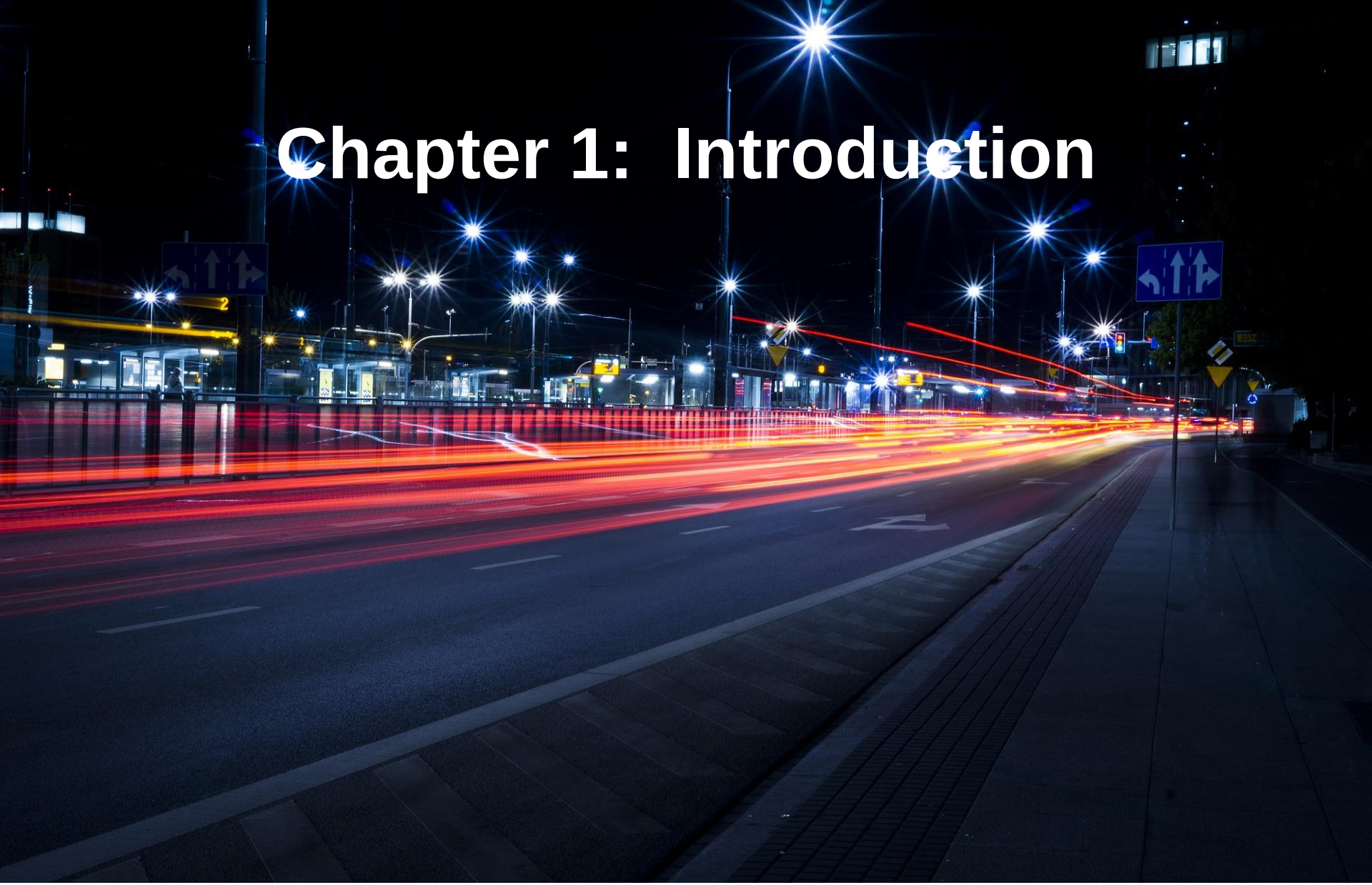
I-SEM Training
Capacity Auctions

August 2017

Chapter 1: Introduction



Foreword

Capacity Auctions

- The focus of the "Capacity Auctions" course relates to the how the Capacity Auction works.

- It is assumed that the reader has already completed the Capacity Market courses on Registration and Qualification and on the Auction Offers.

Currency

- This learning material focuses on examples to illustrate concepts rather than providing comprehensive coverage of every topic. The Capacity Market facilitates settlement in both Euro and Sterling. As the market internally operates in Euro the examples tend to be presented in Euro. However, in practice participants in Northern Ireland will see a Sterling equivalent price.

Learning Objectives

This training session will help you appreciate:

- The inputs to a Capacity Auction.
- The basic features of the Unconstrained Auction.
- How locational capacity constraints impact Auction results.
- How the “Lumpiness” due to Inflexible Offers is addressed.
- The Interim Secondary Trading Arrangements.

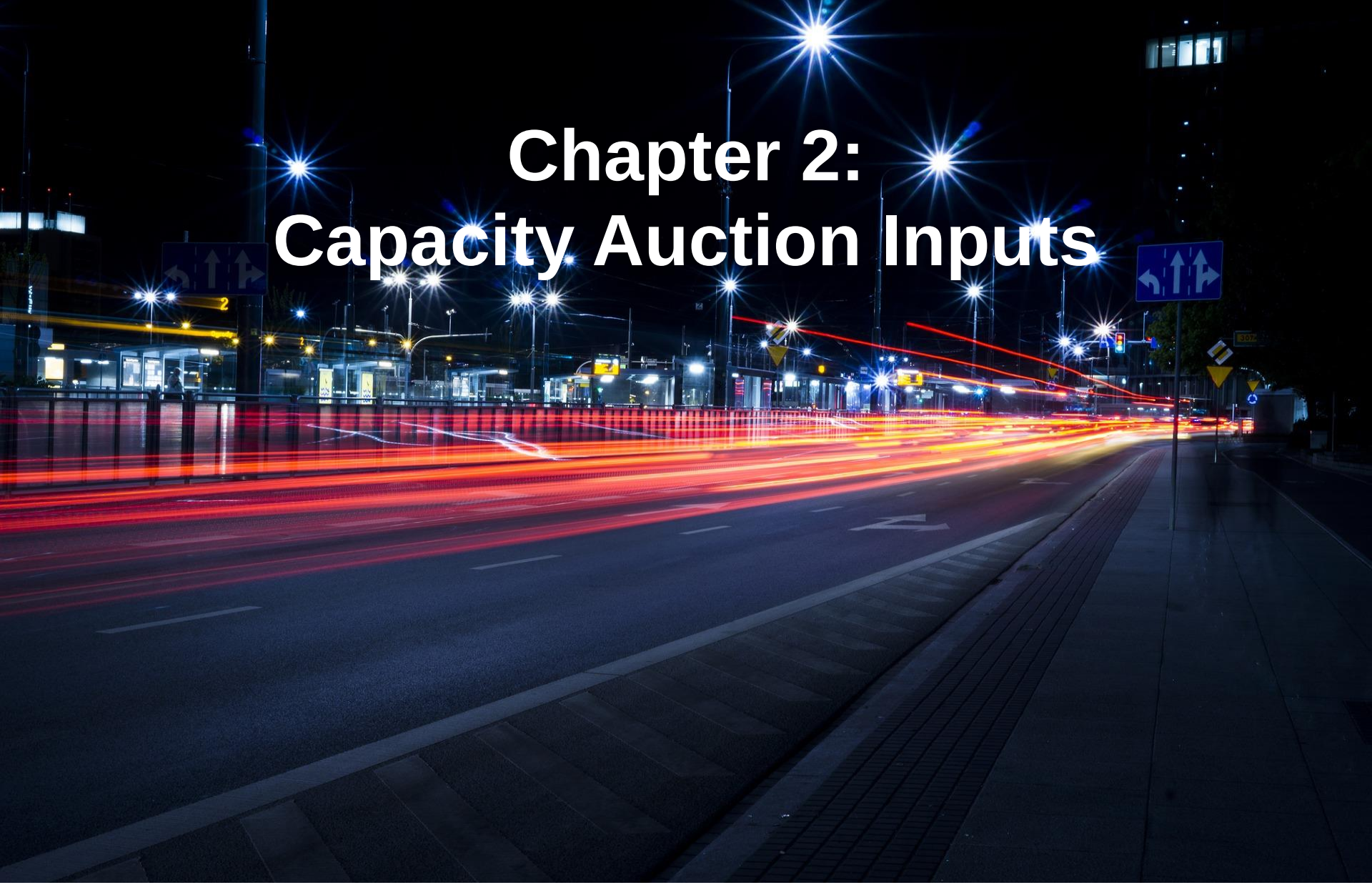
After this course you should be in a more informed position to follow the more detailed description of the Capacity Market in the Instructor Led Training.

Governing Rules

The Capacity Market arrangements are governed by a set of rules know as the **Capacity Market Code** (CMC). **[**https://www.semcommittee.com/news-centre/publication-i-sem-crm-capacity-market-code-decision**]** The CMC define obligations and responsibilities of the Parties to that code, including the registration, qualification, operation of the capacity market and secondary trade, and the obligations on those awarded capacity. Settlement arrangements are covered under the **Trading and Settlement Code** (TSC). **[**https://www.semcommittee.com/news-centre/publication-i-sem-trading-and-settlement-code-amendments-decision-paper**].**

The CMC is supported by a set of Agreed Procedures. The most relevant of these for this training module is **Agreed Procedure 3 "Qualification and Auction Process" [**https://www.semcommittee.com/news-centre/publication-i-sem-crm-capacity-market-code-decision**].**

It is important to note that these Agreed Procedures are different to the set of Agreed Procedures that support the TSC.



