

Chapter 2: Capacity Auction Inputs

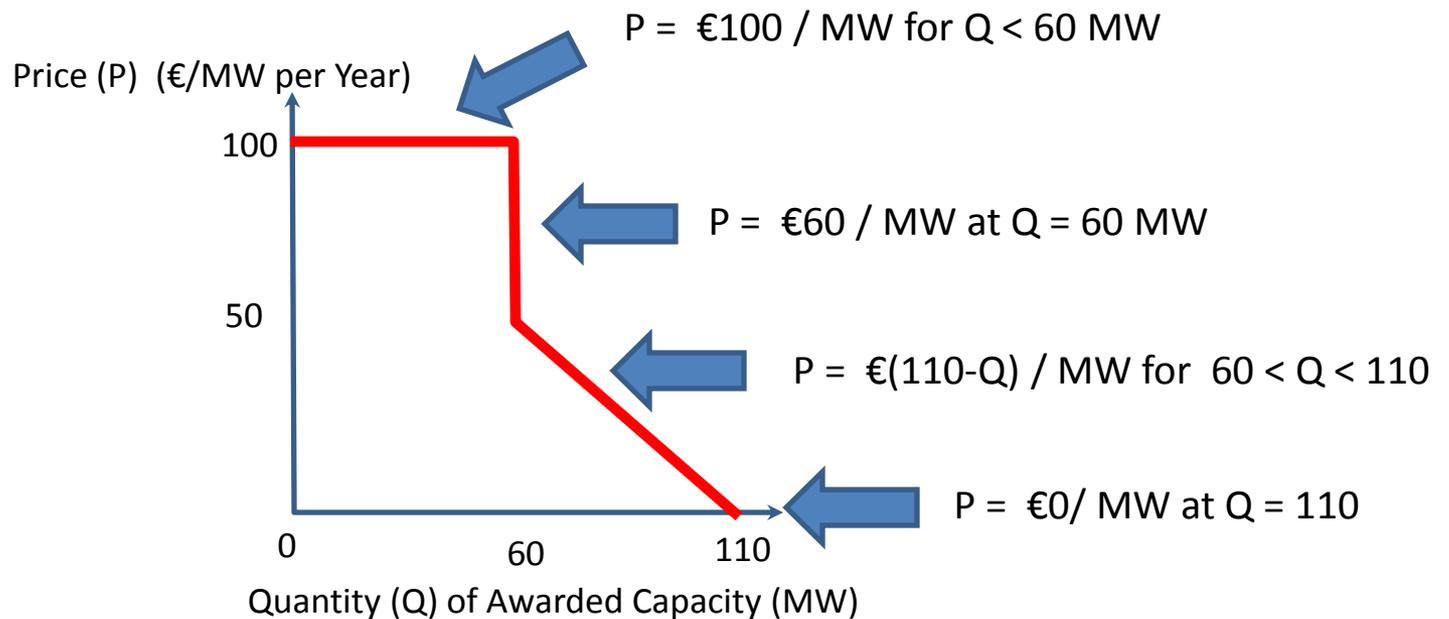
Introduction

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.

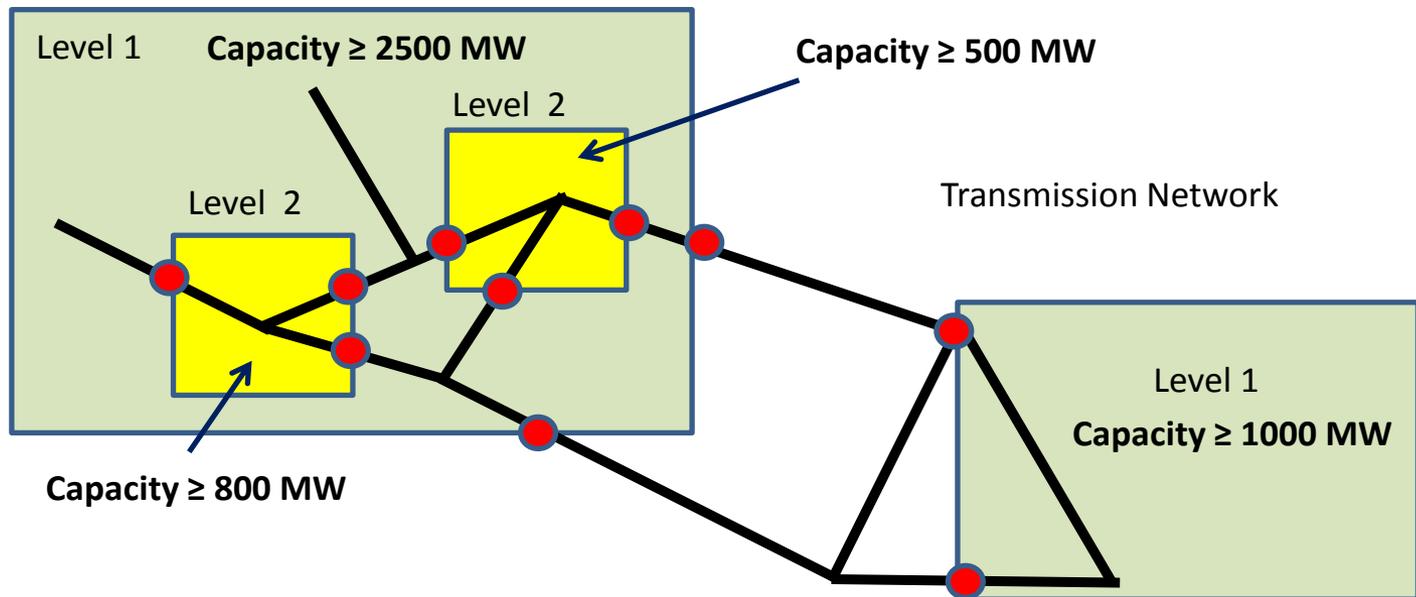
The Qualified Capacity Market Units – New Capacity

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

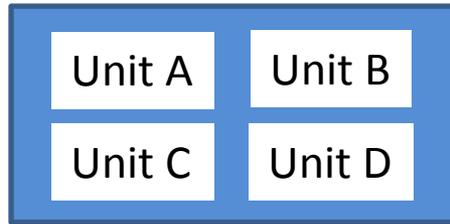
- Now we introduce Locational Capacity Constraints:
 - These require a minimum amount of capacity to clear in defined geographic regions defined by transmission network nodes.
 - They help in maintaining power system security given network constraints.
 - One constraint (a Level 2 constraint) can be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

Locational Capacity Constraint R2



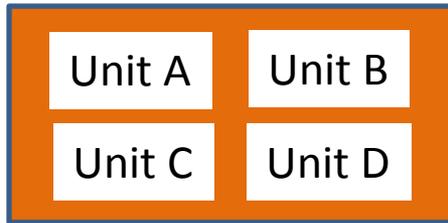
Required Awarded Capacity = **35**
 Available Capacity (Existing) = **25**
 Available Capacity (Total) = **42**

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

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	-			

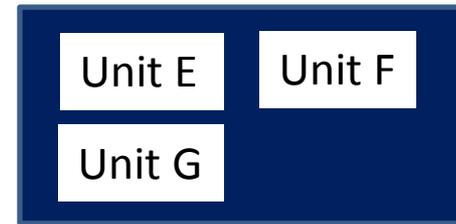
Capacity Market Units & Locational Capacity Constraints – (3/3)

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.

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.