Charge, and therefore they would not make a loss by paying this charge for those reference markets. However the Non-Performance Difference Charge is by definition a charge which applies when the unit did not trade to the level required by its obligation, and therefore it would not receive revenue to assist in paying this charge. Therefore it is this element to which to Stop-Loss Limits apply.

Stop-Loss Limits – 2/5

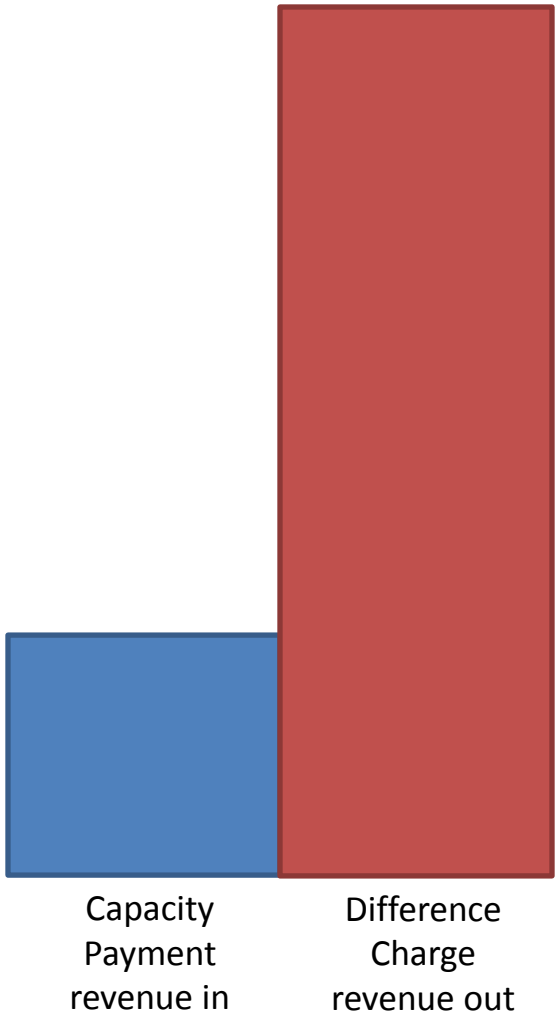
- As Difference Charges could be quite high in value, it may be possible that the entire Annual Stop-Loss Limit is reached with the first Difference Charge in the year. If this happens, then the Capacity Market Unit would no longer be subject to Non-Performance Difference Charges through not meeting their capacity obligations, and would no longer have the incentive to be reliable. Therefore a weekly limit, which is smaller than the annual limit, is also imposed in order to spread the incentive out throughout the year so that there is not a situation where the annual limit is hit and the reliability incentive is removed for the whole year in one single event.

- The multiplier for the limit is determined through a parameter setting process, and for go-live its value will be 0.75, meaning that the Billing Period Stop-Loss Limit and the maximum loss a Capacity Market Unit can make in a week will be 0.75 times its Capacity Payment revenue.

- In summary, on one side the stop loss limits are trying to ensure that participants aren't overly exposed so that the perceived risk of losses is sufficiently manageable, and on the other side it is designed to try and maintain the incentive to provide capacity reliably through energy market trades at times of most need. The following slide illustrates the impact of the Stop-Loss Limit on the net cash flow of a CMU.