Chapter 2:
Capacity Auction Inputs

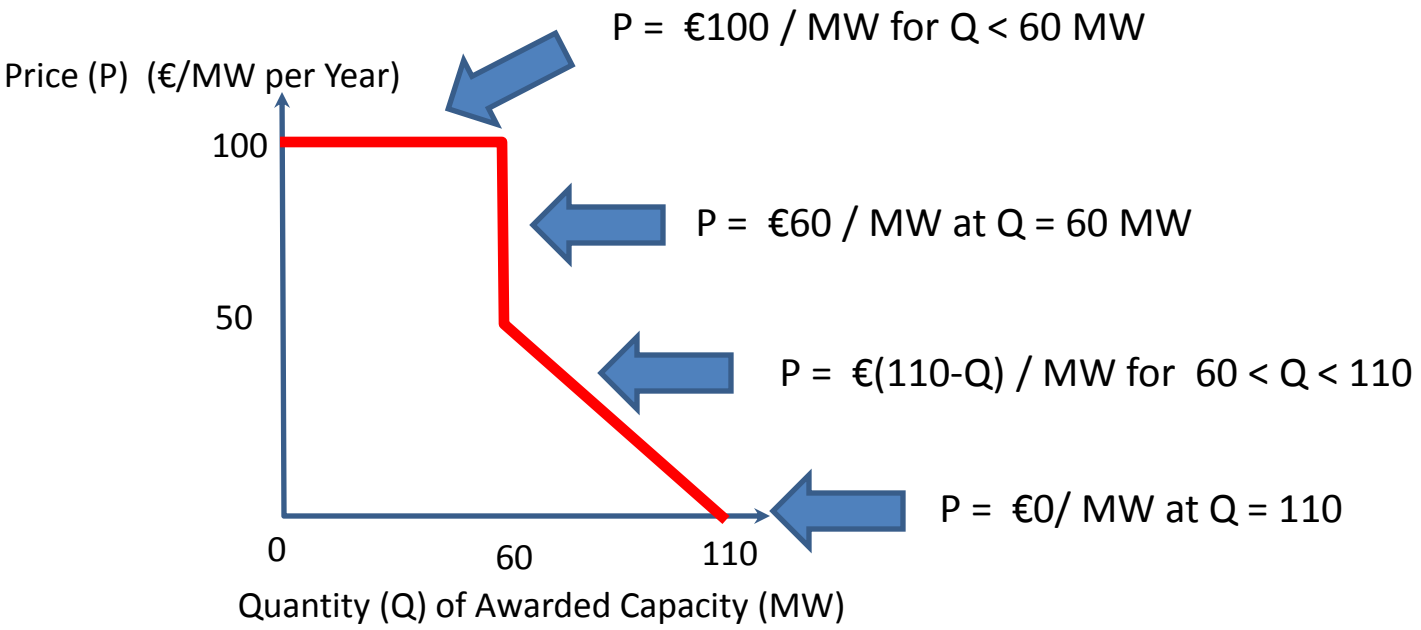
Introduction

This chapter presents a set of input data for an illustrative capacity auction example. The data is described below and will be used throughout this course.

- The Demand Curve:
  - This provide a measure of the value to the market of capacity.
  - It is set by the Regulatory Authorities.
- The Capacity Market Units (CMUs):
  - This is a set of CMUs with data based on their Qualification Results.
- The Locational Capacity Constraints:
  - These set minimum capacities to be procured by region in the auction.
  - These are set by the System Operators and approved by the Regulatory Authorities.
  - Their relationship with CMUs is presented. This comes from Qualification Results.
- The Auction Offers:
  - A simple set of Offers representing the cost of capacity submitted by each CMU.
  - The offers must be consistent with the Qualification Results.

The Demand Curve

Demand Curve



- This curve is used in the auction to limit how much the market is prepared to pay for a given amount of awarded capacity.

The Qualified Capacity Market Units – Existing Capacity

Existing Capacity from Units	A	B	C	D	E	F	G
Net De-Rated Capacity (Existing)	10	20	10	25	10	15	-
Existing Capacity Price Cap	We assume all existing units limited to €40/MW per year.						
Maximum Capacity Duration (years)	Existing Capacity has a Maximum Capacity Duration of 1 year. Capacity is only awarded for one Capacity Year.						
Firm Offer Requirement	10	15	0	25	7	6	-
Existing capacity required to offer (Lesser of: Net De-Rated Capacity (Existing) & Firm Offer Requirement)	10	15	0	25	7	6	-

- We work with seven CMUs. Units A to F exist today but unit G has no existing capacity.
- We assume all units have one offer step (they are actually allowed five in total).
- We assume no special price caps apply to units so as existing capacity they can all offer up to the Existing Capacity Price Cap. We set this to €40/MW per year.
  The initial auction information pack value for the first auction is €41,060/MW per year.
- Based on the Firm Offer Requirement (which reflects de-rated Firm Network Access) we show the existing capacity required to be offered into the Capacity Auction.

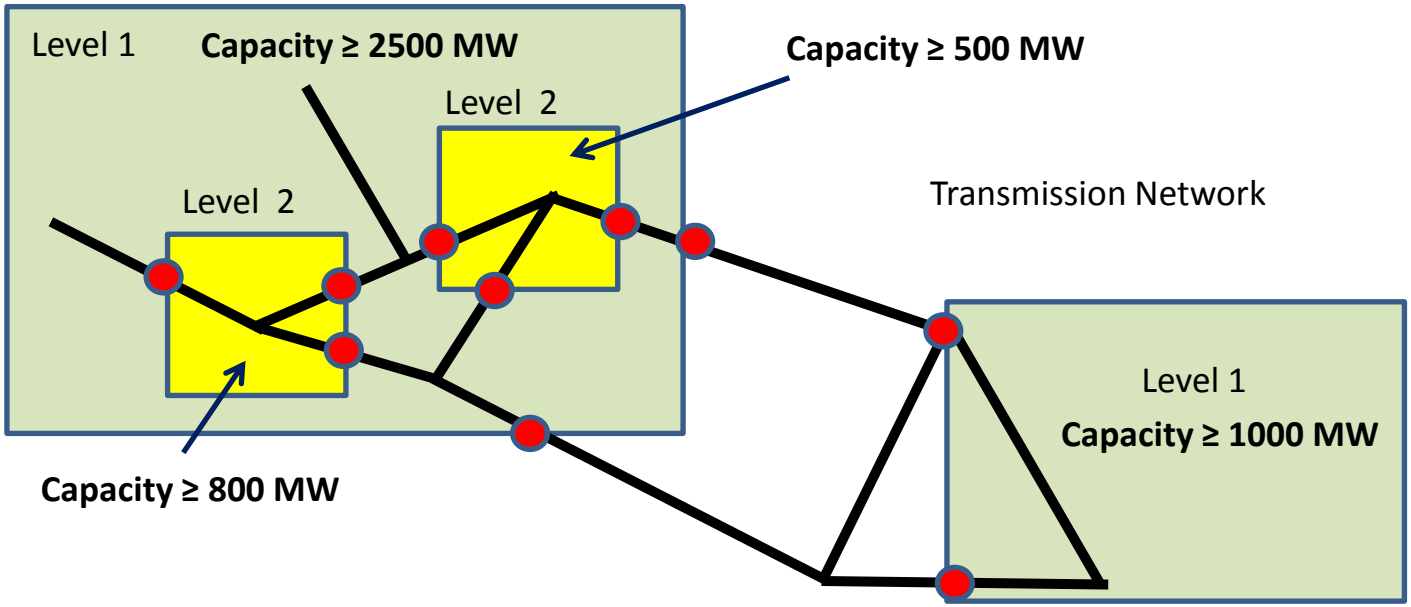
The Qualified Capacity Market Units – New Capacity

New Capacity from Units	A	B	C	D	E	F	G
Net De-Rated Capacity (New)	-	-	5	-	5	6	7
Auction Price Cap	We assume all new units limited to €100/MW per year.						
Maximum Capacity Duration (years)	-	-	10	-	1	10	10

- Units C, E, F and G are all offering New Capacity. This capacity is yet to be commissioned.
- All New Capacity offers are capped at the Auction Price Cap. We use €100/MW per year. *The initial auction information pack value for the first auction is €123,190/MW per year.*
- New Capacity that is qualified is not required to offer into the auction so we do not show a Firm Offer Requirement.
- By default all capacity has a Maximum Capacity Duration of 1 year.
- The RAs have been satisfied that Units C, F & G (but not E) are undergoing significant investment in New Capacity and have allowed a Maximum Capacity Duration of 10 Years:
  - Their participants can set a Capacity Duration on each of their auction offer steps to be anywhere from 1 to 10 years. If an offer step is cleared then the capacity awarded and the price paid for that capacity will be fixed for a number of Capacity Years equalling the Capacity Duration (provided code conditions are satisfied).

Locational Capacity Constraints

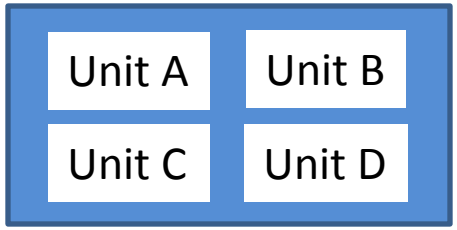
- Now we introduce Locational Capacity Constraints:
  - These require a minimum amount of capacity to clear in defined geographic regions defined by transmission network nodes.
  - They help in maintaining power system security given network constraints.
  - One constraint (a Level 2 constraint) can be within another (a Level 1 constraint).



- Our example is simplified in that we assume two Level 1 constraints with no Level 2 constraints.

Capacity Market Units & Locational Capacity Constraints – (1/3)

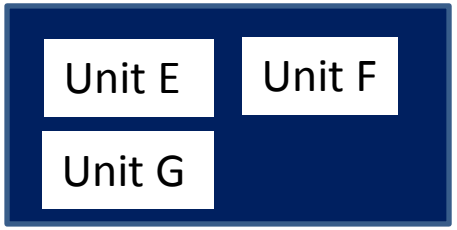
Locational Capacity Constraint R1



Required Awarded Capacity = **40**
Available Capacity (Existing) = **65**
Available Capacity (Total) = **70**

These constraints require that a minimum amount of capacity is awarded in pre-defined defined geographic areas.

Locational Capacity Constraint R2

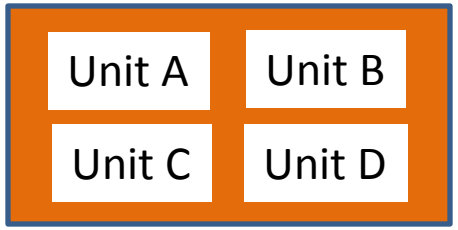


Required Awarded Capacity = **35**
Available Capacity (Existing) = **25**
Available Capacity (Total) = **42**

Unit	A	B	C	D	E	F	G
Net De-Rated Capacity (Existing)	10	20	10	25	10	15	-
Net De-Rated Capacity (New)	-	-	5	-	5	6	7
Max. Capacity Duration for New	-	-	10	-	1	10	10
Locational Capacity Constraint	R1	R1	R1	R1	R2	R2	R2

Capacity Market Units & Locational Capacity Constraints – (2/3)

Locational Capacity Constraint R1



Required Awarded Capacity = **40**
Available Capacity (Existing) = **65**
Available Capacity (Total) = **70**

As a network upgrade could quickly remove the need for a Locational Capacity Constraint, in general, New Capacity with an offered Capacity Duration > 1 year **cannot** be cleared if its offer price exceeds the Auction Clearing Price. The commitment to pay for this capacity could exceed the life of the constraint. The RA's may exempt new capacity from this if there would otherwise be a shortage. There is plenty of existing capacity in Region 1 so New Capacity from Unit C is **not** exempt. However, if in its offer it only specified a 1 year Capacity Duration then it can clear even if not exempted.

*Auction participants will **not** know if they are exempt or not.*

Unit	A	B	C	D			
Net De-Rated Capacity (Existing)	10	20	10	25			
Net De-Rated Capacity (New)	-	-	5	-			
Max. Capacity Duration for New	-	-	10	-			
Locational Capacity Constraint	R1	R1	R1	R1			
Exemption for New Capacity	-	-	N	-			

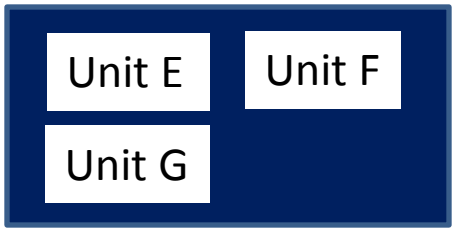
Capacity Market Units & Locational Capacity Constraints – (3/3)

In Region 2 we have three units offering new capacity and contributing to the constraint. Unit E has a Maximum Capacity Duration of 1 year, so it has no restrictions on being cleared to satisfy the constraint. However Units F and G have 10 year Maximum Capacity Durations and need to be exempted to be cleared to satisfy a constraint.

As there is only 25 MW of existing capacity and the required capacity is 35 MW the RAs have exempted Units F and G. In the auction they are only cleared if this is the only way to achieve a feasible solution.

*Auction participants will **not** know if they are exempt or not.*

Locational Capacity Constraint R2



Required Awarded Capacity = **35**
Available Capacity (Existing) = **25**
Available Capacity (Total) = **42**

Unit					E	F	G
Net De-Rated Capacity (Existing)					**10**	**15**	**-**
Net De-Rated Capacity (New)					**5**	**6**	**7**
Max. Capacity Duration for New					**1**	**10**	**10**
Locational Capacity Constraint					**R2**	**R2**	**R2**
Exemption for New Capacity					**N/A**	**Y**	**Y**

The Offers – Existing Capacity

Existing Capacity From Units	A	B	C	D	E	F	G
Net De-Rated Capacity (Existing)	10	20	10	25	10	15	-
Existing capacity required to offer	10	15	0	25	7	6	-
Offer (MW)	10	15	10	25	10	15	-
Price (€/MW per year)	€5	€10	€25	€40	€15	€35	-
Flexible?	Y	N	N	N	N	N	-
Capacity Duration	1	1	1	1	1	1	-

- We assume one offer step per unit for existing capacity. In reality a CMU has 5 offer steps available across Existing and New Capacity.
- Offer prices vary, with Unit D offering at the Existing Capacity Price Cap of €40/MW per year.
- Unit B has been qualified to 20 MW but as it is only required to offer 15 MW has done so. If it offered less than 15 MW the auction will treat the difference as offered at the applicable price cap. Unit C has no requirement to offer but offers all its qualified capacity.
- All offers are inflexible except for unit A. Inflexible offers must be cleared fully or not at all. Unit A's flexible offer can be cleared to any value between 0 MW and its offered 10 MW.
- Existing capacity can only be offered for a Capacity Duration of 1 year.

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The Offers – New Capacity

New Capacity From Units	A	B	C	D	E	F	G
Gross De-Rated Capacity (New)	-	-	5	-	5	6	7
Offer (MW)	-	-	5	-	5	6	7
Price (€/MW per year)	-	-	€99	-	€80	€65	€75
Flexible?	-	-	N	-	Y	N	N
Capacity Duration	-	-	10		1	10	10

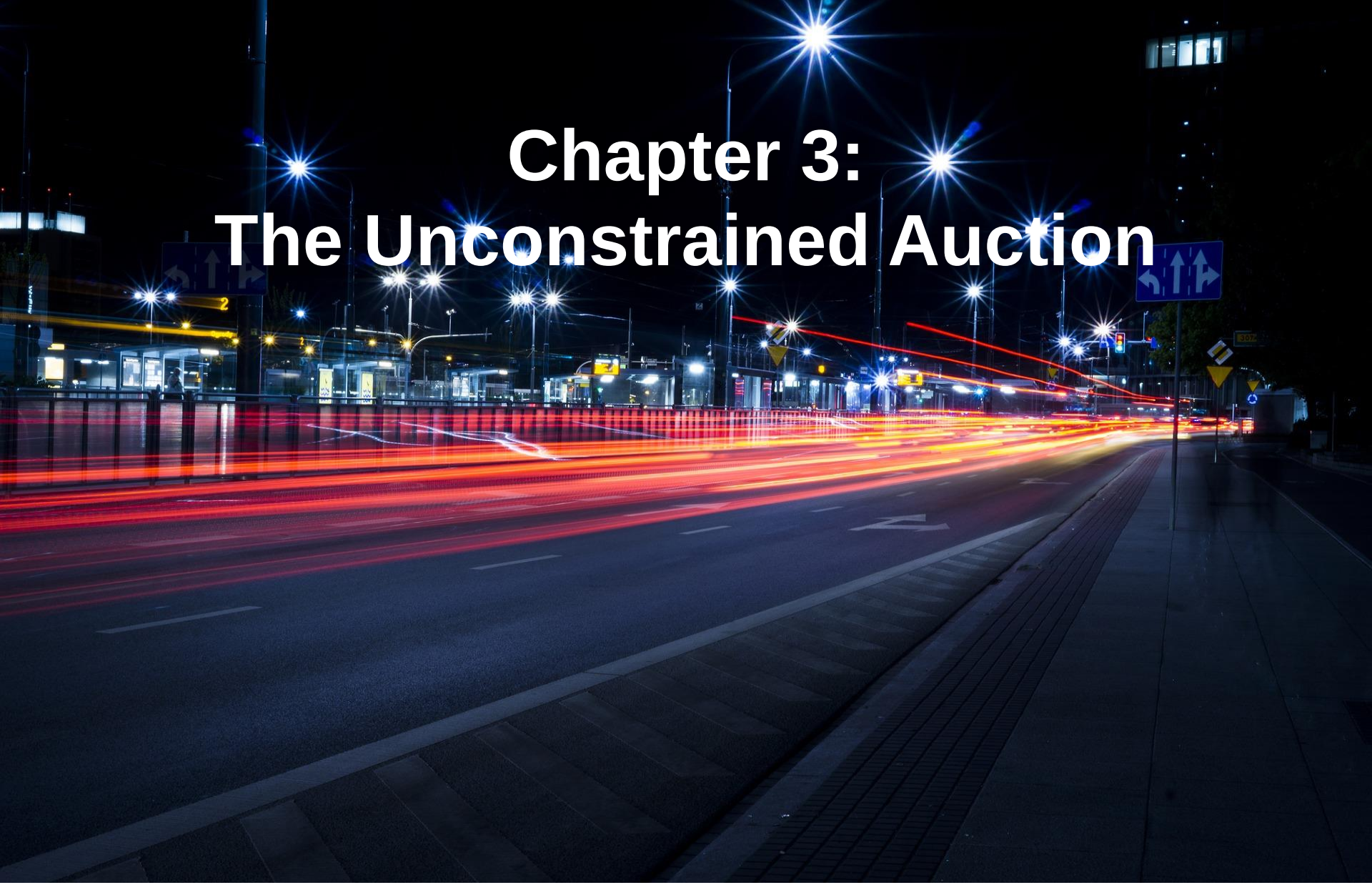
- Again we assume only one offer step per unit for New Capacity.
- Offer prices vary with Unit C offering at a price just below the Auction Price Cap of €99/MW per year.
- New Capacity is not required to offer into the auction. This is because it is possible that the project to build a unit could hit difficulty or collapse between qualification and the auction.
- All the New Capacity offers are inflexible except for that from Unit E.
- All new capacity steps are offered with a Capacity Duration at the maximum allowed value. Since Unit E's New Capacity has a 1 year offered duration it is not subject to any restrictions on clearing in the constrained auction.

The Offers Summarised And Ordered

	A	B	E	C	F	D	F*	G*	E*	C*
Price (€/MW per year)	€5	€10	€15	€25	€35	€40	€65	€75	€80	€99
Offer (MW)	10	15	10	10	15	25	6	7	5	5
Flexible?	Y	N	N	N	N	N	N	N	Y	N
Exemption	-	-	-	-	-	-	Y	Y	N/A	N
Capacity Duration	1	1	1	1	1	1	10	10	1	10
E*, C*, F*, G* indicate offers from New Capacity. All other offers are from Existing Capacity										

- In reality it would also be important to track for each unit whether it is a clean technology as this and the Capacity Duration of each step are measures used in breaking ties between offers within the Auciton. These topics are covered in the Instructor Lead Training.

- There are no tied offers in this example.