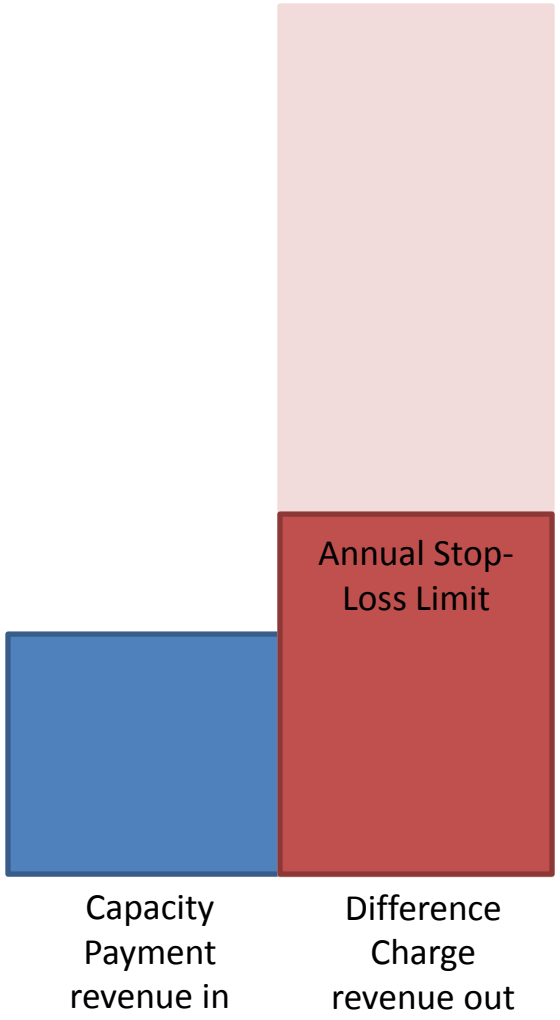
Stop-Loss Limits – 3/5

Stop-Loss Limits



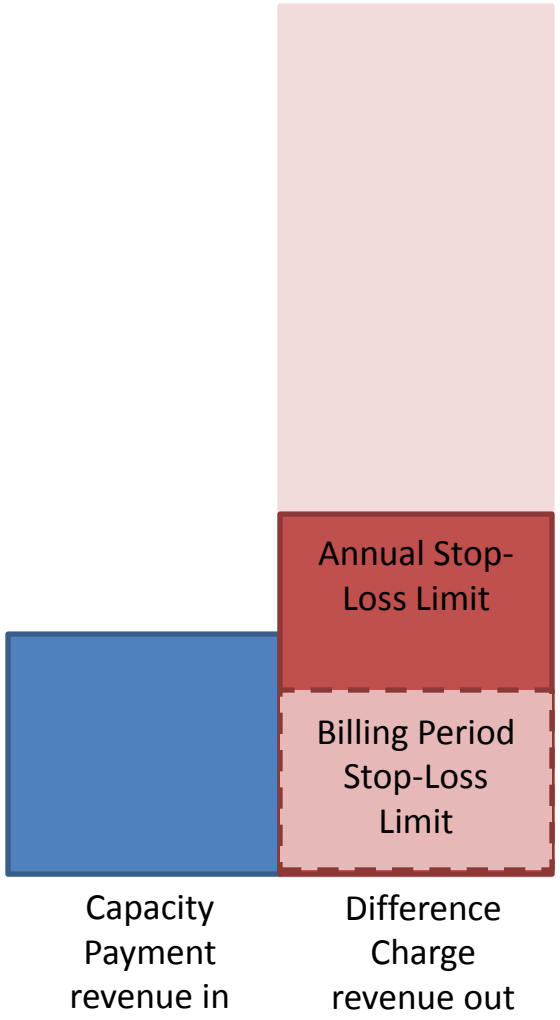
Stop-Loss Limits – 4/5

Stop-Loss Limits



Stop-Loss Limits – 5/5

Stop-Loss Limits



Chapter 7: Market Difference Charges and Difference Payments

Market Difference Charges and Payments – 1/10

- Since the I-SEM consists of a number of market timeframes, each one is made a reference market for meeting capacity obligations. This means that Capacity Market Units can meet their obligation, and can be exposed to Difference Charges, through trading in any of the energy market timeframes: day-ahead, intraday and balancing. The provision of certain reserves is also allowed to count towards meeting obligations. It also means that Suppliers are protected from the price in all market timeframes, as they are hedged against the price through Difference Charges in each timeframe.

- The complexity of dealing with the interactions of the charges in all of these timeframes is managed through multiple layers of settlement algebra. While it appears complicated, this algebra can be explained as trying to implement a number of principles for the interaction of these charges.

Market Difference Charges and Payments – 2/10

- All markets are reference markets, i.e. can meet capacity obligation with, and be hedged against prices in:
  - Traded quantities in Day-ahead Market (charges and payments);
  - Traded quantities in 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.

Market Difference Charges and Payments – 3/10

- The first principle relates to when capacity of a unit is traded in the energy market more than once. Imagine a unit has traded to a certain position in the day-ahead market, then traded out of that position, and back into that position, multiple times in opposite directions in the intraday market. Despite the fact that there are multiple trades in opposite directions, they all just represent a single capacity position of the unit provided through the net position of those trades, and therefore only a single trade representing this capacity position should be exposed to the charge. The capacity is only delivered (through trades) once, even if the energy amounts for that capacity have been traded multiple times, and therefore there needs to be a single reference price for the capacity delivered.

- A similar mirrored principle is present in terms of the hedge for demand: while there may be multiple energy trades in opposite directions, it all just represents a single demand consumption position, and therefore only a single trade representing this demand consumption position should be eligible for the hedge.

- Another principle which builds this one is that the single trade taken as exposed to the charge, or eligible for the hedge payment, is based on where the capacity or demand position was traded first. This means the capacity or demand position can be traded multiple times but only exposed to charges or eligible for payments for the first trade.

Market Difference Charges and Payments – 4/10

- The next principle is on the reference price, which is the price of the traded quantities. For those who have traded in the day-ahead market there is one price for the I-SEM zone and therefore it is easy to identify the reference price. However, when considering balancing market or intraday market trades, every single individual unit trade quantity could have a different price associated with it. Because of this, the reference price for each trade is taken to be the price at which that trade is settled through energy payments or charges.

- The next principle relates to the sign or the direction of trades considered. For Capacity Market Units, only the quantities which represent selling power (positive quantities which can be seen as the provision of capacity through trades) are exposed to charges, and similarly for Suppliers only quantities which represent buying power (negative quantities) are eligible for the payments to enact the hedge.

Market Difference Charges and Payments – 5/10

- The final principle also relates to when a trade is determined to contribute to the provision of capacity, and this one is based on the net effect of all trades. It is important to ensure that if a Participant trades out of a position that this is reflected in increasing the Non-Performance Difference Quantity. Otherwise a Participant could meet their capacity obligation through taking on a physical obligation in earlier trades, trade out of this physical obligation in later trades while keeping their capacity obligation fulfilled, therefore severely limiting the reliability incentive provided through Non-Performance Difference Charges.

- The algebra ensures that there is an inverse relationship between increasing energy obligation and decreasing capacity obligation, so that if a unit trades out of its energy position, it would be seen as non-performance against the capacity obligation.

- This could be thought of more simply as a see-saw effect: the more power is provided through increasing the net traded quantities then the less additional trades need to be provided before the capacity obligation is fully met, the less power is provided through decreasing the net traded quantities then the more additional trades need to be provided before the capacity obligation is fully met.

Market Difference Charges and Payments – 6/10

- This has an important interaction with the principle of not exposing capacity multiple times through applying difference charges to multiple trades. In the case where a unit has traded out of or decreasing its imbalance position, it is increasing the amount of its capacity obligation no longer being met and therefore the volume exposed to Non-Performance Difference Charges.

- Since this volume is now exposed to Non-Performance Difference Charges based on the net position of the energy market trades, any traded volume above this net position should not be exposed to difference charges because then that part of the unit's capacity would be exposed a number of times – once through a market Difference Charge, and again through Non-Performance Difference Charges.

- This is managed by taking into account the net energy trading position of the unit in the algebra used to calculate the quantities to which Difference Charges apply, and the quantity of the obligation met.