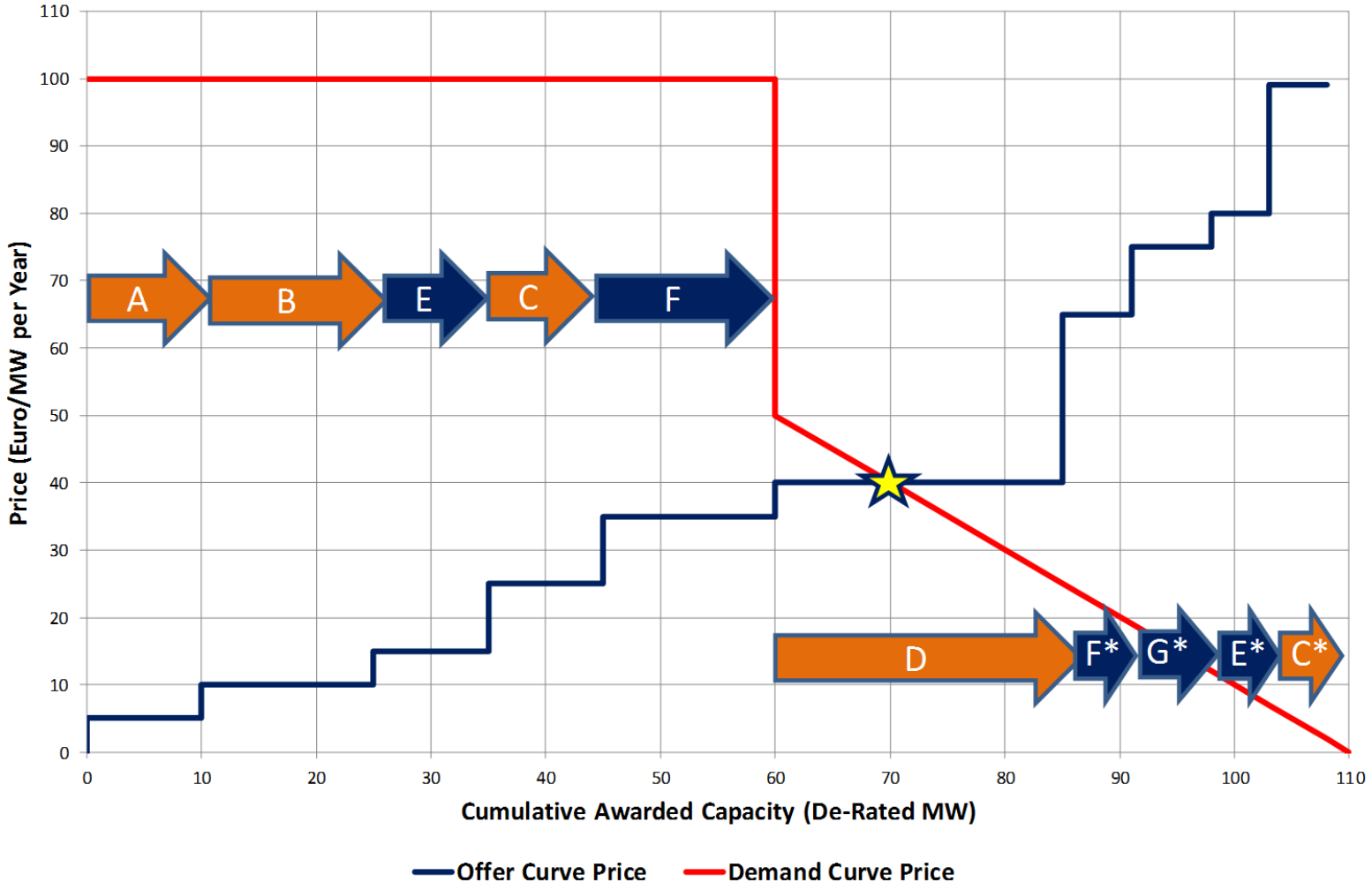


Chapter 3:
The Unconstrained Auction

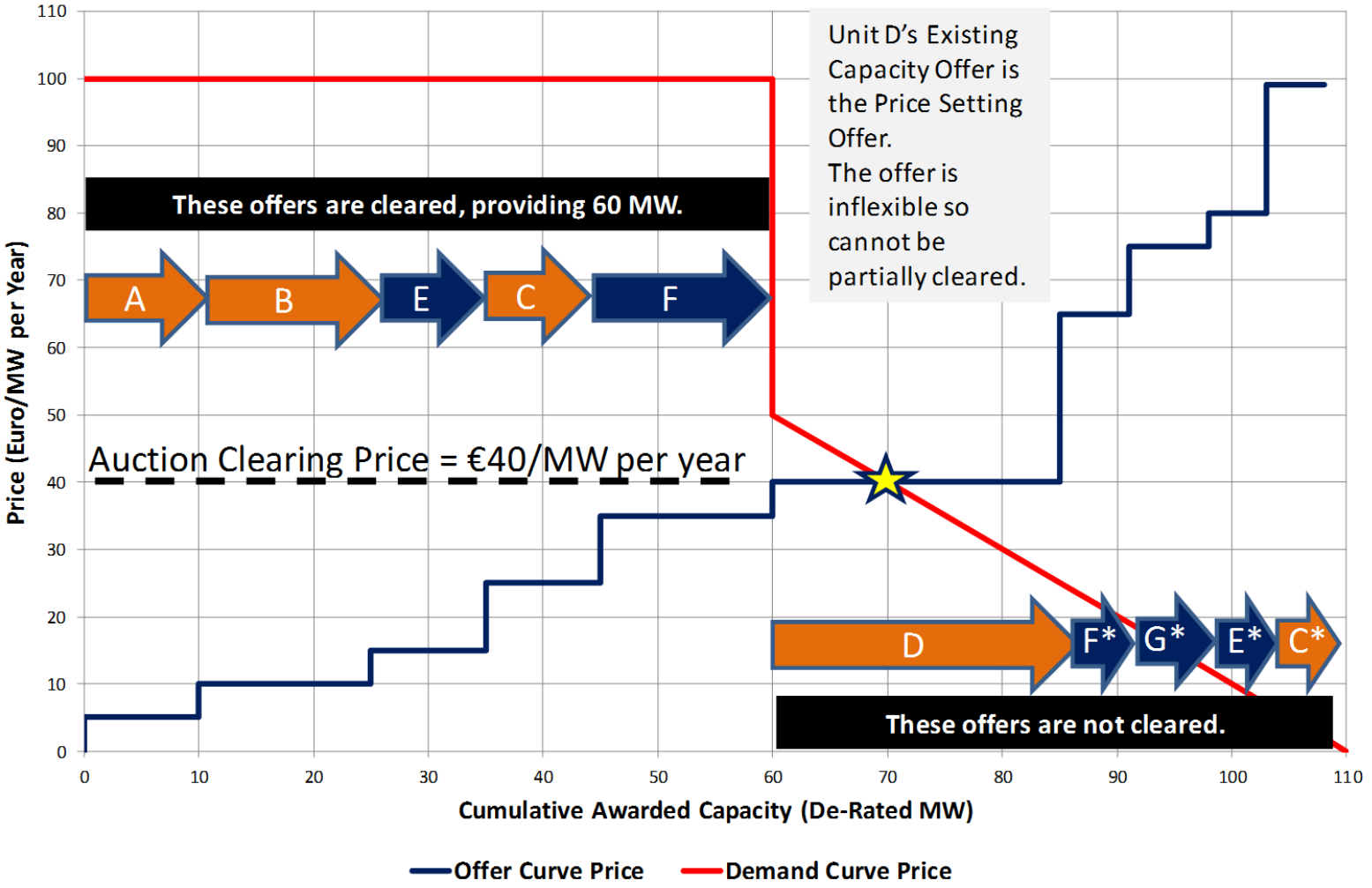
Introduction

- We focus on the auction design to be used in the first Capacity Auctions:
  - This combines two steps which we call the “Unconstrained Auction” covered here, and the “Constrained Auction” covered later.
- The Unconstrained Auction takes the aggregate offer curve from all Capacity Market Units and compares it with the Demand Curve. Locational Capacity Constraints are not considered.
- For a given total quantity scheduled:
  - the area under the Demand Curve is the **Benefit** that the market receives from that capacity.
  - the area under the Offer Curve is the **Cost** of that capacity scheduled (based on their offers, not what the market actually pays).
  - the difference between these areas is **Net Social Welfare = Benefit – Cost**
- The aim is to find the solution that maximises Net Social Welfare.
- The Unconstrained Auction treats all offers as Flexible, which means in practice Net Social Welfare is maximised where the Demand Curve and the Offer Curve cross.

The Unconstrained Auction – (1/2)

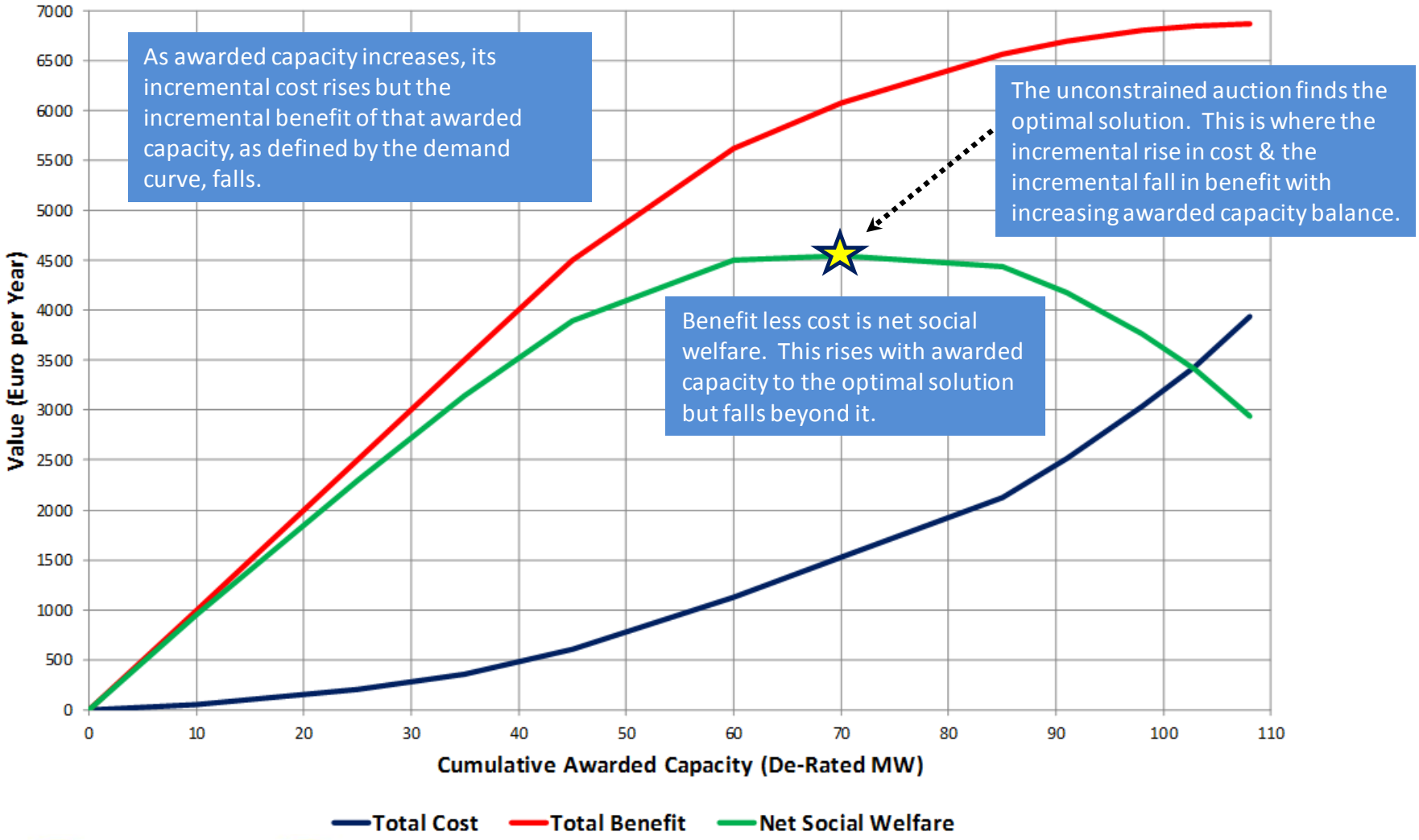


The Unconstrained Auction – (2/2)

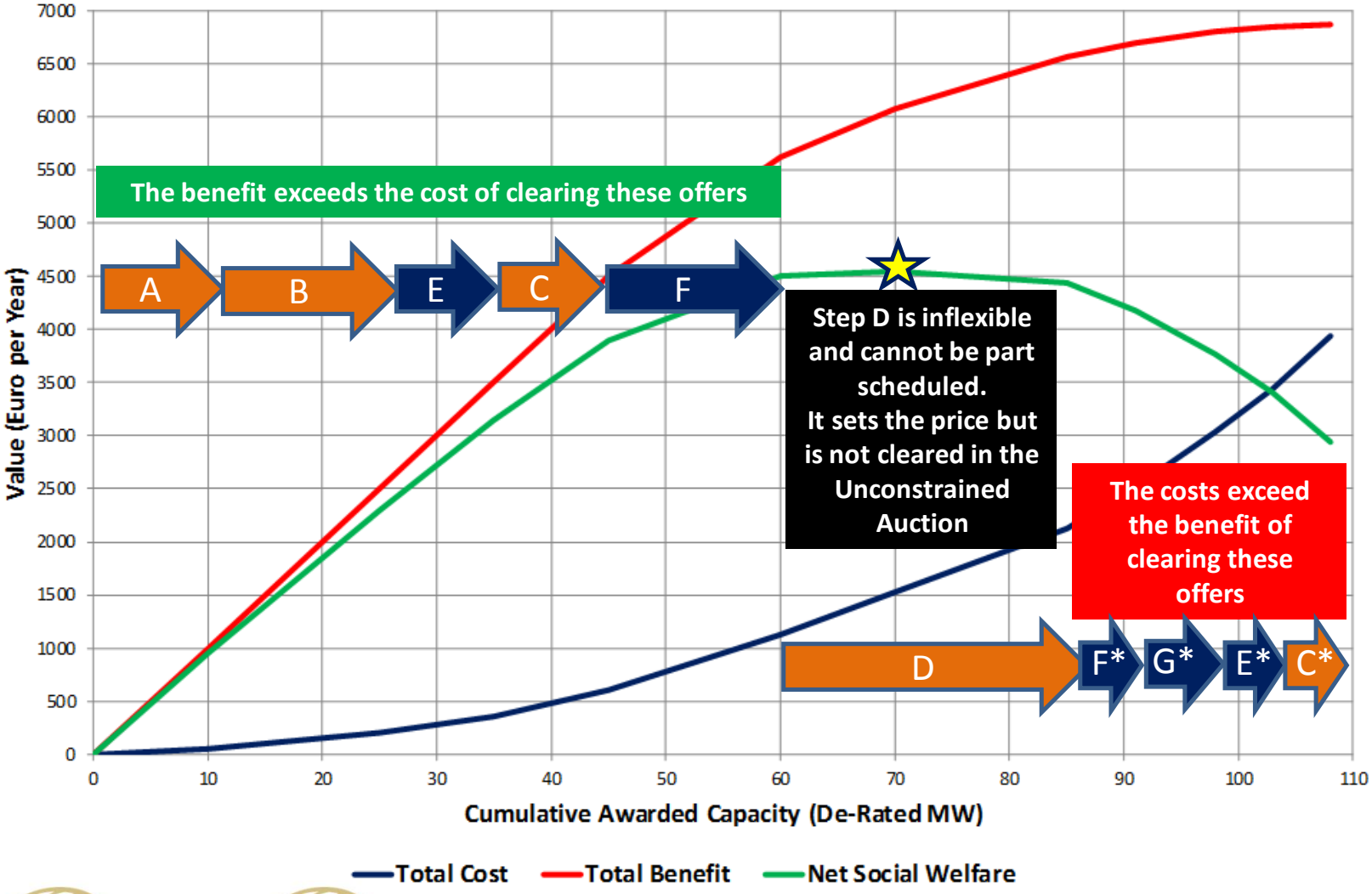


Note – The Auction Clearing Price is set at the offer price of the last offer scheduled. It cannot be set by the Demand Curve.

The Unconstrained Auction – Net Social Welfare



The Unconstrained Auction – Net Social Welfare



The Unconstrained Auction Solution

	A	B	E	C	F	D	F*	G*	E*	C*
Price (€/MW per Year)	€5	€10	€15	€25	€35	€40	€65	€75	€80	€99
Offer (MW)	10	15	10	10	15	25	6	7	5	5
Flexible?	Y	N	N	N	N	N	N	N	Y	N
Unconstrained Auction Cleared Quantities (MW)	**10**	**15**	**10**	**10**	**15**					
Settlement Price(€/MW per Year)	**€40**	**€40**	**€40**	**€40**	**€40**					
Capacity Duration	1	1	1	1	1	1	10	10	1	10
E*, C*, F*, G* indicate offers from New Capacity. All other offers are from Existing Capacity										

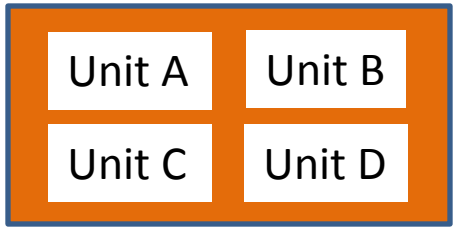
Chapter 4: The Constrained Auction & Locational Capacity Constraints

Introduction

- We focus on the auction design to be used in the first Capacity Auctions.
- The Constrained Auction introduces Locational Capacity Constraints.
- Relative to the Unconstrained Auction solution, additional offers can be cleared to cover these constraints.
- The Constrained Auction explicitly recognises whether offers are Flexible or Inflexible.
- The focus is on concepts, not the actual solution methods or finer points (like tie-breaking).

Locational Capacity Constraints Revisited

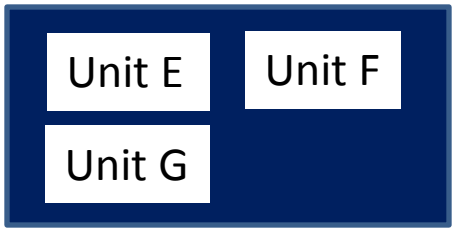
Locational Capacity Constraint R1



Required Awarded Capacity = **40**
Cleared Capacity = **35**
Additional Capacity Required = 5

We have updated the constraint information based on the solution to the Unconstrained Auction from earlier.

Locational Capacity Constraint R2

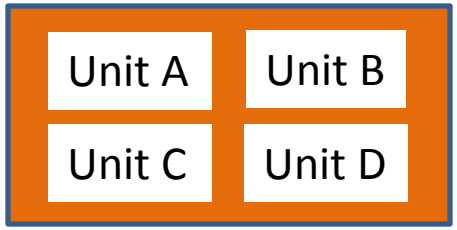


Required Awarded Capacity = **35**
Cleared Capacity = **25**
Additional Capacity Required = 10

Unit	A	B	C	D	E	F	G
Cleared Capacity	10	15	10		10	15	
Remaining Existing Capacity				*25*			
Remaining New Capacity			*5*		*5*	*6*	*7*
Locational Capacity Constraint	R1	R1	R1	R1	R2	R2	R2
Exemption for New Capacity			N		N/A	Y	Y

Solving for Locational Capacity Constraint R1

Locational Capacity Constraint R1



Required Awarded Capacity = **40**
Cleared Capacity = **35**
Additional Capacity Required = 5

To get 5 more MW we could take Unit C's new capacity of 5 MW at €99/MW year. Being inflexible we would take it all, costing €485/year, and in its offer it has a Capacity Duration of 10 years so would be paid that for 10 years.

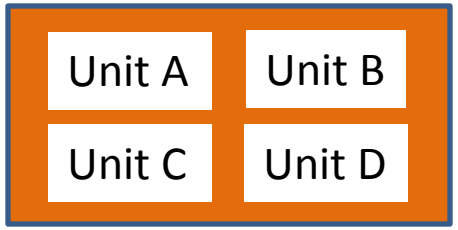
Or we could take Unit D's existing capacity for 1 year, being an inflexible 25 MW at €40/MW year or €900/year. This is more per year than Unit C but has shorter term commitment.

However - As Unit C is not exempt, its offer exceeds the Auction Clearing Price, and its Capacity Duration > 1 year it is not allowed to be cleared.

Unit	A	B	C	D			
Cleared Capacity	10	15	10				
Remaining Existing Capacity				*25*			
Remaining New Capacity			*5*				
Locational Capacity Constraint	R1	R1	R1	R1			
New Capacity Exemption			N				

Solution for Locational Capacity Constraint R1

Locational Capacity Constraint R1



Required Awarded Capacity = **40**
Cleared Capacity = **60**
Constraint Satisfied

Since Unit C's New Capacity cannot clear we can only take the inflexible 25 MW from Unit D.

The constraint is satisfied, though the inflexibility of Unit D requires more to be cleared than is necessary to satisfy the constraint.

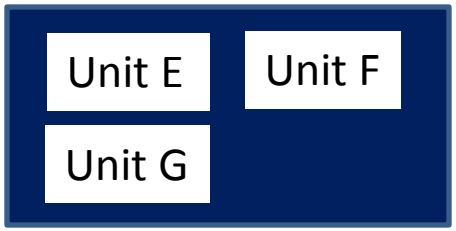
Unit	A	B	C	D			
Cleared Capacity	10	15	10	25			
Remaining Existing Capacity							
Remaining New Capacity			5				
Locational Capacity Constraint	R1	R1	R1	R1			
New Capacity Exemption			N				

Solving for Locational Capacity Constraint R2

Constraint R2 is not fully satisfied. Only 25 MW of Awarded Capacity has been cleared in that region. A further 10 MW must be procured from the region.

This can only be supplied by New Capacity supplied by some mix of units E, F or G.

Locational Capacity Constraint R2



Required Awarded Capacity = **35**
Cleared Capacity = **25**
Additional Capacity Required = 10

Unit	A	B	C	D	E	F	G
Cleared Capacity					**10**	**15**	
Remaining Existing Capacity							
Remaining New Capacity					***5***	***6***	***7***
Locational Capacity Constraint					**R2**	**R2**	**R2**
New Capacity Exemption						**Y**	**Y**

Solution for Local Capacity Constraint R2

Additional Capacity Required = 10

Options: New Capacity from E, F, G:

E: Flexible, can take 0 to 5 MW at €80/MW per year. Can be cleared as 1 year duration.
F: Inflexible, can take 0 or 6 MW at €65/MW per year. Long term award but exempt.
G: Inflexible, can take 0 or 7 MW at €75/MW per year. Long term award but exempt.

F & G exemptions mean that E should be treated as lower cost and given priority in clearing. However, to supply 10 MW we must take one of F or G fully, with the flexible offer from E covering the remainder.