Market Difference Charges and Payments – 7/10

- In order to implement all of this, a systemic approach is taken to ensure that the correct quantities are calculated to be exposed to a charge or eligible for a payment taking into account all of these principles. Subsequently, if the trade price is greater than the strike price then a charge or a payment is calculated, otherwise for that trade there is none.
- The complication lies around working out the quantities. The approach taken is to look at every single trade from the day-ahead, intraday and balancing markets. These are all lined up in the order that they were accepted. The next step is to look at one of those trades and calculate the quantity of it that is exposed to the difference charges or eligible for the difference payments. To ensure the right amount is calculated, tracking variables which keep track of the net trade position of all trades prior to the one considered are used. The purpose of this is that if something was traded already it is not going to be double-exposed to difference charges.
- There are also capping variables in place. CMUs need to trade up to the level to meet their obligations in the capacity market, and those trades are exposed to difference charges, however any trades beyond the obligated level should not be exposed. If the CMU trades up that obligated level, then the calculations for difference charges ensure that the quantity of trades above that level are not exposed to being charged by using a combination of the tracking variables and capping variables to calculate the exposed quantity to be zero.

Market Difference Charges and Payments – 8/10

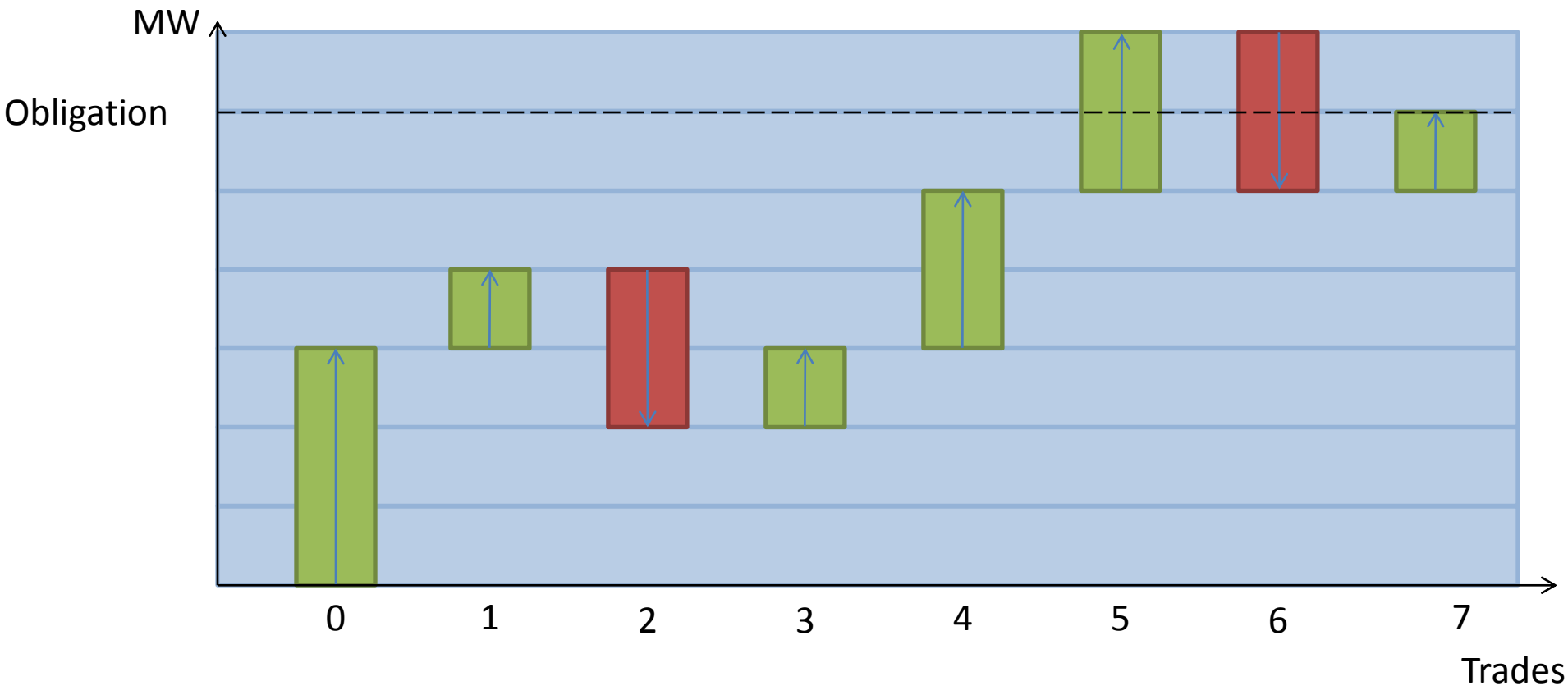
- The principles are implemented in a mechanism which can be explained with the following three step iterative process, looking at each trade in order of acceptance:

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 from this trade.

- Repeat the three steps with the next trade, until there are no trades left.
- Once the quantity has been calculated, then the charge can be calculated as the quantity times the difference between the trade price and the Strike Price.
- The following slides show a simple example of the trading a CMU does for a single period, and the resulting quantities which are can be exposed to difference charges. More examples will be given as part of Instructor Led Training.

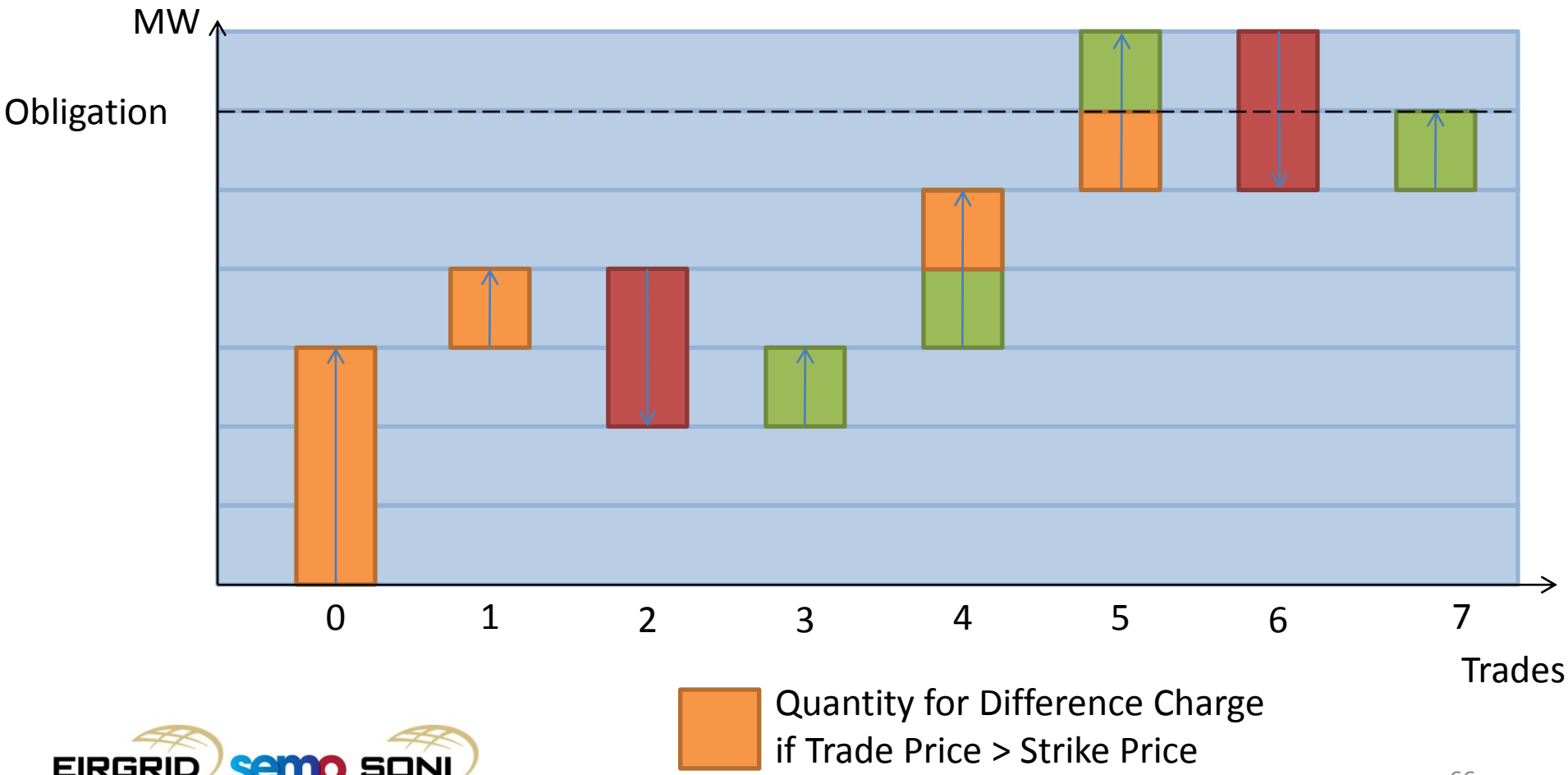
Market Difference Charges and Payments – 9/10

- Day-ahead and Intraday trades:

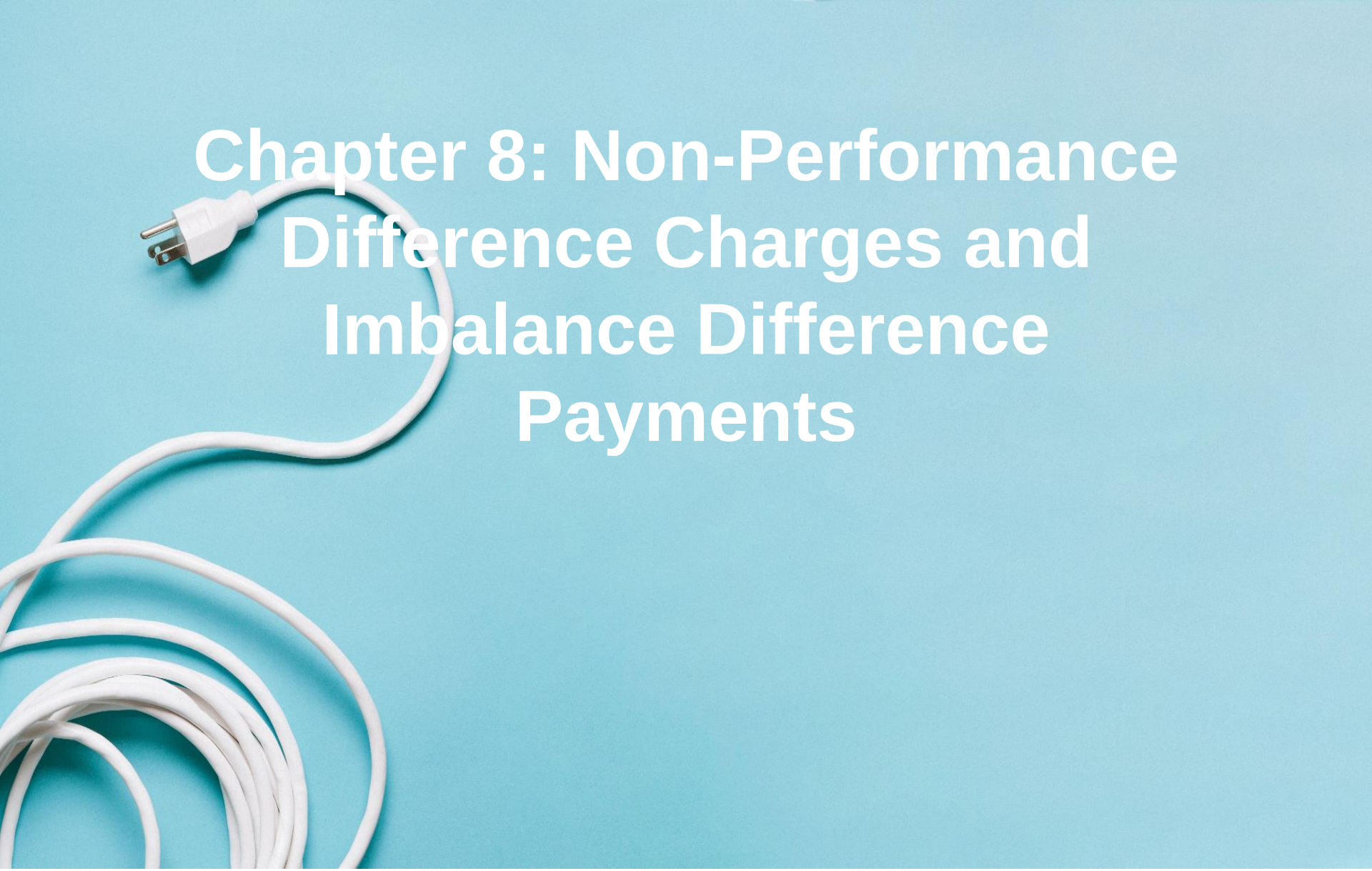


Market Difference Charges and Payments – 10/10

- Day-ahead and Intraday trades:



Chapter 8: Non-Performance Difference Charges and Imbalance Difference Payments



Non-Performance Difference Charges and Imbalance Difference Payments – 1/2

- Another Difference Charge on Capacity Market Units is one for non-performance, where the incentive for reliability is most strongly implemented. This is a charge on the amount of the capacity obligation which the Capacity Market Unit did not meet through energy market trades: this charge applies to the quantity between the level of obligation met and total load-scaled obligation.

- The price used for this charge is the Imbalance Settlement Price, and like other reference markets the charge is triggered when this price is greater than the strike price. This can happen due to the bid offer prices submitted by participants setting the price higher, but an Administered Scarcity Price function is also included in the calculation of the Imbalance Settlement Price to ensure the Imbalance Settlement Price is at least at a high enough level to reflect the value of scarcity at times where the system needs reliable capacity in order to maintain system security (such as at times of reserve shortfalls or demand control). 3000€/MWh has been set as the price of the full value of scarcity for go-live, with a plan to change this to the Value of Lost Load after a number of years.

- Because this charge is on a quantity which has not been traded, the Capacity Market Unit has no revenue from the energy market for this quantity to help cover this charge, and would be in a position to make a loss if these charges arise. Therefore, the incentive for a Capacity Market Unit is to trade on in the energy markets as early as possible, or make themselves available in the balancing market at the lowest prices possible, to ensure that they have trades to provide energy at times where scarcity is expected in order to avoid exposure to this risk of revenue loss. Also because of the risk associated, it is the Non-Performance Difference Charge to which the Stop-Loss Limits apply.

- The provision of some reserves is counted towards meeting the capacity obligation, and reduces the non-performance quantity.

Non-Performance Difference Charges and Imbalance Difference Payments – 2/2

- Suppliers are also exposed to the Imbalance Settlement Price and potential Administered Scarcity Price in the energy market settlement, however like the other market timeframes they are eligible to be hedged against this price for any imbalances they incur. This is done through the Imbalance Difference Payment. Therefore while the potential for very high imbalance prices have been introduced through Administered Scarcity Pricing functionality, in reality Suppliers would not have to pay this price either because they bought this energy sufficiently in the ex-ante markets rather than as an imbalance, or if this energy is purchased as an imbalance they would only have to pay a maximum of the Strike Price for that volume.

- This means that Administered Scarcity Pricing can largely function to create the incentive for reliability on Capacity Market Units while not overly affecting consumers.

- Demand Side Units and Interconnectors are only exposed to this charge, and not the charges in the other timeframes. This is because they operate quite differently to other units. Interconnectors do not trade in the markets and so none of the charges associated with the day-ahead, intraday or balancing market prices would be possible. Therefore they are only exposed to the Non-Performance Difference Charge, and only to the extent that they were not available to import to the obligated level. Demand Side Units do not get the benefit of the energy market revenue to help cover the Difference Charges so they are treated slightly differently also – only being exposed to Non-Performance Difference Charges and only to the extent to the TSO deems they did not meet the obligation.

Chapter 9: Difference Payment Socialisation Charge and Socialisation Fund

Difference Payment Socialisation Charge and Socialisation Fund – 1/9

- Money in through Difference Charges may not equal money out for Difference Payments, resulting in a phenomenon which has been called the “hole in the hedge” where there is insufficient money available for the payment to enact the hedge for suppliers. This can happen for a number of reasons:
  - Stop-Loss Limits (in the absence of these limits non-performance difference charges at the imbalance price would be received to help pay imbalance difference payments at the imbalance price, but the charges element of this is limited after a certain point);
  - Multiple markets as the market reference price (Capacity Market Units could meet their obligation in a certain market, e.g. the Day-ahead Market with a price lower than the strike price, which meant they did not need to make a difference charge, while difference payments in other markets for suppliers who did not trade in that same ex-ante market, for example an imbalance with a price greater than the strike price, may still be required in order to enact the hedge);
  - Different treatment of some units (interconnectors, DSUs) so that they may not have difference charges levied in situations where other units would;
  - Possible that less capacity than the amount required to meet peak demand is procured through the capacity auction, or the peak demand used in the auction has been under-forecast, so there is insufficient capacity making difference charges to cover the supply which requires difference payments;
  - Exclusion of non-bidding plant from the amount of capacity to be procured in the auction – this capacity is meeting demand without being paid, and without being exposed to difference charges, while that demand is still eligible for difference payments.