Feasible Combinations:

3 MW from E (Flexible), 7 MW from G (Inflexible).
Gives 10 MW for a cost of 3×80 + 7×75 = 240 + 525 = €765

Expensive

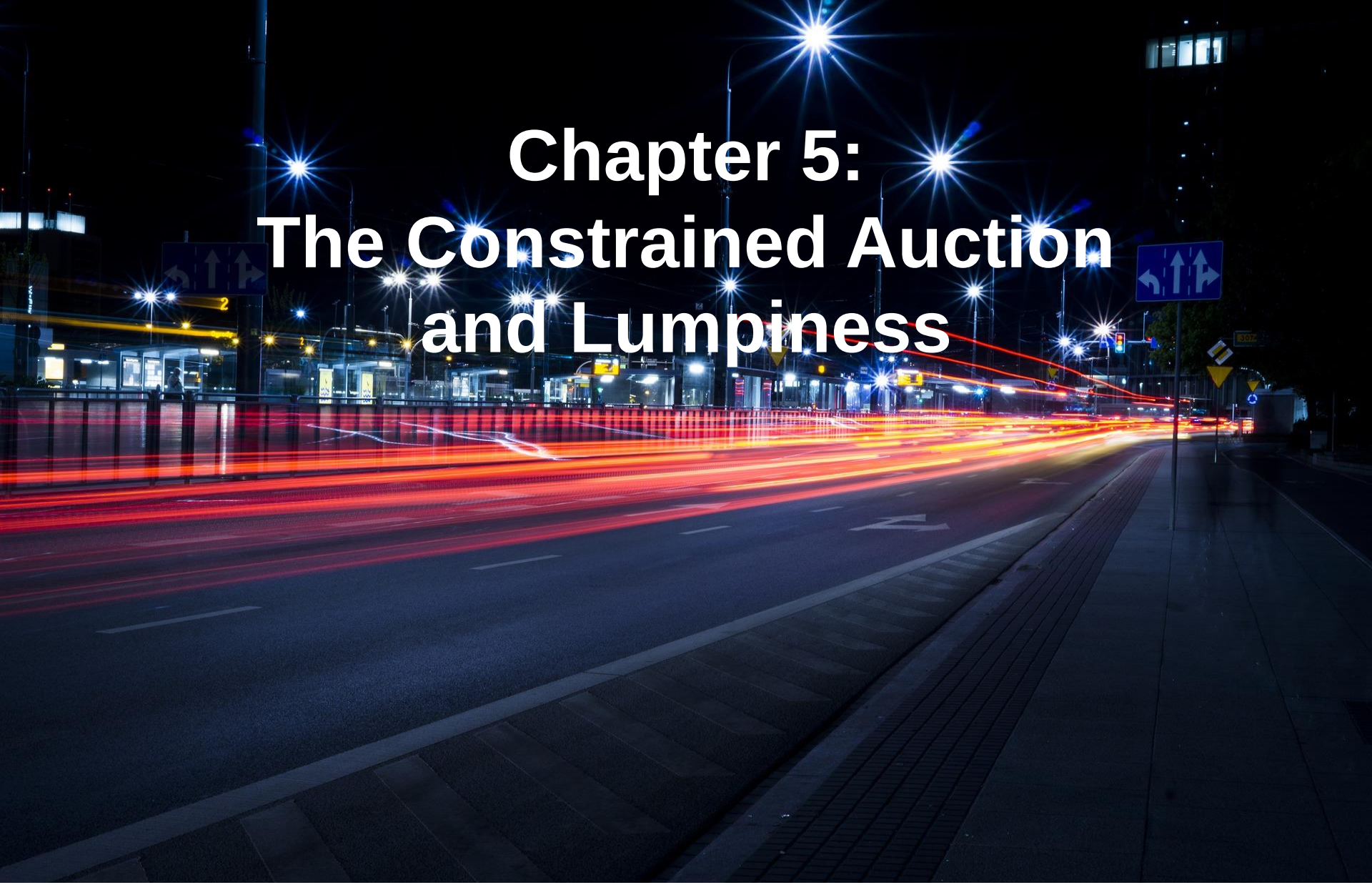
4 MW from E (Flexible), 6 MW from F (Inflexible).
Gives 10 MW for a cost of 4×80 + 6×65 = 320 + 390 = €710

Best

The Solution – With Locational Capacity Constraints

	A	B	E	C	F	D	F*	G*	E*	C*
Price (€/MW per Year)	€5	€10	€15	€25	€35	€40	€65	€75	€80	€99
Offer (MW)	10	15	10	10	15	25	6	7	5	5
Flexible?	Y	N	N	N	N	N	N	N	Y	N
Unconstrained Auction Cleared Quantities (MW)	10	15	10	10	15					
Final Cleared Quantity (MW)	10	15	10	10	15	25	6		4	
Settlement Price (€/MW per Year)	€40	€40	€40	€40	€40	€40	€65		€80	
Capacity Duration	1	1	1	1	1	1	10	10	1	10
E*, C*, F*, G* indicate offers from New Capacity. All other offers are from Existing Capacity										

- All the offers cleared based on the unconstrained auction solutions are settled at the Auction Clearing Price of €40/MW per year set by the Price Setting Offer from Unit D. Unit D is cleared to cover the R1 constraint. It receives a pay-as-offer price, though being the Price Setting Offer this happens to equal the Auction Clearing Price.
- New Capacity from Units E and F is cleared to cover the R2 constraint and each receives a pay-as-offer price. Unit F is awarded capacity for 10 years, all other units are awarded for 1 year.



Chapter 5: The Constrained Auction and Lumpiness

Introduction

- The Unconstrained Auction attempts to find the best solution from the point of view of Net Social Welfare. Recall that the last offer scheduled is the Price Setting Offer.

- If the Price Setting Offer is inflexible and partially scheduled, it will not be cleared. Without this offer it may be possible to improve Net Social Welfare by accepting other, more expensive, offer steps that are flexible or are smaller inflexible offer steps:
  - Locational Capacity Constraints may clear more capacity, such that the final amount of awarded capacity has gone beyond the level with the optimum Net Social Welfare.
  - But if Locational Capacity Constraints do not apply, or have little effect, then higher cost offers could still be cleared before reaching the optimum Net Social Welfare.

- This "Lumpiness" problem arises from the Inflexible offers. The Constrained Auction attempts to find a mix of offers that can improve Net Social Welfare.

- The focus is on concepts, not the actual solution methods or finer points (like tie-breaking).

- In this section we assume all uncleared offers are available to be cleared without worrying about the special rules on the treatment of New Capacity in the Constrained Auction.

The Case with No Locational Capacity Constraints

	A	B	E	C	F	D	F*	G*	E*	C*
Price (€/MW per year)	€5	€10	€15	€25	€35	€40	€65	€75	€80	€99
Offer (MW)	10	15	10	10	15	25	6	7	5	5
Flexible?	Y	N	N	N	N	N	N	N	Y	N
Unconstrained Auction Quantities (MW)	**10**	**15**	**10**	**10**	**15**					
Capacity Duration	1	1	1	1	1	1	10	10	1	10
E*, C*, F*, G* indicate offers from New Capacity. All other offers are from Existing Capacity										

- If there were no locational constraints we still have to consider "lumpiness".
- Lumpiness reflects the fact that unconstrained auction scheduled Unit D but being inflexible and only partly scheduled it was not accepted.
- Given we have excluded Unit D, are there additional Units we could schedule that give a better Net Social Welfare than the current solution?
- The starting solution has 60 MW cleared from units A, B, C, E and F.

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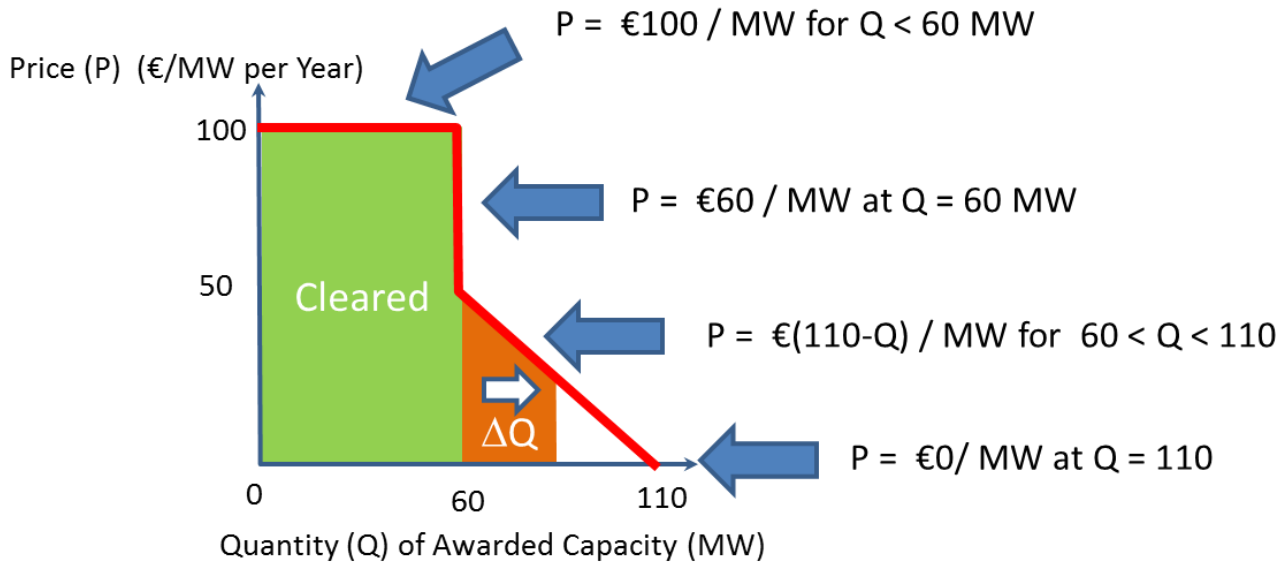
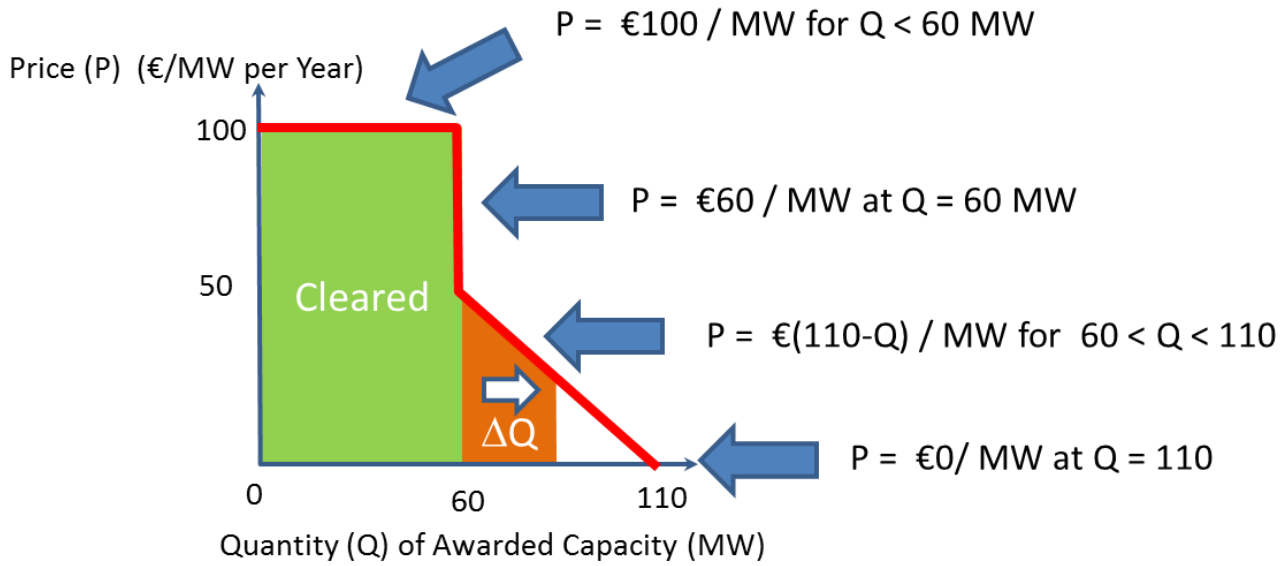
How Do We Measure Improved Net Social Welfare? – (1/2)