Difference Payment Socialisation Charge and Socialisation Fund – 2/9

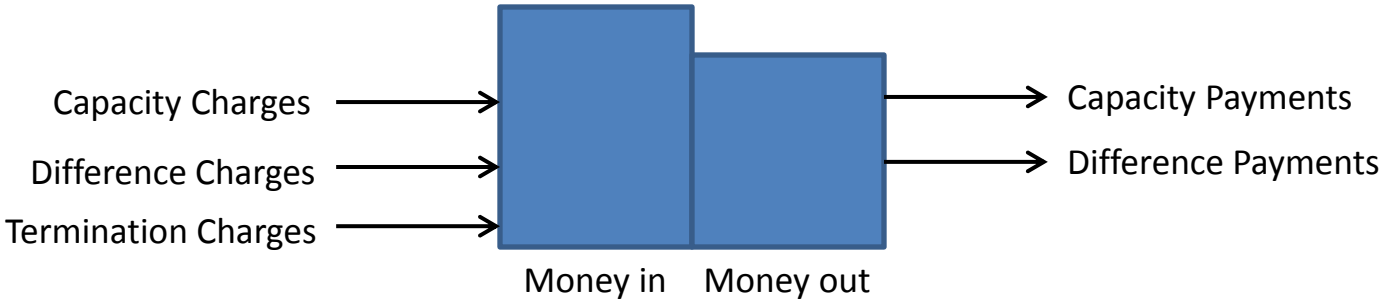
- This relates to a mismatch in the total money in and out over the course of a year. There are also other areas where there can be a mismatch between cash flow in and cash flow out within the year, such as:
  - An over-forecast of demand or demand reducing in line with the incentive resulting in less Capacity Charges being available to meet Capacity Payments; and
  - Seasonal variations in demand resulting in some times where the Capacity Charges are less than that required for Capacity Payments, and other times where the Capacity Charges are greater than that required for Capacity Payments; and
  - The design of the Capacity Charge for Suppliers creating the incentive to shift load away from periods where the charge is applied – if the incentive is successful and load was less than that forecasted in setting the price for the charge, then less funds will be available.

- The solution to all of these has been to manage all capacity market funds together, and with an additional charge on suppliers.

Difference Payment Socialisation Charge and Socialisation Fund – 3/9

There are 4 stages of managing this:

1. All cash flow in single “socialisation fund”.

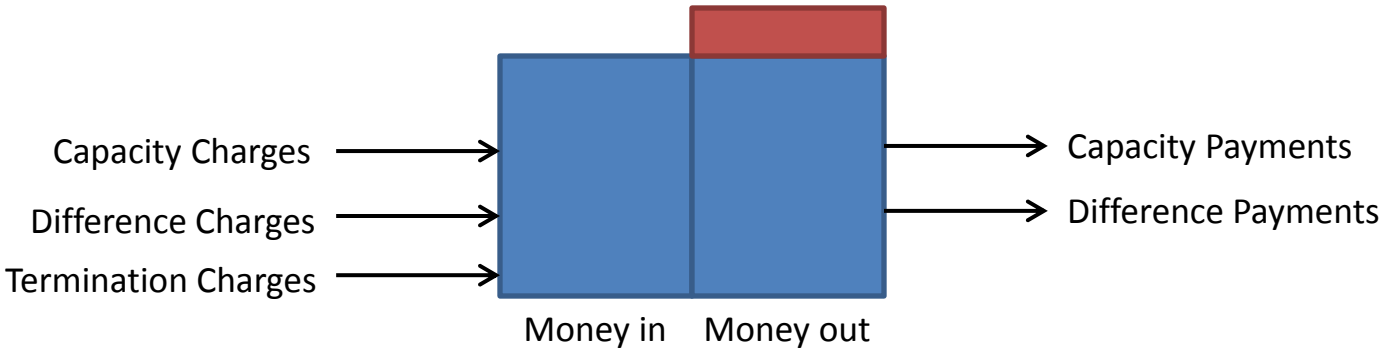


The socialisation fund solution pools all of the money from payments and charges together with the expectation that the surpluses in one will offsets that deficits in another.

Difference Payment Socialisation Charge and Socialisation Fund – 4/9

There are 4 stages of managing this:

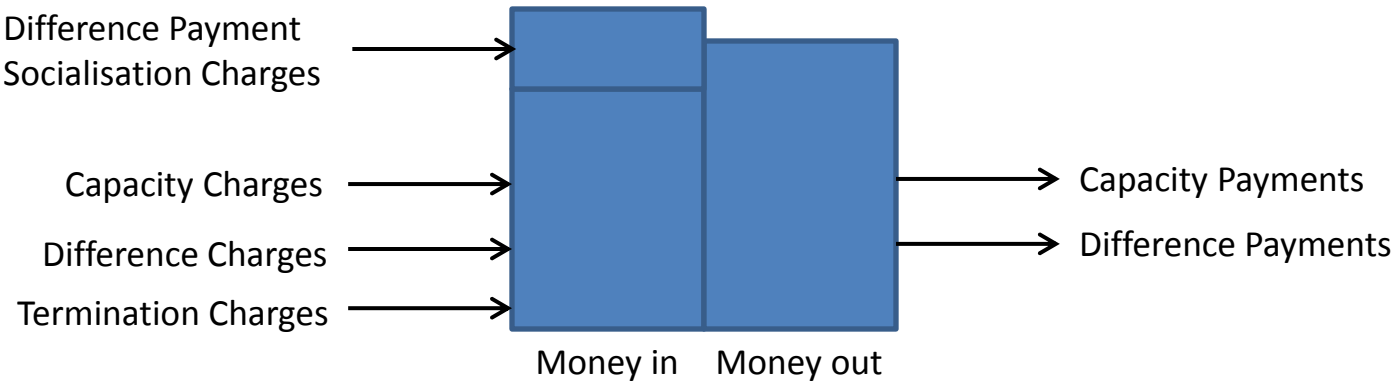
1. All cash flow in single “socialisation fund”.
2. If insufficient,



Difference Payment Socialisation Charge and Socialisation Fund – 5/9

There are 4 stages of managing this:

1. All cash flow in single “socialisation fund”.
2. If insufficient, plug gap with Difference Payment Socialisation Charge.