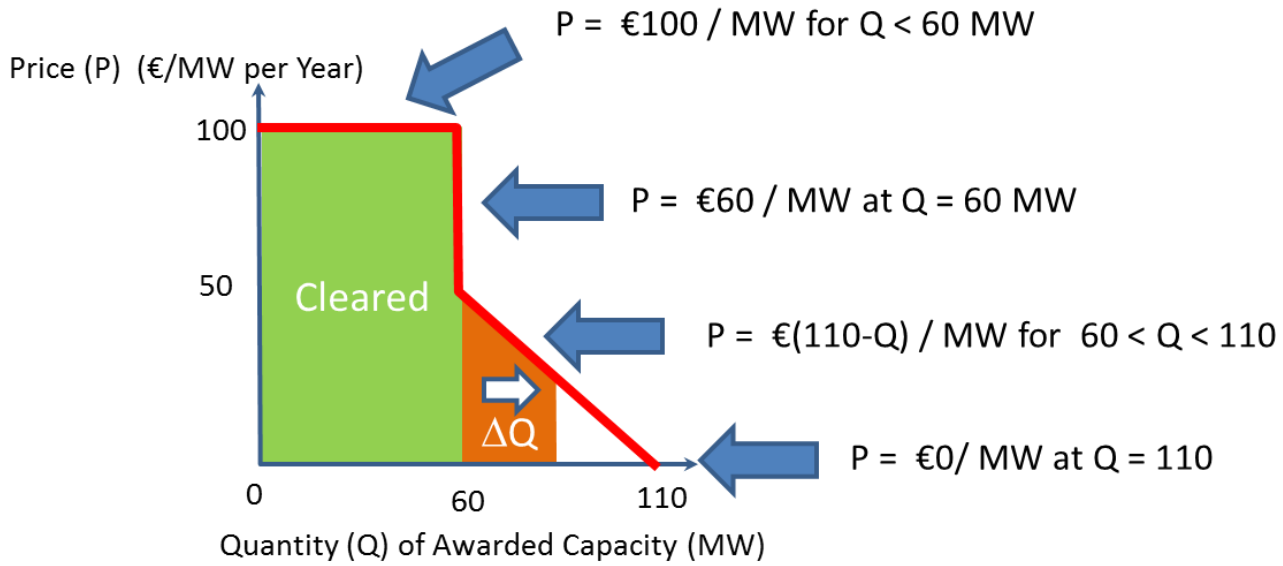
- Consider this version of the demand curve. In order to determine if we can improve Net Social Welfare (NSW) by clearing additional Capacity Auction Offers, we first need to use the demand curve to define an equation to calculate increased benefit. We can then use this equation to test what combination of additional offers, if any, would increase net benefit if cleared.
- The Price P at point (Q=60MW) of the demand curve = €50.
- Any additional quantity cleared, ΔQ, will be on the segment where price changes based on the formula P = €(110-Q) / MW. The quantity Q beyond 60 is given by $Q = 60 + \Delta Q$, putting this into the formula for change in price we have $P = 50 - \Delta Q$.

How Do We Measure Improved Net Social Welfare? – (2/2)



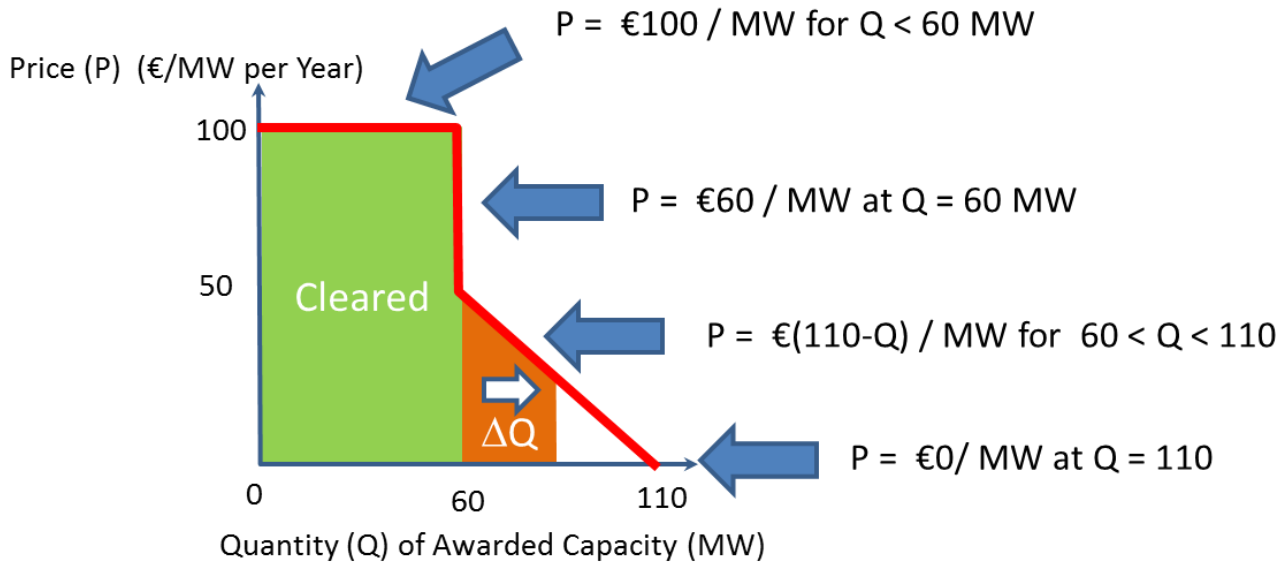
- The increased benefit is the area of the orange region, being its average height (considering changes in prices) times its width (considering changes in quantities). Taking our inputs from the previous points, this area is $0.5 \times [(P(Q=60) + P(Q= 60+ \Delta Q)] \times \Delta Q = 0.5 \times [(50 + (50- \Delta Q)] \times \Delta Q = (50 – 0.5\ \Delta Q) \times \Delta Q$.

What Increase in Quantity Maximises Net Social Welfare? – (1/2)



- So the orange area is given by the formula Increased Benefit = $(50 – 0.5\,\Delta Q) \times \Delta Q$.
- If the cost of clearing an additional 1MW of a Capacity Auction Offer (ΔQ) is its offer price, OP, and a change in Net Social Welfare is given by the difference between the change in benefit and change in cost, the change in Net Social Welfare resulting from clearing ΔQ from that step is $\Delta NSW = (50 – 0.5\,\Delta Q – OP) \times \Delta Q$.
- We want to increase ΔQ while ΔNSW is positive, or until ΔNSW=0.
- Taking ΔNSW=0 as the desired result, we can build it into the formula. Now $(50 – 0.5\,\Delta Q – OP) \times \Delta Q = 0$ when either we make no change, $\Delta Q = 0$, or when $\Delta Q = 100 – 2OP$ which could be positive or negative. We only want a positive ΔQ so can only increase a quantity if OP, the offer price, is less than €50 /MW per year.

What Increase in Quantity Maximises Net Social Welfare? – (2/2)



- Now (50 – 0.5 DQ – OP) × DQ = 0 when either we make no change, DQ = 0, or when DQ = 100 – 2OP which could be positive or negative. We only want a positive DQ so can only increase a quantity if OP, the offer price, is less than €50 /MW per year.
- These rules allows us to determine what quantity of an individual offer step, given its price, can be accepted while having a net increase or net neutral change in Net Social Welfare. From this and considering additional rules on flexibility of offers (i.e. if the offer must be taken as a whole or can be partially taken) we can determine if any offer step additional to those from the unconstrained auction should be cleared.

Can any Offer Replace the Price Setting Offer?

	D	F*	G*	E*	C*
Price (€/MW per year)	€40	€65	€75	€80	€99
Offer (MW)	25	6	7	5	5
Flexible?	N	N	N	Y	N
Is Offer Price < €50	Y	N	N	N	N
$\Delta Q = 100 - 2OP$	20	-40	-60	-70	-98

- The last slide demonstrated that we could only justify clearing more from an offer with an offer price, OP, less than €50/MW per year.
- We see that only offer D, the Price Setting Offer, satisfies this condition.
- The optimal increase in D is 20 MW but this is not acceptable because the offer was inflexible. Taking all 25 MW gives $\Delta NSW = (50 - 0.5\,\Delta Q - OP) \times \Delta Q = (50 - 0.5\times25 - 40)\times25 = -62.5$. This is worse that taking nothing.
- The optimal change in net social welfare from the other uncleared steps require a negative cleared quantity, so they are not acceptable.
- No additional offers are cleared.

The Solution – No Locational Capacity Constraints

	A	B	E	C	F	D	F*	G*	E*	C*
Price (€/MW per Year)	€5	€10	€15	€25	€35	€40	€65	€75	€80	€99
Offer (MW)	10	15	10	10	15	25	6	7	5	5
Flexible?	Y	N	N	N	N	N	N	N	Y	N
Unconstrained Auction Cleared Quantities (MW)	**10**	**15**	**10**	**10**	**15**					
Settlement Price(€/MW per Year)	**€40**	**€40**	**€40**	**€40**	**€40**					
Capacity Duration	1	1	1	1	1	1	10	10	1	10
E*, C*, F*, G* indicate offers from New Capacity. All other offers are from Existing Capacity										

- We cannot improve the solution by clearing any offers, including the Price Setting Offer so the Unconstrained Auction solution (excluding the Price Setting Offer) is the final solution.