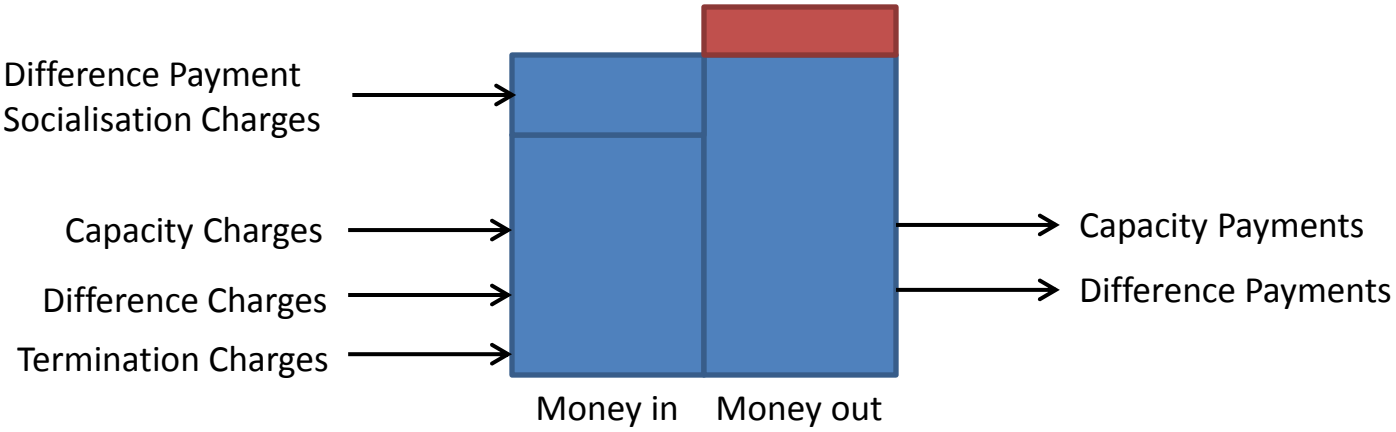


An additional charge on suppliers, known as the Difference Payment Socialisation Charge, may be required in order to ensure there is sufficient funds available. This charge is calculated as a multiplier of the Capacity Charge for each Supplier, based on the forecasted shortfall in the Difference Charges required to meet the Difference Payments. This could be thought of as all Suppliers pre-paying into the fund to ensure that payments to those owed them can happen at the correct time.

Difference Payment Socialisation Charge and Socialisation Fund – 6/9

There are 4 stages of managing this:

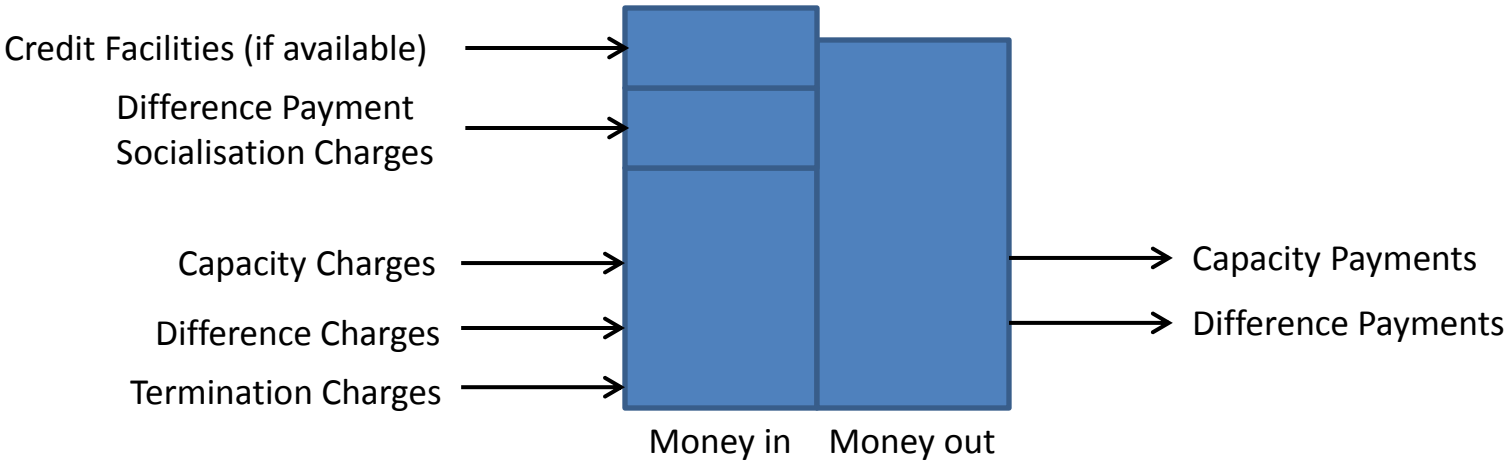
1. All cash flow in single “socialisation fund”.
2. If insufficient, plug gap with Difference Payment Socialisation Charge.
3. If insufficient,



Difference Payment Socialisation Charge and Socialisation Fund – 7/9

There are 4 stages of managing this:

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.