A Case Where Lumpiness Does Change The Solution

	D	Z
Price (€/MW per year)	€40	€45
Offer (MW)	25	6
Flexible?	N	N
Is Offer Price < €50	Y	Y
$\Delta Q = 100 - 2OP$	20	10

- Here is an alternative example where a new offer Z would be cleared to resolve lumpiness.
- Unit D is as before and will not be selected.
- Unit Z is smaller than Unit D and only slightly more expensive. It is also inflexible like Unit D. Because the benefit declines less over a change in capacity of 6 MW, the optimal quantity to clear from Z is 10 MW, which is more than it has available. Hence 6 MW will be cleared. It will be awarded capacity at a price of €45/MW per year, its offer price.

Auction Results and New Capacity

- Final Capacity Auction Results for a participant are final and binding.

- When capacity is awarded in respect of New Capacity the Participant must post a Performance Security with the System Operators and must confirm acceptance of any updates to its Implementation Plans submitted in Qualification so as to reflect final Auction Results (e.g. what capacity was awarded).

Chapter 6: The Interim Secondary Trading Arrangements

Interim Secondary Trading Arrangement – (1/3)

- The Capacity Auction determines Awarded Capacity.
- Participants holding Awarded Capacity will have obligations linked to that capacity.
- Secondary Trading exists to allow Qualified Participants to buy Awarded Capacity from others when, for Legitimate Reasons, they cannot otherwise cover their obligations.
- The full Secondary Trading arrangement will not be ready for market commencement, with an interim arrangement used in its place.
- This section describes that interim arrangement.

Interim Secondary Trading Arrangement – (2/3)

- The Interim Secondary Trading Arrangement (ISTA) applies until the First Secondary Trading Day (set by the RAs). Secondary Trading will apply after that.

- During the period of the ISTA, Participants have the option to seek protection from difference charges for Planned Outages.

- To do this, a Participant provides the System Operators with an "Interim Secondary Trade Notification" (ISTN) indicating for a given CMU:
  - Whether the ISTN is to activate or deactivate the interim secondary trade arrangements (ISTA) (effectively an On or Off switch). By default the ISTA is inactive for a CMU.
  - The month from which the ISTN is to apply - it will actually take effect from the later of the stated month or the next month starting after 10 Working Days in the future.
  - The change in Net Capacity Quantity desired by the Participant in respect of existing capacity for its CMU.

Interim Secondary Trading Arrangement – (3/3)

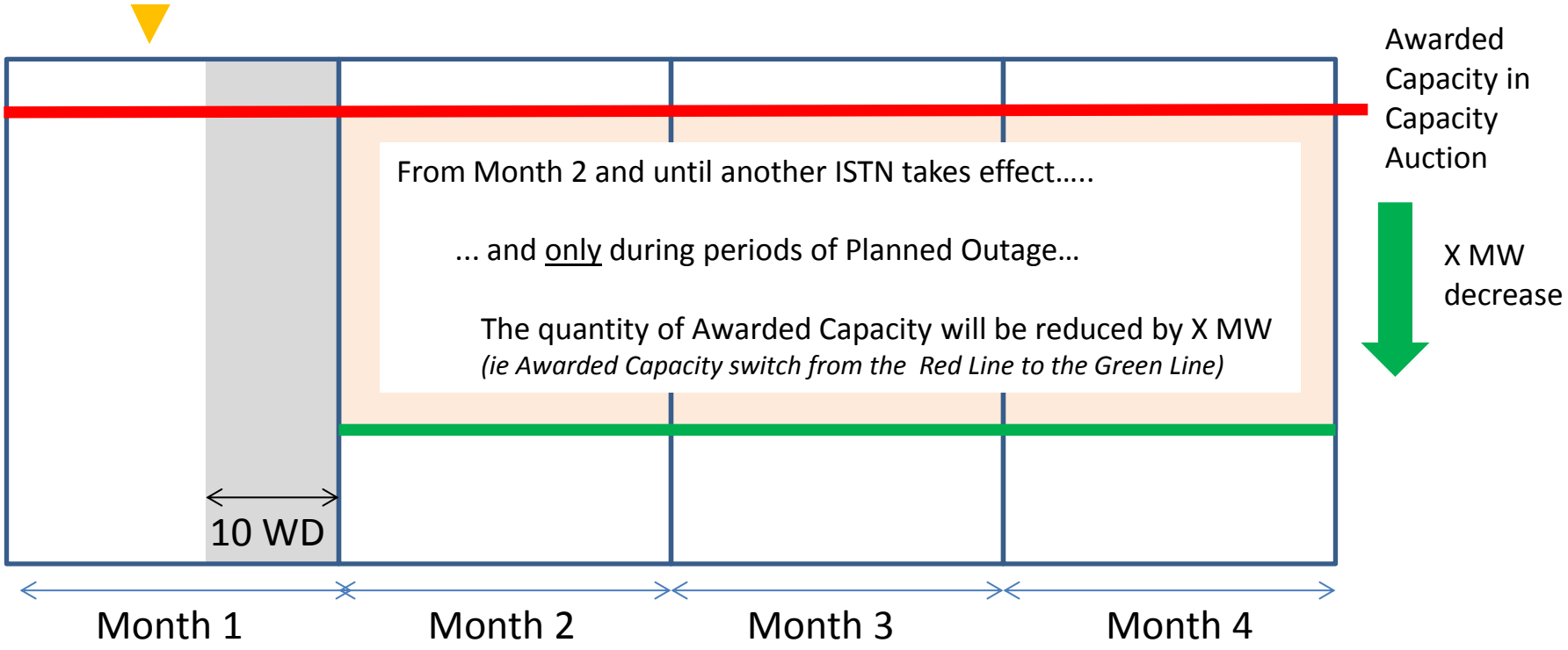
- Planned Outages include reductions in availability of CMUs due to:
  - An outage in the Committed Outage Program (Ireland) or the Final Outage Program (Northern Ireland).
  - Planned outages of part of the transmission system under the Grid Code.
  - For a generator, the result of an outage of the plant that it is the sole source of fuel for the plant (e.g. in case of a Combined Heat and Power plant).

- The change is implemented by the System Operators creating an offsetting Secondary Trade for the duration of the Planned Outage with:
  - The participant as the buyer of the capacity.
  - a price equal to the volume weighted average price of capacity awarded in the Capacity Auction to that CMU.
  - a Capacity Duration Exchange Rate as specified in the Final Auction Information Pack for the Capacity Auction.

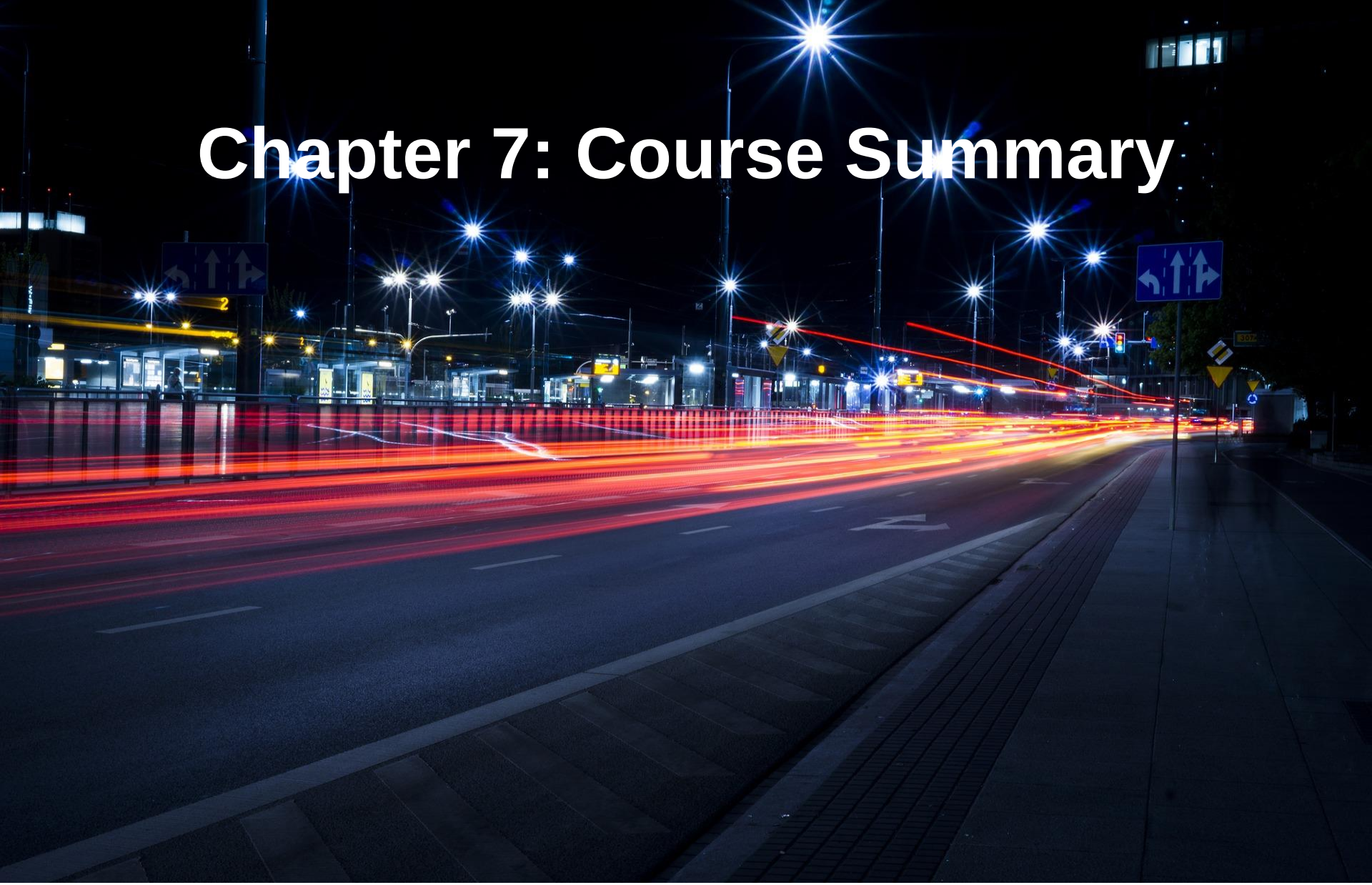
- The effect is to lower the net Awarded Capacity held by the CMU, lowering its exposure to Difference Charges in settlement, but also lowering its net revenue from capacity. Because of this trade off, Participants have the choice over how much capacity they want to buy (if any).

Impact of an Interim Secondary Trade Notification

SOs receive/accept an Interim Secondary Trade Notification (ISTN) to apply from Month 2, specifying a reduction of Awarded Capacity by X MW for the CMU.



Chapter 7: Course Summary



Review of Learning Objectives

As a result of this training module you should now:

Understand the inputs to the Capacity Auction ✓

Understand the basic features of the Unconstrained Auction ✓

Understand how Locational Capacity Constraints impact Auction results ✓

Understand how the “Lumpiness” due to Inflexible Offers is addressed ✓

Understand the Interim Secondary Trade Arrangements ✓

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