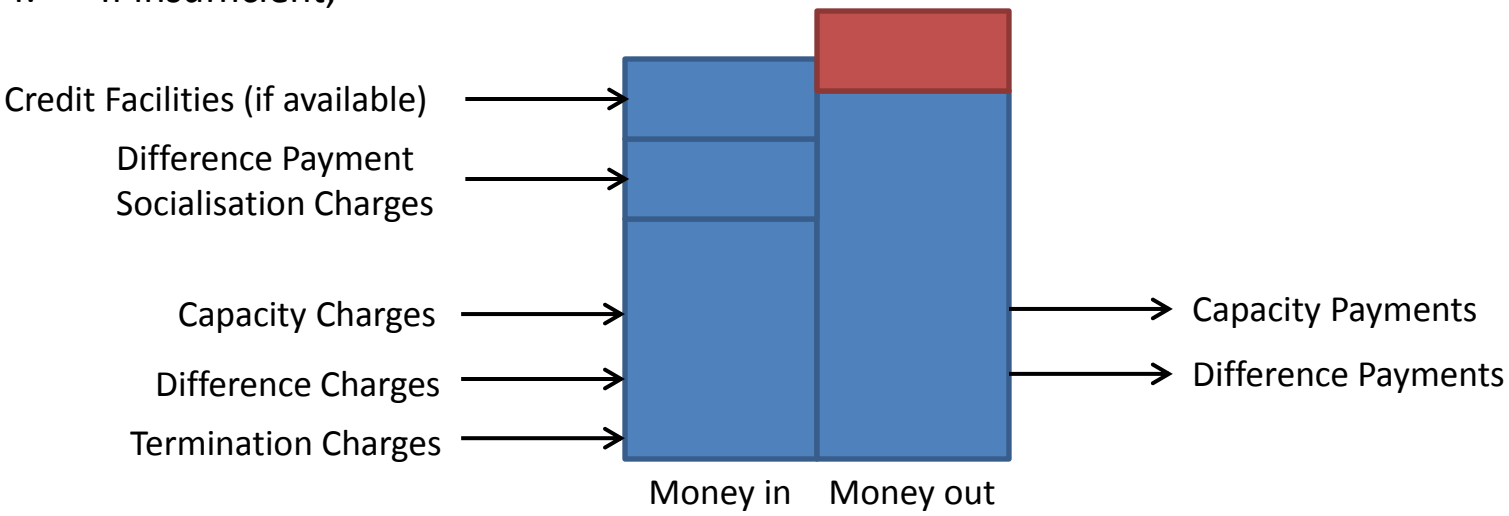


The Difference Payment Socialisation Charge may also be insufficient, for example if the forecast which was the basis of the additional charge was incorrect. If this occurs, then it is possible that the Market Operator can use credit facilities to manage the shortfall in the short term to the extent agreed with the Regulators.

Difference Payment Socialisation Charge and Socialisation Fund – 8/9

There are 4 stages of managing this:

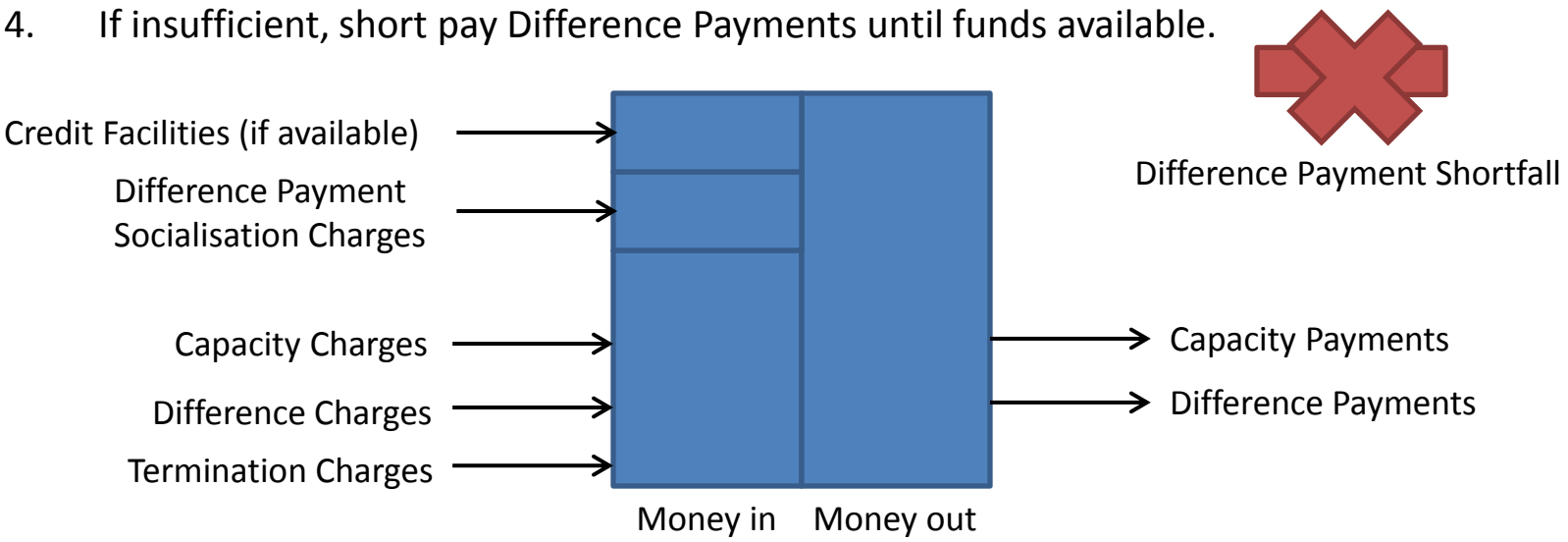
1. All cash flow in single “socialisation fund”.
2. If insufficient, plug gap with Difference Payment Socialisation Charge.
3. If insufficient, plug gap with credit facilities to extent possible.
4. If insufficient,



Difference Payment Socialisation Charge and Socialisation Fund – 9/9

There are 4 stages of managing this:

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.



If that is again insufficient to ensure that money in equals money out, then the money going out is stopped. This is done through reducing the Difference Payments to be made on this occasion pro-rata across all Suppliers owed them until the total payment can be met with the funds available. The amount on each individual Supplier that is short paid will be tracked, and Suppliers will be reimbursed when the funds are recovered (and after any credit facility payments are made).

Chapter 10: Course Summary

Review of Learning Objectives

As a result of this training module you should now understand:

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. ✓